

DEPARTMENT OF MICROBIOLOGY

RATHINAM COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

Rathinam Techzone, Pollachi Road, Eachanari, Coimbatore – 641021



Syllabus for

B.Sc. MICROBIOLOGY

(I, II, III and IV Semester)

2018–2019 Batch Onwards

Vision and Mission of the Institution:

VISION

A world renowned INDUSTRY–INTEGRATED INSTITUTION that imparts knowledge, skill, and research culture in young men and women to suit emerging young India.

MISSION

To provide quality education at affordable cost, and to maintain academic and research excellence with a keen focus on INDUSTRY–INTEGRATED RESEARCH AND EDUCATION.

MOTTO

Meaningful INDUSTRY–READY education and research by all means

Vision and Mission of the Department:

VISION

Our vision is to provide quality higher education to the youth. Apart from imparting subject knowledge and skills, we focus on molding the students with better conduct and character with an utmost commitment to the societal needs and National development. Spirited by the motto “Industry – Ready Education” The Department of Microbiology aims to comprehend the vision of a Microbiologist and transcend knowledge for enriching human life.

MISSION

Our mission is to develop knowledgeable, motivated and skilled youngsters in the field of Microbiology who can establish companies/industries catering the basic needs of agriculture, industry and health sector of people all over the globe and could provide a clean, sustainable environment for the future generation.

Program Educational Objectives (PEO)

PEO 1: Preparation – The students shall excel in various Microbiological aspects or to succeed in industry / technical profession through global, rigorous education.

PEO 2: Core competence – The students shall be provided with a strong foundation in the fundamentals of core Microbiology and allied subjects required to troubleshoot routine problems caused by microbes and also to pursue higher studies.

PEO 3: Broadened knowledge – The students would acquire good scientific and research breadth so as to comprehend, analyze, design, and create novel bio products and solutions for the real life problems.

PEO 4: Professionalism – The students shall be imparted with professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach, and an ability to relate Microbiological issues to broader social context.

Mapping of Institute's Mission to PEO:

Institute Mission	PEO's
Knowledge and skill enhancement	PEO1, PEO3
Research oriented study	PEO2, PEO3
Core competent skill enhancement	PEO1, PEO2
Enhancing young Bio-entrepreneurs	PEO1, PEO4

Mapping of Department's Mission to PEO:

Department Mission	PEO's
Imparting critical thinking	PEO1
Enhancing research skills	PEO2, PEO3
Developing professionalism	PEO1, PEO4
Viable technical knowledge and core competency	PEO2, PEO4

Program Outcomes (PO):

PO1: The candidates shall gain current knowledge in the basic and advanced Microbiology which would enable them to enrich themselves to be competitive in the Life science field.

PO2: Students would gain the ability to understand and make a cognitive thinking on the different aspects of Microbiology and do research in the same.

PO3: Students would learn skills based on the knowledge involved in multidisciplinary facets of Life Sciences.

PO4: Students would be imparted the ability to design and carry out comprehensive techniques and become familiar with routine laboratory practices.

PO5: Students shall attain scientific writing and communication skills with the aid of web based teaching.

PO6: Students shall gain the ability to distinguish between the various methods involved isolation and characterization of microbes.

PO7: Students would gain technical skill sets in handling various laboratory instruments, so as to secure an ability to troubleshoot related problems.

PO8: Students would acquire entrepreneurial skills and techniques to create novel bio products enabling them to establish a startup industry.

Correlation between the POs and the PEOs

Program outcomes	Program Educational Objectives			
	PEO1	PEO2	PEO3	PEO4
PO1	√		√	
PO2	√	√	√	
PO3			√	√
PO4	√		√	√
PO5		√		√
PO6		√	√	
PO7		√		√
PO8	√	√		√

Components considered for course delivery is listed below:

1. Class room Lecture – I
2. Practical and Demos – II
3. Assignments – III
4. Mini Project – IV
5. Project – V
6. Online Course – VI
7. Extracurricular Activities – VII
8. Seminar – VIII
9. Internships – IX
10. Extension activities – X

Mapping of POs with Course Delivery

Program Outcome	Course Delivery								
	I	II	III	IV	V	VI	VII	VIII	IX
PO1	√		√				√	√	
PO2	√	√		√	√				
PO3	√		√	√	√	√			√
PO4		√		√	√			√	
PO5	√		√	√		√	√	√	
PO6	√	√		√	√			√	
PO7		√		√	√			√	√
PO8	√			√	√			√	√

Mapping of Courses and POs

S – Strong Correlation, M – Medium Correlation, B – Blank

Sem ester	Course Code	Course Name	Program Outcomes							
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
1	18BMB13A	Core I	S	M	S	S	B	S	B	S
	18BMB1AA	Allied A	S	S	S	B	S	B	B	B
2	18BMB23A	Core II	S	M	S	S	M	M	S	S
	18BMB23A	Core III	M	S	S	B	M	S	M	M
	18BMB2AB	Allied B	S	S	S	B	S	B	B	B
3	18BMB33A	Core IV	S	S	M	B	B	S	M	B
	18BMB33B	Core V	S	M	S	S	B	S	S	B
	18BMB3AC	Allied C	S	M	S	B	B	S	B	B
4	18BMB43A	Core VII	S	S	S	S	B	M	B	M
	18BMB43B	Core VIII	S	B	M	S	M	M	B	B
	18BMB4AD	Allied D	S	M	S	B	B	S	B	B

RATHINAM COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)
B.SC. MICROBIOLOGY DEGREE COURSE
SCHEME OF CURRICULUM CBCS PATTERN
(For the students admitted from the academic year 2018 – 2019 batch onwards)

Board of Studies –Microbiology (UG)

Semester	Part	Type	Name of the Course	Credit	Hours/ Week	ESE Marks			Duration of Exam
						CIA	ESE	Total	
1	1	L1	Language - I	3	6	40	60	100	3
	2	E1	English - I (General English)	3	6	40	60	100	3
	3	C1	Core Paper I: Fundamentals of Microbiology	4	6	40	60	100	3
	3	CP1	Core Practical I: Fundamentals of Microbiology Practical	-	4	-	-	-	-
	3	A1	Allied – A: Paper I - Biostatistics and Computer Applications I	4	4	40	60	100	3
	3	AP1	Allied Practical I– Biostatistics and Computer Application Practical	-	2	-	-	-	-
	4	AEC1	Ability Enhancement Compulsory Course-I – Environmental studies	2	2	-	50	50	3
	6	VAC1	Value Added Course – I ^{@S}	2	-	100	-	100	-
Semester I Total				18	30	260	290	550	
2	1	L2	Language - II	3	5	40	60	100	3
	2	E2	English -II (English for Scientific Communication)	3	5	40	60	100	3
	3	C2	Core Paper - II : Analytical Microbiology	4	4	40	60	100	3
	3	C3	Core Paper - III: General Biology	4	4	40	60	100	3
	3	CP2	Core Practical - I : Fundamental of Microbiology Practical	4	4	40	60	100	3
	3	A2	Allied – B: Paper II - Biostatistics and Computer Applications II	4	4	40	60	100	3
	3	AP2	Allied Practical I– Biostatistics and Computer Application Practical	2	2	40	60	100	3
	4	AEC2	Ability Enhancement Compulsory Course-II – Human rights	2	2	40	60	100	3
	6	VAC2	Value Added Course - II ^{@S}	2	-	100	-	100	3
Semester II Total				28	30	420	480	900	
3	3	C4	Core Paper - IV: Microbial Physiology and Metabolism	4	5	40	60	100	3
	3	C5	Core Paper - V: Microbial Diversity	4	5	40	60	100	3
	3	CP3	Core Practical - II : Microbial Diversity, Physiology and Metabolism Practical	3	5	40	60	100	3
	3	A3	Allied - C: Paper II - Biochemistry I	3	4	40	60	100	3
	3	AP3	Allied Practical II– Biochemistry Practical	2	3	40	60	100	3
	4	S1	Skill Enhancement Courses – I Waste Management	2	4	40	60	100	3
	4	AEC3	Ability Enhancement Compulsory Course-III – Communicative English Enhancement I	2	2	50	-	50	3

		C6	Core - VI: Industrial Training Report %	2	-	50	-	50	-
	6	VAC3	Value Added Course - III [@]	2	-	100	-	100	3
	6	IDL	Inter Department Learning – I : Mushroom Cultivation Technology ^{#s}	2	2	100	-	100	3
Semester III Total				26	30	540	360	900	
4	3	C7	Core Paper -VII Microbial Genetics	4	5	40	60	100	3
	3	C8	Core Paper - VIII : Medical Microbiology	4	5	40	60	100	3
	3	CP4	Core Practical - III : Microbial Genetics and Medical Microbiology Practical	3	5	40	60	100	3
	3	A4	Allied - D: Paper II - Biochemistry II	3	4	40	60	100	3
	3	AP4	Allied Practical II– Biochemistry Practical	2	3	40	60	100	3
	4	S2	Skill Enhancement Courses – II Clinical Laboratory Technology	2	4	40	60	100	3
	4	AEC4	Ability Enhancement Compulsory Course - IV : General Awareness	2	2	50	0	50	3
	6	VAC4	Value Added Course - IV ^{@s}	2	-	100	0	100	3
	6	IDL	Inter Department Learning – II Dairy Technology [#]	2	2	-	100	100	3
Semester IV Total				24	30	390	460	850	
5	3	C9	Core Paper - IX : Immunology	4	4	40	60	100	3
	3	C10	Core Paper - X : Food and Dairy Microbiology	4	4	40	60	100	3
	3	C11	Core Paper - XI : Medical Mycology, Virology and Parasitology	4	4	40	60	100	3
	3	CP6	Core Practical -IV : Immunology, Food and Industrial Microbiology Practical	3	5	40	60	100	3
	3	EL1	Elective - I [†]	4	4	40	60	100	3
	4	S3	Skill Enhancement Courses – III Large Scale Manufacturing Process	2	4	40	60	100	3
	6	VAC5	Value Added Course - V ^{@s}	2	-	100	-	100	3
Semester V Total				23	25	340	360	700	
6	3	C11	Core Paper - XI : Microbial Ecology	4	4	40	60	100	3
	3	C12	Core Paper - XII : Genetic Engineering	4	4	40	60	100	3
	3	CP7	Core Paper - XIII : Industrial Microbiology	4	4	40	60	100	3
	3	CP8	Core Practical -IV : Environmental and Industrial Microbiology, rDNA Technology Practical	3	5	40	60	100	3
	3	EL2	Elective - II [†]	4	4	40	60	100	3
	3	EL3	Elective - III [†]	4	4	40	60	100	3
	3	C19	Core Project	8	6	50	100	150	3
	4	S4	Skill Enhancement Courses – IV Textile Microbiology	2	4	40	60	100	3
	5	EX	Extension Activity- EX [%]	2	-	50	-	50	-
Semester VI Total				35	35	380	520	900	
TOTAL				154	180	2330	2470	4800	

Students should undergo an institutional training for a continuous period of 15 days before semester VI

@ – No End Semester Examination. Only Continuous Internal Assessment Examination (CIA).

– No Continuous Internal Assessment (CIA) Examination. Only University Examinations.

\$ **Value Added Course** – Examination and Evaluation for Value Added Courses should be conducted by the Industry and the marks shall be submitted to the CoE for the award of Grade.

† Non Major Elective (**NME**) – Student shall choose any one course out of two courses.

List of Elective papers (Colleges can choose any one of the paper as electives)		
Elective – I	A	Bioinformatics and Nanotechnology
	B	Microbial Biotechnology
	C	Biofertilizer and Biopesticides
Elective – II	A	Enterpreneurial Microbiology
	B	Bio inoculants
	C	Food Fermentation techniques
Elective - III	A	Marine Microbiology
	B	Bioethics
	C	Bio-Molecules

Value Added Courses offered by the Department

S. No	Sem	Part	Type	Subject	Credits
1.	I	IV	VAC1	Vaccine Development Technology	2
2.	II	IV	VAC2	Microbial Diagnosis in Health Clinic	2
3.	III	IV	VAC3	ISO22000 and HACCP in Food safety	2
4.	IV	IV	VAC4	Microbes in Sustainable Agriculture	2
5.	V	IV	VAC5	Vermicomposting Technology	2

Inter Departmental Course offered by the Department to the other Department Students

S. No	Sem	Part	Type	Subject	Credits	Hours	Int	Ext	Total
1.	III	6	IDL	Mushroom cultivation Technology	2	2	50	–	50
2.	IV	6	IDL	Dairy Technology	2	2	50	–	50

Self-Study Papers offered by the Department

S. No	Sem	Part	Type	Subject	Credits
1.	II to V		SS	Biosafety and Intellectual Property Rights	2
2.			SS	Personal Health Care	2

Semester: I	Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	17BGE11T	Part I Tamil	3	6	0	0	Theory / Practical

Introduction: gFjp Kjy; ghlkhf mikAk;> jkpo;ghlk; ftpijfs;> ,yf;fzk;> ,yf;fpa tuyhW Mfpaitfs; nfhz;L mike;J cs;sJ. le;J myFfshf gFf;fg;g;Ls;sJ.

Course Outcome:

C01	:	:: jw;fhy ,yf;fpaj;jpy; ghujpahh;> ghujpjhrd; ftpijfs; khzth;fs; mwpe;J nfhs;Stjhy; jd;dk;gpf;ifia ntspf;nfhzUk; tifapy; cs;sJ.
C02	:	ehl;Lg;gw;Wk;> flik czh;Tk; kw;Wk; tho;tpay; fUj;Jf;fisf; \$Wk; tifapy; cs;sJ.
C03	:	mwk; vd;g;gLk; fl;Liu tho;tpay; tpOgpaq;fs; mwpa cjTtdthf cs;sJ.
C04	:	gilg;gpyf;fpak; khzth;fspd; gilg;Gj;jpwid ntspg;gLj;Jk; tpjkhf cs;sJ.
C05	:	rpWfij> GJf;ftpjfs; Mfpaitfspd; tuyhWfis mwpe;J nfhs;syhk;. mjd; %yk; tsh;r;rp epiyfs; njhpe;J nfhs;sKbfpwJ.

Unit I: [12 Periods]
guhjpahh; – fz;zd; vd; Nrtfd;> ghujpjhrd; –jkpopaf;fk;> ituKj;J–vg;NghNjh nga;j kio> fz;zjhrd;–vq;Nf mtd;> rpw;gp– ,se;jkpNo Mfpa ftpijfspd; tpsf;fk; mspj;jy;

Unit II: [12 Periods]
K.Nkj;jh – kuq;fs;> ry;kh– tpyfpg;NghFk; tho;f;if> mg;Jy; uFkhd; – ghUf;Fs;Ns ey;y ehL> fyhg;upah– tsh;r;rp> kD\;a Gj;jpud; – gadw;Wg; NghFk;NghJ Mfpa ftpijfspd; tpsf;fk; mspj;jy;

Unit III: [12 Periods]
mwk; vd;g;gLtJ – 8 fl;Liufs; Mrphpah; (Kidth; mKjd;) – khzth;fSf;F mwpTWj;Jk; fijfs; fw;Wf;nfhLf;g;gLk;.

Unit IV: [12 Periods]
gilg;gpyf;fpak;> ty;ypdk; kpFk;> kpfh ,lq;fs;> ftpij vOJjy;> rpWfij vOJjy;> Ngr;Rj;jpwd;

Unit V: [12 Periods]
ciueilapd; Njhw;wKk; tsh;r;rpAk;> rpWfijapd; Njhw;wKk; tsh;r;rpAk;> GJf;ftpjapd; Njhw;wKk; tsh;r;rpAk; Mfpaitg; gw;wpf; \$Wjy;.

Kjw;gUtk;,,,,,,,,,,,,;

(kuGf;ftpj> GJf;ftpj> ,yf;fzk;> ,yf;fpatuyhW)

myF 1 jw;fhy ,yf;fpak;

1. ghujpahh; – fz;zd; vd; Nrtfd;
2. ghujpjhrd; – jkpopaf;fk;
3. ituKj;J – vg;NghNjh nga;jkio
4. fz;zjhrd; – vq;Nf mtd;
5. rpw;gp – ,se;jkpNo

myF 2 jw;fhy ,yf;fpak;

1. K.Nkj;jh – kuq;fs;
2. ry;kh – tpyfpg;NghFk; tho;f;if
3. mg;Jy; uFkhd; – ghUf;Fs;Ns ey;y ehL
4. fyhg;upah – tsh;r;rp
5. kD\;a Gj;jpud; – gadw;Wg; NghFk;NghJ

myF 3 ciueil

mwk; vdg;gLtJ – 8 fl;Liufs; (Kidth; mKjd;)

myF 4 ,yf;fzk; – gilg;gpapyf;fpak;

1. ty;ypdk; kpFk;> kpfh ,lq;fs;
2. ftpij vOJjy;
3. rpWfij vOJjy;
4. Ngr;Rj;jpwd;

myF 5 ,yf;fpa tuyhW

1. ciueilapd; Njhw;wKk; tsh;r;rpAk;
2. rpWfijapd; Njhw;wKk; tsh;r;rpAk;
3. GJf;ftpjapd; Njhw;wKk; tsh;r;rpAk;

gapw;rpF;Fhpad

nkhopngah;g;G
ghh;it Ehy;fs; : ,yf;fpatuyhW – ghf;fpaNkhp> ,yf;fz Ehy;>

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
17BGE12E	General English I	6	0	0	3	Core

Course Outcome:

CO1:	To know the types of communication and know the body language.
CO2:	To develop the oral communication.
CO3:	To excel in written form.
CO4:	To know about the Summary, paraphrasing and paragraph preparation.
CO5:	To know about the Etiquette and Manners.

UNIT-I

[12 Periods]

- Communication and its Types
 - Verbal and Non Verbal
 - Barriers of communication
 - Process of Communication
- Communication through Body Language
 - Eye Contact
 - Body Posture
 - Distance Contact
 - Facial Expression
 - Gestures
 - Vocal Tone
- Communication through Technology
 - Telephonic Etiquette
 - Email Etiquette
 - SMS Language

Unit II

[12 Periods]

- Oral Communication
 - Public Speaking
 - Presentation Skills
 - Group Discussion
 - Interview Techniques
 - Public Speech
 - Dialogue Writing

Unit III

[12 Periods]

- Written Communication
 - Report Writing
 - Note making
 - Précis Writing
 - Letter Writing
 - Documenting

Unit IV

[12 Periods]

- Reading and Understanding
 - Close reading

- Comprehension
- Summary paraphrasing
- Analysis and interpretation
- Translation
- Literary/ knowledge texts

Unit V

[12 Periods]

• **Etiquette and Manners**

- Table Etiquette
- Workplace Etiquette
- Social Etiquette
- Dress Etiquette
- Toilet Etiquette

Text Book:

1. Dr. M. Richard Robert Raa. (2015). Developing Communication Skills . Laxmi Publications (P) Ltd. New Delhi.

Reference Book:

1. Meenakshi Raman & Sangeetha Sharma, Technical Communication, Oxford University Press, (2015).
2. Krishna Mohan, Developing Communication Skills, Macmillan, (2009).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes							
	P01	PO2	P03	P04	P05	P06	PO7	PO8
CO1	H	H	L	H	L	H	H	L
CO2	L	H	L	L	H	H	H	H
CO3	H	H	H	H	L	L	H	L
CO4	L	L	H	H	H	H	L	L
CO5	H	H	L	H	H	L	H	L

Semester: I

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
18BMB13A	Core I– Fundamentals of Microbiology	4	4	–	–	Theory

Introduction

Microbiology has played a central role in all aspects of Biological sciences, including morphogenesis, Genetics, developmental biology, Physiology, Biochemistry and Cell biology. An understanding of Microbiology and its lineage is essential to inculcate knowledge of basics.

Course Outcome

CO1	To provide a strong foundation in the fundamentals of microbial world.
CO2	To learn techniques and methods used in the cultivation and isolation of bacteria.
CO3	To obtain with the knowledge about the control of microbe using different measures.
CO4	To grasp the knowledge of cultivating different microbes under controlled conditions
CO5	To become proficient in the identification and maintenance of microorganisms.

Unit I: [12 Periods]
History and Scope of Microbiology –Spontaneous generation theory –conflict –Contribution of Leuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Joseph Lister, Winogradsky, Waksman, John Tyndall, Paul Ehrlich, Watson & Crick and Miescher.

Unit II: [12 Periods]
Microscopy– Principles and application – Bright field, Darkfield, Phase contrast, Fluorescence, Confocal, SEM & TEM– Specimen preparation for Electron microscopy.

Unit III: [12 Periods]
Structure and organization of bacterial cell wall: Gram positive and Gram Negative bacterial cell wall. Staining – Principles – Types of staining– Simple, Differential (Gram, Spore, AFB), Capsule staining (Negative), Giemsa Staining, LPCB, KOH Mount.

Unit IV: [12 Periods]
Sterilization and Disinfection– Principles– Methods of Sterilization – Physical methods – Dry heat– Moist heat, Filtration (Membrane & HEPA) – Radiation – Chemical Sterilization –Chemical agents Mode of action – Phenol coefficient test– Sterility testing.

Unit V: [12 Periods]
Culture & –Media preparation – Solid and Liquid– Types of Media – Semi–Synthetic, Synthetic, Enriched, Enrichment, Selective and Differential media, Natural components as media and Special Purpose Media (one eg for each type). Anaerobic culture technique – Wright’s tube, Roll tube, McIntost fildes jar method. Pure culture techniques – Tube dilution, Pour, Spread, Streak plate.

Text book:

1. Prescott, L.M., Harley, J.P., and Klein, C.A. (1995). Microbiology. 2nd Edition. Wm, C. Brown publishers.
2. Michael J. Pelczar, Chan, Jr. E.C.S., Moel.(1986). Microbiology. Mc Graw Hill Book R. Krieg, Company.

Reference:

1. Tauro P., Kapoor, Yadav, K.K. (2019) An introduction to Microbiology first Edition, New Age International Publishers.
2. Stainer, R.Y., Ingraham, J.L., Wheelis, H.H., and Painter, P.R. (1986) The Microbial world, 5th Edition. Eagle Works Cliffs N.J. Prentica Hall.
3. William Claus, G.W. (1989). Understanding Microbes – A Laboratory textbook for Microbiology, W.H. Freeman and Co., New York.
4. Wilson. K, and Goulding, K.H. (1986). A Biologist’s Guide to Principles and Techniques of Practical Biochemistry, ELBS, London.

Mapping of Course Outcome with Program Outcome:

Course	Program Outcome
--------	-----------------

Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√							√
CO2			√	√				
CO3		√			√			
CO4	√					√		
CO5						√	√	√

Semester: I

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
18BMB23P	Core Practical –I: Fundamentals of Microbiology Practical	4	–	–	4	Practical

Introduction:

This course provides the basic knowledge on size, shape and structure of bacteria and enables the students to know about morphology and cultivation of microorganism.

Course Outcome:

CO1	To become proficient in basic laboratory precautions
CO2	To acquire knowledge on preparing different reagents and media
CO3	To learn basic techniques of cultivating microbes under <i>in vitro</i> conditions.
CO4	To grasp microbial characteristics by analyzing different microbial morphologies
CO5	To differentiate microorganisms using various staining methods

LIST OF EXPERIMENTS

- Laboratory precautions
- Preparation of cleaning solutions
- Culture media preparation – Liquid and Solid medium
- Selective and differential media: Mac conkey and Blood agar
- Methods of sterilization
- Pure culture techniques – Pour plate, Spread plate and Looping method
- Streaking techniques: Simple, Quadrant and continuous
- Enumeration of Bacteria, Fungi and Actinomycetes from soil
- Determination of Motility – Hanging drop & SIM agar
- Cultural characteristics of Microorganisms – Colony morphology on Nutrient agar
- Slants, Nutrient broth
- Maintenance and preservation of cultures
- Staining of Bacteria – Simple, Negative, Gram, Spore, Fungal wet mount –LCB – Slide culture method.
- Paper chromatography
- Thin layer chromatography

Text Book:

1.Prescott, L.M J.P. Harley and C.A. Klein 1995. Microbiology 2nd edition Wm, C. Brown publishers.

2.Michael J. Pelczar, Jr. E.C.S. Chan, Moel : Microbiology Mc Graw Hill Book R. Krieg, 1986 Company.

References

3.William Claus. G.W. 1989. Understanding Microbes – A Laboratory textbook for Microbiology, W.H. Freeman and Co., New York.

4.Wilson. K and Goulding. K.H. 1986. A Biologist's Guide to Principles and Techniques of Practical Biochemistry, ELBS, London.

5.Tauro P., Kapoor, K.K. Yadav,K.S. An introduction to Microbiology first Edition, New Age International Publishers.

6. James Cappuccino. Microbiology: A Laboratory Manual (10th Edition).

Mapping of Course Outcome with Program Outcome

Course Outcome	Program Outcome							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√		√					
CO2			√	√				√
CO3						√	√	
CO4	√						√	
CO5				√			√	

Semester : I

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
18BMB1AA	Allied – A : Paper I – Biostatistics and Computer Applications I	4	4	1	–	Theory

Introduction:

This course introduces the basic Statistical tools that are applied in Microbiology. On successful completion of this course the students shall enrich to draw various diagrams and solving various problems in microbiology using computers.

Course Outcome:

CO1	To gain knowledge about the basics of statistics and it's application.
CO2	To learn about the dispersion and its problems.
CO3	To obtain knowledge about probability and types of distribution.
CO4	To understand about basic concepts of computers.
CO5	To apply the statistical problems in Microsoft Excel.

Unit I: [10 Periods]
Nature and Scope of Statistical methods and their limitations – Data collection – Classification and Tabulation – Primary and Secondary data and their applications in life sciences – Diagrams– Line diagram, Bar diagram and Pie diagram – Graphical presentation – Histogram and Ogives.

Unit II: [9 Periods]
Measures of Location and Dispersion – Stem and Leaf plots – Box and Whisker Plots – Co-efficient of variation – Skewness and its measures.

Unit III: [10 Periods]
Probability – Concept and Definition – Addition and Multiplication theorems of Probability (statement only) – simple problems – Binomial, Poisson and Normal distributions (without proof) – simple problems.

Unit IV: [10 Periods]
Introduction to Computers – Classification – Generations – Low, Medium and High level languages – Software and Hardware – Operating Systems – Compilers and Interpreters – Personal, Mini, Main frame and Super computers – their characteristics and application, BIT, BYTE, WORD computer memory and types; data representation and storage, binary codes, binary system.

Unit V: [9 Periods]
Microsoft Excel – Data entry – Graphs – Aggregate functions– formulae and functions (students are expected to be familiar with all operations)– different number systems and conversions, input and output devices, secondary storage media– Numerical problems based on Units I to IV may be worked using Microsoft Excel.

Text Book:

1. Daniel W.W. (1995) BIOSTATISTICS: A foundation for Analysis in health sciences, 6th Edition, John Wiley
2. Campbell R.C.(1989): Statistics for Biologists, Cambridge University Press.

Reference :

1. Snedecor G.W. and Cochran W.G. (1967): Statistical Methods, Oxford Press
2. R.K. Taxali: PC Hardware and Software, Galgotia Publication

Semester : I

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
18BMB2AP	Allied practical – Biostatistics and Computer Application I and II Practical	-	-	-	2	Practical

Introduction:

The Major Practical's aim is to provide the basic knowledge about the practical and handling of instruments. To understand the theoretical aspects by practical methods.

Course Outcome:

CO1	To enable the students to represent statistical problems graphically.
CO2	To display the statistical problems in a diagrammatic way.
CO3	To find the mean, median, modes and quartile deviation of various problems.
CO4	To calculate range, SD, CV, skewness for the given problem.
CO5	To determine the most probable variation of results in the given data.

LIST OF EXPERIMENTS

[24 periods]

1. Graphical Representation

- a. Histogram
- b. Ogives
- c. Scatter diagram

2. Diagrams

- a. Line diagram
- b. Bar diagram
- c. Pie diagram

3. Measures of Location

- a. Mean (Arithmetic, Geometric and Harmonic)
- b. Median
- c. Mode
- d. Quartile

4. Measures of Dispersion

- a. Range (max – min)
- b. Standard Deviation
- c. Variance
- d. Coefficient of variation
- e. Skewness

Semester : I

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BGE1FA	Environmental Studies	2	2	0	–	FC

Introduction:

This course enables the students to gain knowledge on the importance of environmental education and ecosystem.

Course Outcome:

CO1	To provide basic knowledge about the environment and ecosystem.
CO2	To acquire necessary understanding about the problems involved in the managing environmental problems.
CO3	To provide knowledge for contemplating with natural disaster and management.
CO4	To train students on management of natural resources and preservation.
CO5	To generate awareness about the laws involved in the protection of environment and eco system.

Unit I:

[2 periods]

Multidisciplinary nature of environmental studies: Definition, scope and importance, Need for public awareness.

Unit II :

[5 periods]

Ecosystems–Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Food chains, food webs and ecological pyramids. Types of ecosystem Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit III :

[6 periods]

Environmental Pollution – Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards. Solid waste Management : Causes, effects and control measures of urban and industrial wastes. Disaster management: floods, earthquake, cyclone and landslides.

Unit IV :

[5 periods]

Social Issues and the Environment – Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Environmental Issues in Coimbatore District (Noyyal River, Dye Industries and Agricultural issues). Environmental ethics: Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents. Environment Protection Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation.

Unit V :

[4 periods]

Human Population and the Environment – Population growth, variation among nations, Population explosion – Family Welfare Programme, Environment and human health, Human Rights Women and Child Welfare, Role of Information Technology in Environment and human health.

Textbook:

1. Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education Erach Bharucha for University Grants Commission.
2. Thangamani. A and Shymama. T, A Text Book of Environmental Studies, 2nd ed, DPH, New Delhi, 2006.

Reference:

1. Environmental Studies for Undergraduate Course – Bharathiar University.

Mapping of Course Outcome with Program Outcome

Course Outcome	Program Outcome							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√	√						
CO2			√	√				
CO3	√		√					
CO4					√		√	
CO5	√		√					

Semester: II

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BGE11T	Part I Tamil	3	5	1	0	Theory / Practical

Introduction: ,uz;lhk; gUt ghli;jpl;lk; gf;jp ,yf;fpak;> rpw;wpyf;fpak;> mw ,yf;fpak;> rpWfijfs;> ,yf;fpa tuyhW Mfpaitfs; nfhz;L cUthfAs;sJ.

Course Outcome:

C01	: khzth;fs; gf;jpapyf;fpaj;jpy; cs;s nra;jpfs; mwpe;Jnfhs;Stjhy; gf;jpabd; rhuj;ijAk;> ey;y gof;fj;ijAk; mwpa cjTfpwJ.
C02	: rpw;wpyf;fpaj;jpd; nra;jpfs; khzth;fs; njspthf mwpe;Jnfhs;StJ md;gpd; Nkd;ik> gz;G Mfpaitfs; mwpe;J nfhs;s KbfpwJ.
C03	: ePjpnewp fUj;Jf;fis mwpe;J nfhs;Stjhy; thof;ifapy; gz;Gfis gpd;gw;wTk;> mwnwpNthL thoTk; gaDs;sJ.
C04	: rpWfijfspy; cs;s fijfspy; cs;s ikaf;fUj;Jfis; njhpe;J nfhs;StJ rKjhar; rpe;jisiaAk;> tpopg;Gzh;Tk; cUthf;f cjTfpwJ.
C05	: irtk;> itztk;> ngsj;jk;> gf;jp> ePjp rpw;wpyf;fpaq;fs; Mfpaw;wpd; nra;jpfis mwptJ jkpod; tuyhw;iwAk;> gbepiyfisAk; mwpa gad; cs;sJ.

Unit I:

[12 Periods]
Mz;lhs; jpUg;ghit –10 ghly;fs;> ts;syhu; – ,uz;lhk; jpUKiw –10 ghly;fs;> Njk;ghtzp – igjpu ePq;F glyk;> rPwhg;Guhzk; – cLk;G Ngrpa glyk; Mfpaitfs; gf;jpabd; Nkd;ikAk;> rpwg;igAk; tpsf;Fk; ghkhf mike;Js;sJ.

Unit II:

[12 Periods]
kPdhl;rpak;ik gps;is;jkpo; –2 ghly;fs;> fypq;fj;Jg;guzp–Nfhapy; ghbaJ
kJiuf;fyk;gfk;> fps;is tPL J}J Mfpa rpw;wpyf;fpaq;fspd; fUj;Jf;fis
njspthf vLj;Jiuj;jy;.

Unit III:

[12 Periods]
jpUf;Fws; – mwj;Jg;ghy;– nrhy;yhik> – nghUl;ghy;– rpw;wpdQ;Nruhik>
– ,d;gj;Jg;ghy; – gphpthw;whik> ehybahh; –5 ghly;fs;> gonkhop ehD}W –
ghly;fs; Mrhuf;Nfhit –5 ghly;fs; Mfa ePjp ,yf;fpaq;fspd;
ePjp newpfis tpsq;f itj;jy;.

Unit IV:

[12 Periods]
Njh;e;njLf;fg;gl;l 6 –rpWfijfs; fijfs; – khzth;fspd; jdpj;jpwid tsh;f;Fk; nghUl;L vLf;fg;gLk;.

Unit V:

[12 Periods]
ePjp ,yf;fpak;> rpw;wpyf;fpak;> gf;jp ,yf;fpak; – irtk;> itztk;> ngsj;jk;> rkzk;> ,j;yhkpak;> fpwpj;Jtk; – Mfpaitfspd;
Njhw;wj;ijAk;> tsh;r;rpAk; vLj;Jiuf;fg;gLk;.

Textbook:

K.t. jkpo; ,yf;fpa tuyhW> ghf;fpaNkhp – ,yf;fpatuyhW

Semester II

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMB12E	English II –English for Scientific Communication	4	5	–	–	Theory

Introduction

This course is intended to impart English knowledge in candidates and to enhance their technical skill by providing information on a scientific perspective. A candidate undertaking this course would be able to comprehend language skills required for familiarizing topics in their core scientific domain.

Course Outcome

CO1	To understand the Grammar usage in English Language
CO2	To develop the writing skills with proper sentence formation
CO3	To enhance the reading skill and improve the ability to understand scientific terms
CO4	To develop the knowledge on research and provide a scientific approach on technical reading
CO5	To improve the oratory skill and pronunciation

Unit I: [12 Periods]
Basic Grammar Module – Nouns, Pronoun, Verbs, Adverbs, Adjective, Subject and predicate, Agreement, Prepositions, Voices, Tenses, Conjunctions, Question tags, Phrases, Acronym, Pseudonyms, Dialect, Syllables.

Unit II: [12 Periods]
Basic Writing Module – Sentence formation: Simple sentences, Compound sentences, Complex sentences, Parts of speech, Comprehension – Comprehension passage, Vocabulary building, Paragraph writing. Curriculum Vitae, Resume, Bio data Preparation.

Unit III: [12 Periods]
Basic Reading Module – Newspaper, Text books, Magazines, Journals, Short Story. Dictionary, Thesaurus, Usage of Dictionary for Bioscience – Equivalents for Units for US and metric systems, Abbreviations of Amino acids, Universal Genetic Code, Medical terminology– Index and Glossary usage.

Unit IV: [12 Periods]
Scientific writing Module – Basics of Research Methodology – Steps involved in research, Data types and Collection methods. Research article types – Review, Short Communication, Full article, Patents and its types. Medical transcription and Medical coding – Basics process schedule.

Unit V: [12 Periods]
Oratory Module – Understanding science talks, Seminar, Conference, Webinars, Use of Social media for mass scientific communication, Scientific forums for discussions, speech act, Group discussions – verbal and non-verbal communication, Pronunciation – basics of phonetics and dialects for science.

Text Book

1. Michel Swan (1998). Basic English Usage. Oxford University Press. ISBN:0–19–4311872.
2. Alexander LG (1998). Longman English Grammar Practice. Orient Longman, London, ISBN:0–582–04500–2.
3. Ingo Plag (2002). Word formation in English. Cambridge University Press.

References

1. Dictionary of Bioscience (2003) – McGraw Hill – Second Edition
2. Kimball Nill (2002). Glossary of Biotechnology Terms. Third Edition, CRC Press, London
3. Paul Singleton and Diana Sainsbury (2006). Dictionary of Microbiology and Molecular Biology. Third Edition, John Wiley and Sons, ISBN:0–470–03545–5.

Mapping of Course Outcome with Program Outcome

Course Outcome	Program Outcome							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√							√
CO2			√	√				
CO3		√			√			
CO4	√					√		
CO5						√	√	√

Semester : II

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
18BMB23A	Core Paper : II –Analytical Microbiology	4	4	–	–	Theory

Introduction:

This course highlights the basic laboratory skills that are essential for work in clinical, Pharmaceutical, Microbiology, Biochemistry and Biotechnology laboratories. Upon successful completion of this course, students will be able to explain bioinstrumentation techniques, design and application.

Course Outcome:

CO1	To become proficient in various laboratory instruments.
CO2	To acquire knowledge on operating principles of lab equipments.
CO3	To learn basic techniques of cultivating microbes under <i>in vitro</i> conditions.
CO4	To grasp knowledge on troubleshooting problems with different instruments.
CO5	To understand the ultimate purpose of the instruments in the laboratory based on the experimentation.

Unit I:

[10 Periods]

Buffers, Molar and Normal solutions, pH meter, pH electrodes– colomel and glass electrode.

Unit II:

[9 Periods]

Principles and Applications of Autoclave, Hot air oven, Incubator, Laminar air flow chamber / Biosafety cabinets, BOD incubator, Metabolic shaker, Incinerator.

Unit III:

[9 Periods]

Centrifugation: Principle– Types of Centrifuges – Low speed, High speed, Ultra centrifuge. Applications of Centrifuge. Lyophilizer.

Unit IV:

[10 Periods]

Colorimetry, Turbidometry, Spectrometry – UV & Visible Spectrophotometer. Flame Photometry, AAS.

Unit V:

[10 Periods]

Chromatography – Paper, Thinlayer, Column, Ion–exchange, Gas and HPLC. Electrophoresis – SDS – PAGE and Agarose gel electrophoresis, PFG.

Text Book :

- Gedder, A. and L. E. Balsler, John Wiley and Sons, Principles of applied Biomedical instrumentation.
- Upadhyay & Upadhyay. Biophysical Chemistry. 2010 Edition. Himalaya Publishing House.
- Dean, Willard and Merrit, Instrumental Methods of analysis Asian Ed.

Reference:

- Fritschen, L. J and L. W. Gay, Springer, Verlag, Environmental Instrumentation, 1979, New York.
- Boyer, Rodney, F. Benjamin and Cummins, Modern Experimental Biochemistry. 2nd Edition.
- E.Padmini., Biochemical Calculations and Biostatistics (2007) Books and Allied (P) Ltd., First Edtn.

Mapping of Course Outcome with Program Outcome

Course Outcome	Program Outcome							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√						√	
CO2		√		√				
CO3	√					√		
CO4							√	√
CO5			√			√	√	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type		
18BMB23B	Core Paper –III : General Biology	4	3	0	0	Theory		
Introduction								
This course enhances the students skill set by imparting knowledge on the structure and function of prokaryotics and eukaryotic cells. Moreover, information about the plant and animal physiology ensures that the student gains an overall knowledge on their functions.								
Course Outcome:								
CO1	To gain knowledge on the structure and function of microbial cells.							
CO2	To ensure the prompt information on comparative biology.							
CO3	To learn basic information about the plant and animal cell morphology and functions.							
CO4	To grasp knowledge on the physiological aspect of cell system.							
CO5	To acquire a comprehensive understanding on the relation between different cells and its mode of action.							
Unit I: [12 Periods]								
Ultrastructure of Eubacteria– Cell membrane– Extra mural layer – Slime – Capsule – Cytoplasmic inclusions – Mesosomes – Nuclear material – Reserve materials – Pigments – Cell appendages – Flagella – Pili.								
Unit II: [12 Periods]								
Ultrastructure and functions of Eukaryotic cell organelles – Cell wall – Cell membrane – Mitochondria – Chloroplast – Endoplasmic reticulum – Golgi complex – Nucleus – Ribosomes – Other cell inclusions and Flagella.								
Unit III: [12 Periods]								
Cell division in Bacteria – Binary fission – Cell division in Eukaryotes – Mitosis and Meiosis. Reproduction in Microbes.								
Unit IV: [12 Periods]								
Botany: Ultrastructure of plant cell. General characters of Thallophyta–Spirogyra, Bryophyta–Liverwor, Pteridophyta–Fern, Angiosperms–Tulips and Gymnosperms–Pinus. Zoology: Ultrastructure of Animal cell. General characteristics of Vertebrate –Frog and Shark and Invertebrate– Butterfly and Earth Worm								
Unit V: [12 Periods]								
Human physiology–Digestive System and Excretion, Respiratory System, Nervous System, Muscular System and Cardiovascular System.								
Textbook:								
1. Prescott, L.M J.P. Harley and C.A. Klein 1995. Microbiology 2nd edition Wm, C. Brown publishers.								
2. Michael J. Pelczar, Jr. E.C.S. Chan, Moel : Microbiology Mc Graw Hill Book R. Krieg, 1986 Company								
3. Stainer R.Y. Ingraham J.L. Wheelis H.H and Painter P.R. 1986 The Microbial world, 5th edition. Eagle Works Cliffs N.J. Prentice Hall. Yy								
Reference :								
1. Jain V.K. (2000) Fundamentals of Plant Physiology, 5th edition. S.Chand & Co Ltd; New Delhi.								
2. Pandey B.P. (2007) Plant Anatomy, S. Chand & Co. De, New Delhi.								
3. Reddy, S.M. (2010) University Botany – 2. Gymnosperms, Plant Anatomy, Genetics, Ecology. New Age International Publishers, New Delhi.								
4. Ekambarantha Ayyar, and Ananthkrishnan, T.N. 1993 Outlines of Zoology, Vol. I & II Viswanathan and co Madras.								
5. Sambasiviah I, Kamalakara Rao. A.P. Augustine Chellappa, S [1983] Text Book of Animal Physiology, S. Chand & Co., New Delhi.								
6. Dr. C. Chatterjee I & II, Human Physiology. Medical Allied Agency, Kolkatta.								
7. Sarada Subramaniam and K. Madhavan Kutty, Human Physiology. S. Chand and Co, New Delhi.								
8. Ross and Wilson, Anatomy and Physiology, 8 th Edition, Churchill Livingstone.								
Mapping of Course Outcome with Program Outcome								
Course Outcome	Program Outcome							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√	√						
CO2			√					√
CO3	√			√				
CO4	√					√		
CO5			√					√

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
18BMB2AB	Allied – A : Paper II – Biostatistics and Computer Applications II	4	4	–	0	Theory

Introduction : This course introduces the basic Statistical tools that are applied in Microbiology.

On successful completion of this course the students shall enrich to solve various problems in microbiology which helps the students to do research problems.

Course Outcome:

CO1	To gain knowledge about the correlation and regression.
CO2	To learn about the methods of least squares and sampling methods.
CO3	To understand the concept of sampling distribution.
CO4	To know about the non-parametric test and its problems.
CO5	To understand the concept of testing of hypothesis in one way and two way ANOVA.

Unit I: [10 Periods]

Correlation – Scatter diagram – Karl Pearson’s co-efficient of Correlation – Co-efficient of determination – Spearman’s Rank Correlation – Linear Regression.

Unit II: [10 Periods]

Curve fitting– Fitting of Linear, Parabolic and Exponential curves. Need for Sampling – Methods of Sampling – Simple random, Stratified random, Systematic random and Cluster sampling – Sampling and Non-sampling errors

Unit III: [10 Periods]

Concept of Sampling Distribution – Standard error – Tests of significance based on Normal, ‘t’, ‘F’ and Chi square distributions.

Unit IV: [9 Periods]

Non-parametric tests – Advantages and Disadvantages – Uses – Sign test, Mann-Whitney ‘U’ test, Kruskal-Wallis test, Run test and Median test.

Unit V: [9 Periods]

Analysis of Variance – One way and Two way Classifications – Principles of Experimentation – Completely Randomized Design and Randomized Block Design.

Text Book:

1. Gupta S.P. (2014). Statistical Methods. 43rd Edition, Sulthan Chand and Sons, New Delhi.
2. Arora P.N, Sumeet Arora and Arora .S: Comprehensive Statistical Methods Sarada Subramaniam and K. Madhavan Kutty, Human Physiology. S. Chand and Co, New Delhi.

Reference :

1. Daniel W.W. (1995) BIOSTATISTICS: A foundation for Analysis in health sciences, 6th Edition, John Wiley
2. Camphell R.C.(1989): Statistics for Biologists, Cambridge University Press.
3. Snedecor G.W. and Cochran W.G. (1967): Statistical Methods, Oxford Press.

Semester : II

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
18BMB2AP	Allied practical – Biostatistics and Computer Application I and II Practical	2	–	–	2	Practical

Introduction:

The Major Practical's aim is to provide the basic knowledge about the practical and handling of instruments. To understand the theoretical aspects by practical methods.

Course Outcome:

CO1	To find the correlation of various problems.
CO2	To calculate the regression analysis and its curve fitting.
CO3	To apply various parametric test in real life problems.
CO4	To determine the ANOVA for one way and two way classification.
CO5	To determine the correctness of data using probability analysis.

Correlation

[24 Periods]

- a. Karl Pearson's coefficient
 - b. Spearman's Rank
 - c. Coefficient of determination
- 6. Curve Fitting**
- a. Linear Regression
 - b. Parabolic
 - c. Exponential curves
- 7. Parametric tests**
- a. Normal (z)
 - b. t (Equal Variance)
 - c. F
 - d. Chi square
- 8. Analysis of Variance (ANOVA)**
- a. One way classification.
 - b. Two way classification.

Semester : II

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BGE2FB	Ability Enhancement Compulsory Course – II – Human Rights	2	2	–	–	Theory

Introduction

This course presents the basic introduction towards human rights and its social implications.

Course Outcome

CO1	To make the student to understand the concept of Human values.
CO2	To enable the student to incept the Global development.
CO3	To make students gain knowledge on Ethics and Values.
CO4	To make students to understand various Therapeutic measures.
CO5	To give the concept of Human Rights and types.

UNIT – I : Concept of Human Values, Value Education Towards Personal

Development

Aim of education and value education; Evolution of value oriented education; Concept of Human values; types of values; Components of value education.

Personal Development :

Self analysis and introspection; sensitization towards gender equality, physically challenged, intellectually challenged. Respect to – age, experience, maturity, family members, neighbours, co-workers.

Character Formation Towards Positive Personality:

Truthfulness, Constructivity, Sacrifice, Sincerity, Self Control, Altruism, Tolerance, Scientific Vision.

UNIT – II : Value Education Towards National and Global Development National and International Values:

Constitutional or national values – Democracy, socialism, secularism, equality, justice, liberty, Freedom and fraternity.

Social Values – Pity and probity, self control, universal brotherhood.

Professional Values – Knowledge thirst, sincerity in profession, regularity, punctuality and faith.

Religious Values – Tolerance, wisdom, character.

Aesthetic values – Love and appreciation of literature and fine arts and respect for the same. National Integration and international understanding.

UNIT – III : Impact of Global Development on Ethics and Values

Conflict of cross-cultural influences, mass media, cross-border education, materialistic values, professional challenges and compromise. Modern Challenges of Adolescent Emotions and behavior; Sex and spirituality: Comparison and competition; positive and negative thoughts. Adolescent Emotions, arrogance, anger, sexual instability, selfishness, defiance.

UNIT – IV : Therapeutic Measures

Control of the mind through

- a. Simplified physical exercise
- b. Meditation – Objectives, types, effect on body, mind and soul
- c. Yoga – Objectives, Types, Asanas
- d. Activities:
 - (i) Moralisation of Desires
 - (ii) Neutralisation of Anger
 - (iii) Eradication of Worries
 - (iv) Benefits of Blessings

UNIT – V : Human Rights

1. Concept of Human Rights – Indian and International Perspectives

- a. Evolution of Human Rights
- b. Definitions under Indian and International documents

2. Broad classification of Human Rights and Relevant Constitutional Provisions.

- a. Right to Life, Liberty and Dignity
- b. Right to Equality
- c. Right against Exploitation
- d. Cultural and Educational Rights
- e. Economic Rights
- f. Political Rights
- g. Social Rights

3. Human Rights of Women and Children

- a. Social Practice and Constitutional Safeguards

- (i) Female Foeticide and Infanticide
- (ii) Physical assault and harassment
- (iii) Domestic violence
- (iv) Conditions of Working Women

4. Institutions for Implementation

- a. Human Rights Commission
- b. Judiciary

5. Violations and Redressal

- a. Violation by State
- b. Violation by Individuals
- c. Nuclear Weapons and terrorism
- d. Safeguards.

Text Book:

1. Dey A. K – “Environmental Chemistry” New Delhi – Vile Dasaus Ltd.
2. Gawande . EN – “Value Oriented Education” – Vision for better living. New Delhi (2002) Saruptsons
3. Brain Trust Aliyar – “Value Education for health, happiness and harmony” Erode (2008) Vethathiri publications.
4. Ignacimuthu S. J. S – “Values for life” Bombay (1999) Better Yourself – Books
5. Seetharam. R. (Ed) – “Becoming a better Teacher” Madras (1998) – Academic Staff College
6. Grose. D. N – “A text book of Value Education’ New Delhi (2005) Dominant Publishers and Distributors

Reference Book:

1. Shrimali K. L – A Search for Values in Education” Delhi (1974) – Vikas Publishers
2. Yogesh Kumar Singh and Ruchika Nath – “Value Education” New Delhi (2005) A. P. H Publishing Corporation
3. Venkataram & Sandhiya . N – “Research in Value Education” New Delhi (2001) APH Publishing corporation
4. Ruhela S. P – “Human Value and Education” New Delhi – Sterling publishers
5. Brain Trust Aliyar– “Value Education for Health, Happiness and Harmony” Erode (2004) Vethathiri publications
6. Swami Vivekananda –“Personality Development” Kolkata(2008) Advaita Ashrama
7. Swami Jagadatmananda –“Learn to Live” Chennai–Sri Ramakrishna Math

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
18BMB33A	Microbial Physiology and Metabolism	4	5	–	–	Theory

Introduction:

This course deals with the study on how a microbial cell utilizes the available nutrient and obtain energy in nature. Understanding microbial physiology is vital in manipulating both the beneficial and harmful characteristics of microbes.

Course Outcome:

CO1	To identify and study the morphology of prokaryotic and eukaryotic cells.
CO2	To understand nutritional requirements and physiological aspects of nutrient uptake in microbes.
CO3	To analyze the role of different metabolic pathways involved in the nutrient metabolism.
CO4	To grasp the aspect of anaerobic respiration in the microbial metabolism.
CO5	To decipher the concept of various biosynthetic pathway involved in microbial metabolism.

Unit I: [12 Periods]

Bacterial Cell structure and Function

Subcellular structures of microbes – slime layer – capsule, cell wall – Gram positive and Gram negative, cytoplasmic membrane – pili – flagella – storage granules – comparison of prokaryotic and eukaryotic organisms – sporulation and germination – cell division in bacteria – binary fission.

Unit II: [12 Periods]

Nutrition

Nutritional requirements of microorganisms – macro elements, micro elements and growth factors, nutritional groups of microbes – transport mechanisms and types – simple diffusion – facilitated diffusion – active transport – group translocation – Ion transport. Growth curve – Generation time – factors influencing microbial growth – batch, continuous, synchronous growth – diauxic growth.

Unit III: [12 Periods]

Aerobic respiration and Photosynthesis

EMP – HMP – ED pathways – TCA cycle– electron transport chain (ETC) – oxidative and Substrate level phosphorylation – photosynthesis – oxygenic and an oxygenic, carbon dioxide fixation.

Unit IV: [12 Periods]

Anaerobic respiration and Fermentation

Anaerobic respiration – sulphur, nitrogenous compounds and CO₂ as final electron acceptor – Fermentation – alcoholic, lactic acid, propionic, butanediol and mixed acid fermentation.

Unit V: [12 Periods]

Biosynthesis

Biosynthesis of bacterial cell wall – Biosynthesis of amino acids (Pyruvate family) – Biosynthesis of fatty acids – general pathway – Biosynthesis of purine and pyrimidine nucleotides denovo and salvage pathways – bioluminescence.

Text Book:

1. Caldwell DR., “Microbial physiology and Metabolism”, WMC Brown Publishers, New Delhi.

Reference Books

1. Moat, A.G. and Foster, J.W., “Microbial Physiology”, Springer, New York.
2. Schlegel HG., “Microbiology” Cambridge University press, London.
3. Stainer, R.Y., Ingraham, J.L., Wheelis, M.L. and Painter, P.R., “Microbial Physiology”, McGraw–Hill Higher Education New York.
4. Lehninger, Nelson and Cox., “Principles of Biochemistry”, W.H.Freeman & Company, New York.

Mapping of Course Outcome with Program Outcome

Course Outcome	Program Outcome							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√	√	√					
CO2	√			√			√	
CO3	√	√	√	√				
CO4	√		√			√	√	
CO5	√	√		√		√		

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
18BMB33B	Microbial Diversity	3	5	–	–	Theory

Introduction:

This paper has been structured to make the students familiarize with fundamental knowledge on the classification and diversity of microorganisms.

Course Outcome:

CO1	To understand the principle of microbial taxonomy and it's types.
CO2	To describe common groups of bacteria and archaea in different ecosystems.
CO3	To describe common groups of fungi, algae, protozoa, and virus in different ecosystems.
CO4	To evaluate, synthesize and present scientific studies of genetic and functional microbial diversity.
CO5	To describe the composition of microbial communities and for the function and occurrence of individual groups.

Unit I: [12 Periods]

Principles of Taxonomy

Taxonomy – Principles – Modern approaches – Numerical, Molecular, Serotaxonomy and Chemotaxonomy. Introduction to Microbial Classification and Taxonomy –Taxonomic ranks.

Unit II: [12 Periods]

Taxonomy of Bacteria

Bergey's Manual, Binomial Nomenclature and Universal Phylogenetic tree. Classification system: Phenetic and Phylogenetic, Whittaker's Five Kingdom and Carl Woese's three kingdom classification system and their application. Difference between prokaryotic and eukaryotic microorganism.

Unit III: [12 Periods]

Taxonomy of Fungi

General Characteristics of Fungi – Life Cycle of *Aspergillus*, *Mucor*, *Rhizopus* and *Penicillium* – Modes of reproduction and its economic importance.

Unit IV: [12 Periods]

Taxonomy of Algae and Protozoa

General characteristics of algae including algal cell ultra-structure. Classification of algae–Chlamydomonas, Volvox, Diatoms, red algae and brown algae. Application of Algae in agriculture, industry, environment and food. General characteristics of protozoa with special references with *Entamoeba histolytica*, *Trichomonas*, *Giardia* and *Plasmodium*.

Unit V: [12 Periods]

Taxonomy of viruses

Virus– Morphology, general characteristics, classification (Baltimore classification) and multiplication of viruses. The structure of viruses – virion size – General structure properties – helical capsids, icosohedral capsid – nucleic acids – Viral envelopes and enzymes.

Text Book:

1. Tortora, G.J., Funke, B.R., and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education.
2. Wiley, J.M., Sherwood, L.M., and Woolverton, C.J. (2013) Prescott's Microbiology. 9th edition. McGraw Hill International.
3. Pelczar, M.J., Chan, E.C.S., and Krieg, N.R. (1993). Microbiology. 5th edition. McGraw Hill Book Company.
4. Duby, R.C. (2014) Textbook of Microbiology. 5th edition. S. Chand Publishing.

Reference Books:

1. Stanier, R.Y., Ingraham, J.L., Wheelis, M.L., and Painter, P.R. (2005). General Microbiology. 5th edition. McMillan.
2. Madigan, M.T., Martinko J.M., Dunlap, P.V., and Clark, D.P. (2014). Brock Biology of Microorganisms. 14th edition. Pearson International Edition.
3. Cappucino, J., and Sherman, N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Ltd.
4. Atlas, R.M. (1997). Principles of Microbiology. 2nd edition. W.M.T.Brown Publishers.

Mapping of Course Outcome with Program Outcome

Course Outcome	Program Outcome							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√	√	√	√				
CO2		√		√	√	√		

CO3		√	√	√		√			
CO4	√	√		√	√				
CO5	√	√	√				√		

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type		
18BMB3AC	Biochemistry – I	3	3	–	–	Theory		
Introduction:								
Biochemistry is a branch of science which deals with the chemistry of living organisms and that of their biological processes. It deals with the ability to comprehend chemical combinations and reactions that occurs due to biological processes such as growth, reproduction, metabolism, heredity.								
Course Outcome:								
CO1	To provide the basics of Biochemistry and it's applications.							
CO2	To describe the structure and functions of enzymes, proteins, lipids and carbohydrates.							
CO3	To understand the molecular basis of Cell regulation by Nucleic acid							
CO4	To understand the regulatory mechanism of physiological and biochemical reactions of cell.							
CO5	To present the basis behind the biosynthetic pathway of biomolecules.							
Unit I:						[7 Periods]		
Carbohydrates								
Monosaccharides, disaccharides and polysaccharides – classification, structure, biological and physiological importance.								
Unit II:						[8 Periods]		
Amino acids								
Classification of amino acids – essential amino acids – properties – zwitter ion – isoelectric. Proteins: classification and function of proteins– structural level of organization.								
Unit III:						[7 Periods]		
Lipids								
Classification and properties of lipids. Types of fatty acids – saturated, unsaturated and essential fatty acids. Classification and significance of lipoproteins, glycolipids and phospholipids. Biological significance of steroids and cholesterol.								
Unit IV:						[7 Periods]		
Nucleic acids								
Components of DNA and RNA. Double helical structure of DNA – Structure and types of RNA.								
Unit V:						[7 Periods]		
Enzymes								
Classification of enzymes with examples, coenzymes and cofactors (structures not needed) – Active site: Lock and key model– induced fit hypothesis. Factors affecting enzyme activity. Enzyme inhibitors. Chemical and industrial applications of enzymes.								
Text Book:								
<ol style="list-style-type: none"> 1. Deb A.C., (2001) Fundamentals of Biochemistry, 9th edition, New Central Book Agency, Calcutta. 2. Ambika Shanmugam., (2016) Fundamentals of Biochemistry for Medical students, WMC Brown Publishers, New Delhi. 3. Sathyanarayana U. (2008) Biochemistry. Books and Allied Pvt. Ltd., New Delhi. 								
Reference Books:								
<ol style="list-style-type: none"> 1. Campbell, M.K. (2012) Biochemistry, 7th edition. Published by Cengage Learning. 2. Tymoczko, J.L., Berg, J.M., and Stryer, L. (2012) Biochemistry: A short course, 2nd edition. W.H.Freeman. 3. Berg, J.M., Tymoczko, J.L., and Stryer, L. (2011) Biochemistry, 2nd edition. W.H.Freeman and Company. 4. Lehninger A.L., and Nelson D.L., (2016) Principles of Biochemistry. Cox– CBS Publishers, New Delhi. 5. Willey, M.J., Sherwood, L.M., and Woolverton, C. J. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGrawHill. 								
Mapping of Course Outcome with Program Outcome								
Course Outcome	Program Outcome							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√	√	√			√		
CO2	√		√	√				
CO3		√		√			√	
CO4	√	√	√			√		
CO5	√		√	√		√		

Semester : III

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
18BMB33P	Core Practical – II : Microbial Diversity, Physiology and Metabolism Practical	3	–	–	5	Practical

Introduction:

Understanding microbial physiology is vital in manipulating both the beneficial and harmful characteristics of microbes. This course has been framed such that a candidate would get a complete hands on experience on the techniques involved in the characterization of the microbial diversity and physiological characteristics.

Course Outcome:

CO1	To enhance knowledge on Microbial Physiology like growth.
CO2	To gain information on cultivation of microbes on variable factors.
CO3	To determine the biochemical characterization of the microbial flora.
CO4	To learn about the representative forms of various microbial cells.
CO5	To determine the nature of microbial nutrient utilization.

List of Experiments

[60 Periods]

1. Micrometry – determination of size of bacteria.
2. Determination of bacterial Growth curve by turbidometric method.
3. Effect of temperature and pH on growth of microorganism
4. Biochemical characterization of microbes
 - IMViC test
 - Catalase test
 - Oxidase test
 - Urease test
 - Nitrate test
 - Triple sugar iron agar test
 - Carbohydrate fermentation test
5. Demonstration of alcoholic fermentation
6. Hydrolysis test
 - Starch hydrolysis
 - Gelatin
 - Casein hydrolysis
7. Cultivation of anaerobes – Wrights tube method, Mc Intosh fildes jar
8. Observation of representative forms of Algae – *Anabena* , *Volvox*.
9. Observation of representative forms of Fungi – Yeast, *Penicillium*.
10. Observation of representative forms of Parasites – *Entamoeba*, *Plasmodium*.

Text Book:

1. Kannan, N. (2002). Laboratory Manual in General Microbiology. 2nd Edition. Panima Publishing Corporation. New Delhi.
2. Alfred E. Brown (2001). Benson's Microbiological Application – Laboratory Manual in General Microbiology. The McGraw Hill Company.

Reference Books:

1. Cappucino, J., and Sherman, N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Ltd.
2. Tiwari, G. S. Hoondal (2005). Laboratory Techniques In Microbiology & Biotechnology. Swastik publishers.

Mapping of Course Outcome with Program Outcome

Course Outcome	Program Outcome							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√		√	√			√	
CO2	√	√			√		√	
CO3	√	√				√	√	
CO4	√	√	√			√		
CO5	√		√		√		√	

Semester : IV

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
18BMB3AP	Allied Practical – II : Biochemistry Practical	2	–	–	3	Practical

Introduction:

The course aims to develop the skills in biochemical analysis and to develop the skills of the students in Qualitative and analysis of biomolecules. A successful student will be able to equip themselves with the basic biochemical tools and standard operation procedures.

Course Outcome:

CO1	To perform qualitative identification of carbohydrate.
CO2	To perform qualitative identification of amino acid.
CO3	To perform separation of carbohydrates by paper chromatography.
CO4	To perform Separation of amino acids by paper chromatography.
CO5	To determine the acid number and iodine number of lipids.

List of Experiments 36 Periods]

QUALITATIVE ANALYSIS

1. Analysis of carbohydrates

- a. Monosaccharides – Hexoses – Glucose and Fructose
- b. Disaccharides – Sucrose and Lactose
- c. Polysaccharide – Starch

2. Analysis of Amino acids

- a. Histidine
- b. Tyrosine
- c. Tryptophan
- d. Arginine

3. Characterization of Lipids

- a. Determination of acid number
- b. Determination of iodine number

Text Book:

Reference Books:

1. Martin Holtzhauer. (2006). Basic Methods for the Biochemical Lab. 1st Edition. Springer, Germany.

Mapping of Course Outcome with Program Outcome

Course Outcome	Program Outcome							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√		√	√			√	
CO2	√	√			√		√	
CO3	√	√				√	√	
CO4	√	√	√			√		
CO5	√		√		√		√	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
18BMB3ZA	Skill Enhancement Courses – I Waste Management	2	4	–	–	Theory

Introduction:

This course was intended to create a general awareness among the candidates on the importance of waste management. Students would be imparted with knowledge on the various methodologies involved in managing different type of wastes.

Course Outcome:

CO1	To provide the basics of municipal solid waste.
CO2	To describe the process of collection and segregation of waste.
CO3	To understand the importance of nuclear and e-waste.
CO4	To analyze different methods involved in the management of wastes
CO5	To study the health hazards and environmental effects caused by wastes.

Unit I: [10 Periods]

Municipal solid waste

Definition - Sources and types of solid waste- composition and its determinants of solid waste-factors influencing generation-methods of sampling and characterization.

Unit II: [9 Periods]

Collection and segregation

Collection: Collection of Solid waste – collection services –Transport– transfer stations – types –waste segregation - equalization - reduction in volume and strength.

Unit III: [10 Periods]

Nuclear wastes and e-waste

Characteristics – Types – Uranium mining and processing – Power reactors – Refinery and fuel fabrication wastes – spent fuel – Management of nuclear wastes – Hazard analysis health and environmental effects.

Unit IV: [10 Periods]

Biomedical and chemical wastes

Biomedical wastes – Types – Management – control of biomedical wastes Chemical wastes – Sources – Domestic and industrial - Inorganic pollutants – Environmental effects – Treatment and disposal techniques – Physical, chemical and biological processes – Health and environmental effects.

Unit V: [9Periods]

Management of wastes

Disposal of Solid Wastes – land fill – incineration and composting, recycling- reuse- anaerobic digestion- energy recovery-standards for composting- treated leachates and incineration.

Text Book:

1. George Tchobanoglous. (2002). Integrated Solid Waste Management, 2nd Edition, McGraw - Hill, New Delhi.

Reference Books:

1. Tchobanoglous Thiesen Ellasen.(1977). Solid Waste Engineering Principles and Management, McGraw – Hill, New Delhi.
2. J. Glynn Henry and Gary. W. Heinke. (1996). Environmental Science and Engineering. Prentice Hall of India, India.
3. Prescott and Rehm. (2007). Industrial Microbiology, 2nd Edition. Wiley and Sons, France.
4. Nduka Okafor. (2007) Modern Industrial Microbiology and Biotechnology, CRC Press, New Delhi.

Mapping of Course Outcome with Program Outcome

Course Outcome	Program Outcome							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√	√	√			√		√
CO2	√		√	√	√			
CO3	√		√			√		√
CO4	√	√			√		√	
CO5			√		√	√		√

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
IDC – 1	Mushroom cultivation Technology	2	2	0	0	Theory

Introduction:

This course deals with the process of identifying different types of mushrooms and the methods involved in mushroom cultivation. A successful candidate will develop the learner's ability to select and cultivate appropriate varieties of mushrooms in different environmental conditions, with particular emphasis on the Genus *Agaricus*.

Course Outcome:

CO1	To inculcate knowledge on identification and classification of fungi based on morphology.
CO2	To understand the life cycle of different Mushroom varieties.
CO3	To learn and experiment on techniques involved in the cultivation of fungi.
CO4	To determine the nutritional value of cultivated mushroom from a quality perspective.
CO5	To gain insight on the problems involved in mushroom cultivation process.

Unit I: [4 Periods]

Morphology and Classification:

Mushroom morphology: Different parts of a typical mushroom and variations in mushroom morphology. Key to differentiate edible from poisonous mushrooms. Mushroom Classification: Based on occurrence – Epigenous and hypogenous, Natural habitats – Humicolous, Lignicolous & Coprophilous, Color of spores – white, yellow, pink, purple brown and black.

Unit II: [4 Periods]

Biology of Mushrooms:

Vegetative characters, general morphology, spore germination and life cycle of button mushroom (*Agaricus bisporus*), milky mushroom (*Calocybe indica*), oyster mushroom (*Pleurotus sajorajaju*) and paddy straw mushroom (*Volvariella volvcea*).

Unit III: [6 Periods]

Equipment and sterilization techniques:

Isolation and culture of spores, culture media preparation. Production of mother spawn, multiplication of spawn – Inoculation technique – Cultivation technology – Substrates, composting technology, bed, polythene bag preparation, spawning – casing – cropping – Mushroom production – harvest – packing, storage and marketing.

Unit IV: [4 Periods]

Nutritional profile of Mushrooms:

Protein, amino acids, calorific values, carbohydrates, fats, vitamins & minerals. Medicinal Properties of Mushrooms: Antibacterial, antifungal, antiviral, anti-tumour effect and hematological value. Cardiovascular and renal effect, in therapeutic diets, adolescence, for aged persons and diabetes mellitus. Mushroom nutraceuticals.

Unit V: [4 Periods]

Problems in Mushroom cultivation:

Diseases, pests and nematodes, weed molds and their management strategies. Mushroom economics: economics of spawn and mushroom, cultivation, postharvest technologies. Processing and preservation of mushrooms. Mushroom research centers in India.

Text Book:

1. Tripathi, D.P. (2005). Mushroom Cultivation. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Reference Books:

1. Kannaiyan, S. and Ramasamy, K. (1980). A hand book of edible mushroom. Today & Tomorrows printers and publishers, New Delhi.
2. Alice, D., Muthusamy and Yesuraja, M. (1999). Mushroom Culture. Agricultural College, Research Institute Publications, Madurai.
3. Nita Bhal. (2000). Handbook on Mushrooms. 2nd ed. Vol. I and II. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Pathak Yadav Gour, (2010). Mushroom Production and Processing Technology. Published by Agrobios, India.

Mapping of Course Outcome with Program Outcome

Course Outcome	Program Outcome							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√		√		√			
CO2	√		√		√			
CO3	√	√		√			√	
CO4	√		√	√		√		
CO5	√			√		√		√

Semester : IV

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type		
18BMB43A	Microbial Genetics	4	5	–	–	Theory		
Introduction: This course is framed to emphasize on the knowledge of the candidate on the types of Genetic material and the regulations under which it acts. Students undertaking this course would be able to study the role of nucleic acids in regulating the microbial cells functions.								
Course Outcome:								
CO1	To provide the basics knowledge on the historical perspective of Genetics.							
CO2	To describe the process of DNA replication.							
CO3	To understand the mechanism of Transcription and Translation.							
CO4	To analyze different types of mutation and its regulation.							
CO5	To study the various types of gene transfer mechanisms.							
Unit I:						[12 Periods]		
Genetic Materials Genetics- historical introduction- DNA as a genetic material – structure and chemical composition of DNA- Watson and Crick model – topological forms of DNA. Organization of genes in prokaryotes - RNA as a genetic material.								
Unit II:						[12 Periods]		
Replication DNA replication – semi conservative- Messelson and Stahl’s experiment- replication in Prokaryotes – mechanism and enzymology of replication – helicase, DNA gyrase, polymerases, ligase - rolling circle model – theta replication.								
Unit III:						[12 Periods]		
Transcription and Translation Enzymology and mechanism of transcription in prokaryotes - structure of mRNA, rRNA and tRNA - genetic code – characteristics of genetic code - Enzymology and mechanism of translation in prokaryotes.								
Unit IV:						[12 Periods]		
Mutation and gene regulation Mutation – spontaneous and induced mutations- mutagenesis- - Physical and chemical agents – site specific mutagenesis- mutagenicity testing - DNA damage and repair - regulation of gene activity- operon model- lac and trp operon.								
Unit V:						[12Periods]		
Gene recombination in bacteria Transformation – transduction (Specialized & Generalized)-conjugation F+ v/s F, Hfr + v/s F- - recombination – homologous recombination - site specific recombination and transposition.								
Text Book: 1. Russell, P.J. (2009). i Genetics- A Molecular Approach. 3 rd edition, Benjamin Cummings.								
Reference Books: 1. Klug, W.S., Cummings, M.R., Spencer, C., Palladino, M. (2011). Concepts of Genetics, 10 th edition, Benjamin Cummings. 2. Krebs, J., Goldstein, E., Kilpatrick, S. (2013). Lewin’s Essential Genes, 3 rd edition, Jones and Bartlett Learning. 3. Pierce, B.A. (2011) Genetics: A Conceptual Approach, 4 th edition, Macmillan Higher Education Learning. 4. Watson, J.D., Baker, T.A., Bell, S.P., et al. (2008) Molecular Biology of the Gene, 6 th edition, Benjamin Cummings. 5. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. 8 th edition, Wiley-India. 6. Maloy, S.R, Cronan, J.E., and Friefelder, D. (2004) Microbial Genetics 2 nd edition, Jones and Barlett Publishers.								
Mapping of Course Outcome with Program Outcome								
Course Outcome	Program Outcome							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√		√		√		√	
CO2		√	√			√	√	
CO3	√	√	√		√			√
CO4		√		√	√		√	
CO5	√	√		√		√		

Semester : IV

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type		
18BMB43B	Medical Microbiology	3	5	–	–	Theory		
Introduction: This course provides the ability to characterize, isolate and identify different microbes. It includes a detailed study of characterization, etiology, pathogenicity, clinical systems, and laboratory diagnosis of disease causing Microorganisms.								
Course Outcome:								
CO1	To provide the basics knowledge about infections.							
CO2	To describe the morphology and cultural characters of Gram positive bacteria.							
CO3	To understand the morphology and cultural characters of Gram negative bacteria.							
CO4	To understand the morphology and cultural characters of mycobacteria, spirochetes and intracellular parasites.							
CO5	To study the methods of diagnosis of infections.							
Unit I:						[12 Periods]		
Infections Normal microflora of human body - Sources and types of infections- methods of transmission – Virulence Factors - adhesion, exotoxins and endotoxins - Epidemic, Endemic and Pandemic diseases- Infectious disease cycle.								
Unit II:						[12 Periods]		
Gram positive organisms Gram positive organisms - Morphology, cultural characteristics, pathogenicity <i>Staphylococcus aureus</i> , <i>Streptococcus pyogenes</i> , <i>Pneumococcus</i> , <i>Bacillus anthracis</i> , <i>Clostridium tetani</i> and <i>Clostridium botulinum</i> .								
Unit III:						[12 Periods]		
Gram negative organisms Gram negative organisms Morphology, cultural characteristics, pathogenicity and clinical manifestations 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>Neisseria gonorrhoeae</i> , and <i>Neisseria meningitidis</i> .								
Unit IV:						[12 Periods]		
Mycobacteria, Spirochetes and Intracellular parasites Morphology, cultural characteristics, pathogenicity and clinical manifestations of <i>Corynebacterium diphtheriae</i> , <i>Mycobacterium tuberculosis</i> , <i>Mycobacterium leprae</i> . <i>Spirochaetes – Treponema pallidum</i> , and <i>Leptospira icterohaemorrhagiae</i> , <i>Mycoplasma pneumoniae</i> , <i>Rickettsia rickettsii</i> and <i>Chlamydia trachomatis</i> .								
Unit V:						[12Periods]		
Diagnosis Laboratory diagnosis of common bacterial infections– Process of sample collection, transportation and processing-antibiotics- modes of action-Antibacterial susceptibility testing- drug resistance.								
Text Book: 1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication.								
Reference Books: 1. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms. 14th edition. Pearson International Edition. 2. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott, Harley and Klein’s Microbiology. 9th edition. McGraw Hill Higher Education. 3. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007). Mims’ Medical Microbiology. 4th edition. Elsevier.								
Mapping of Course Outcome with Program Outcome								
Course Outcome	Program Outcome							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√		√		√		√	
CO2		√	√			√	√	
CO3	√	√	√		√			√
CO4		√		√	√		√	
CO5	√	√		√		√		

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type		
18BMB4AD	Biochemistry-II	3	4	–	–	Theory		
Introduction:								
Biochemistry is a branch of science which deals with the chemistry of living organisms and that of their biological processes. It deals with the ability to comprehend chemical combinations and reactions that occurs due to biological processes such as growth, reproduction, metabolism, heredity.								
Course Outcome:								
CO1	To provide the basics of Biochemistry and buffer systems.							
CO2	To describe the process of Bioenergetics.							
CO3	To understand the properties of vitamins and minerals.							
CO4	To understand the types of Hormones and its functions.							
CO5	To present the basis behind the inborn errors of metabolism.							
Unit I:						[10 Periods]		
Buffer system								
pH – acid base indicators - Henderson – Hasselbalch equation – buffer systems of blood and body fluids acidosis and alkalosis – distribution of fluids in the body – dehydration.								
Unit II:						[9 Periods]		
Bioenergetics								
Basic principles of thermodynamics – entropy, enthalpy and free energy. High energy phosphates, oxidation – reduction reactions – oxidases, dehydrogenases, oxygenases – organization of the respiratory chain in mitochondria.								
Unit III:						[10 Periods]		
Vitamins and Minerals								
Classification, properties and physiological functions of vitamins – fat soluble – (A,D,E and K) and water soluble (B and C) – deficiency – Macronutrients – Physiological importance of Calcium , Phosphorus, Magnesium, Sodium and Potassium – Trace elements – Physiological functions of Iron, Copper and Iodine								
Unit IV:						[10 Periods]		
Hormones								
General characteristics – classification – functions of thyroid stimulating hormone (TSH) – oxytocin – vasopressin – thyroid – tyrosine – pancreas – insulin – diabetes.								
Unit V:						[9 Periods]		
Inborn errors of Metabolism								
Hereditary anemias – sickle cell anemia and thalassemia – errors of carbohydrate (galactosemia) and protein metabolism (phenylketonuria) – disease and syndromes.								
Text Book:								
1. Deb A.C., (2001) Fundamentals of Biochemistry, 9 th edition, New Central Book Agency, Calcutta.								
2. Ambika Shanmugam., (2016) Fundamentals of Biochemistry for Medical students, WMC Brown Publishers, New Delhi.								
3. Sathyanarayana U. (2008) Biochemistry. Books and Allied Pvt. Ltd., New Delhi.								
Reference Books:								
1. Campbell, M.K. (2012) Biochemistry, 7 th edition. Published by Cengage Learning.								
2. Tymoczko, J.L., Berg, J.M., and Stryer, L. (2012) Biochemistry: A short course, 2 nd edition. W.H.Freeman.								
3. Berg, J.M., Tymoczko, J.L., and Stryer, L. (2011) Biochemistry, 2 nd edition.W.H.Freeman and Company.								
4. Lehninger A.L., and Nelson D.L., (2016) Principles of Biochemistry. Cox– CBS Publishers, New Delhi.								
5. Willey, M.J., Sherwood, L.M., and Woolverton, C. J. (2013) Prescott, Harley and Klein’s Microbiology. 9 th edition. McGrawHill.								
Mapping of Course Outcome with Program Outcome								
Course Outcome	Program Outcome							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√	√	√			√		
CO2	√		√	√				
CO3		√		√			√	
CO4	√	√	√			√		
CO5	√		√	√		√		

Semester : IV

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
18BMB43P	Core Practical - III : Microbial Genetics and Medical Microbiology Practical	3	–	–	5	Practical

Introduction:

Understanding Microbial Genetics and Medical Microbiology is vital in manipulating both the beneficial and harmful characteristics of microbes. This course has been framed such that a candidate would get a complete hands on experience on the techniques involved in the characterization of the Microbial nucleic acids and also study on different types of pathogens.

Course Outcome:

CO1	To enhance knowledge on Microbial Genetics like nucleic acid isolation and characterization.
CO2	To gain information on cultivation of microbes on variable factors.
CO3	To determine the morphological characters of pathogenic microbial flora.
CO4	To learn about the representative forms of various microbial cells.
CO5	To determine the characteristics of genetic material.

List of Experiments

[60 Periods]

- Isolation of plasmid DNA from *E. coli*.
- Isolation of chromosomal DNA from bacteria.
- Separation of proteins by SDS – PAGE.
- Isolation of mutants using physical agent – UV.
- Isolation of auxotrophic mutants using chemical agents
- Isolation of antibiotic resistant mutants by Gradient plate
- Identification of clinically important bacteria
 - Identification of *Staphylococcus aureus*
 - Identification of *Streptococcus pyogenes*
 - Identification of *E. coli*
 - Identification of *Salmonella*
 - Identification of *Klebsiella*
 - Identification of *Pseudomonas*
 - Identification of *Proteus*
- Microscopic identification of clinically important fungi
 - Candida albicans*,
 - Cryptococcus neoformans*
 - Aspergillus*.
- Direct examination of parasites in blood- Thick and thin film
- Antibiotic sensitivity testing – Kirby Bauer method

Text Book:

- Kannan, N. (2002). Laboratory Manual in General Microbiology. 2nd Edition. Panima Publishing Corporation. New Delhi.
- Alfred E. Brown (2001). Benson's Microbiological Application – Laboratory Manual in General Microbiology. The McGraw Hill Company.

Reference Books:

- Cappucino, J., and Sherman, N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Ltd.
- Tiwari, G. S. Hoondal (2005). Laboratory Techniques In Microbiology & Biotechnology. Swastik publishers.

Mapping of Course Outcome with Program Outcome

Course Outcome	Program Outcome							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√		√	√			√	
CO2	√	√			√		√	
CO3	√	√				√	√	
CO4	√	√	√			√		
CO5	√		√		√		√	

Semester : IV

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
18BMB4AP	Allied Practical – II : Biochemistry II Practical	2	–	–	3	Practical

Introduction:

The course aims to develop the skills in biochemical analysis and to develop the skills of the students in Qualitative and analysis of biomolecules. A successful student will be able to equip themselves with the basic biochemical tools and standard operation procedures.

Course Outcome:

CO1	To perform quantitative identification of carbohydrate.
CO2	To perform quantitative identification of proteins.
CO3	To perform separation of carbohydrates by paper chromatography.
CO4	To perform Separation of amino acids by paper chromatography.
CO5	To determine the acid number and iodine number of lipids.

List of Experiments 36 Periods]

QUALITATIVE ANALYSIS

1. Measurement of pH.
2. Preparation of Buffers – Acids and Alkaline Range.
3. Preparation of Solutions (Molar and Normal Solutions).
4. Protein estimation (Lowry *et al*).
5. Quantitative of determination protein by Bradford method.
6. Determination of Maximum absorption (μ_{max}) spectra of standard Proteins.
7. Quantitative determination of carbohydrate by Anthrone method.
8. Estimation of Carbohydrates (DNSA method).

Text Book:

Reference Books:

1. Martin Holtzhauer. (2006). Basic Methods for the Biochemical Lab. 1st Edition. Springer, Germany.

Mapping of Course Outcome with Program Outcome

Course Outcome	Program Outcome							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√		√	√			√	
CO2	√	√			√		√	
CO3	√	√				√	√	
CO4	√	√	√			√		
CO5	√		√		√		√	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
18BMB3ZB	Skill Enhancement Courses – II Clinical Laboratory Technology	2	4	–	–	Theory

Introduction:

This course was intended to create a skill set among the candidates on the clinical lab techniques. Students would be imparted with knowledge on the various methodologies involved in clinical analysis of samples.

Course Outcome:

CO1	To understand different types of microbial diseases.
CO2	To describe the process of collection of samples in labs.
CO3	To understand the methods of processing clinical samples.
CO4	To analyze and perform clinical serology.
CO5	To study about the antibiogram analysis in lab.

Unit I: [10 Periods]

Bacterial, Viral, Fungal and Protozoan Diseases of various human body systems, Disease associated clinical samples for diagnosis.

Unit II: [9 Periods]

Collection of clinical samples

How to collect clinical samples (oral cavity, throat swab, tissue sample, skin, Blood, CSF, urine and faeces) and precautions required. Method of transport of clinical samples to laboratory and storage.

Unit III: [10 Periods]

Processing of Clinical Samples

Examination of sample by staining – Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa-stained thin blood film for malaria. Preparation and use of culture media - Blood agar, Chocolate agar, Lowenstein-Jensen medium, MacConkey agar, distinct colony properties of various bacterial pathogens

Unit IV: [10 Periods]

Clinical serology

Serological Methods - Agglutination, ELISA, immune fluorescence, Nucleic acid based methods – PCR, Nucleic acid probes, Typhoid, HBV, HCV, HIV and Denque.

Unit V: [9Periods]

Antibiogram analysis

Importance, Determination of resistance/sensitivity of bacteria using disc diffusion method (Kirby Bauer Method) Determination of minimal inhibitory concentration (MIC) of an antibiotic by broth dilution method (LC50, LC90).

Text Book:

- Ananthanarayan R and Paniker CKJ (2009). Textbook of Microbiology, 8th edition, Universities Press Private Ltd.
- Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013). Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication.

Reference Books:

- Tille P (2013) Bailey's and Scott's Diagnostic Microbiology, 13th edition, Mosby
- Collee JG, Fraser, AG, Marmion, BP, Simmons A (2007) Mackie and McCartney Practical Medical Microbiology, 14th edition, Elsevier.

Mapping of Course Outcome with Program Outcome

Course Outcome	Program Outcome							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√			√		√		√
CO2		√	√			√	√	
CO3	√			√			√	√
CO4	√					√		√
CO5		√	√	√			√	√

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
IDC – 2	Dairy Technology	2	2	0	0	Theory

Introduction:

This course deals with the process involved in Dairy industry that are used to obtain, process and preserve milk. It is intended to provide knowledge in various unit operations and basic concepts in dairy processing.

Course Outcome:

CO1	To inculcate knowledge on protective factors involved in milk production.
CO2	To understand the methods of enhancing the quality of milk by different industrial techniques.
CO3	To learn the principles, effects and application of homogenization in milk industries.
CO4	To determine the process of advanced dairy product preservation.
CO5	To gain insight on the problems involved in dairy industry and utilizing current trends to overcome problems.

Unit I: [4 Periods]

Use of bio-protective factors for preservation of raw milk: effects on physicochemical, microbial and nutritional properties of milk and milkproducts, present status of preservation of raw milk by chemical preservatives; thermal processing for preservation.

Unit II: [4 Periods]

Methods of determining lethality of thermal processing, UHT processed milk products, their properties and prospects, types of UHT plants, aseptic fillers, heat stability and deposit formation aspects, effect on milk quality; techno- economic considerations; retort processing.

Unit III: [6 Periods]

Principles and equipment for bacto-fugation and Bactotherm processes, Microfluidization of milk: Principle, equipment, effects and applications, Homogenization and their applications in dairy industry.

Unit IV: [4 Periods]

Dehydration: advances in drying of milk and milk products; freeze concentration, freeze dehydration: physicochemical changes during freeze drying and industrial developments.

Unit V: [4 Periods]

Current trends in cleaning and sanitization of dairy equipment: biological; detergents; Automation; Ultrasonic techniques in cleaning; bio-detergents, development of sanitizers- heat; chemical; radiation, mechanism of fouling and soil removal; Bio-films, assessing the effectiveness of cleaning and sanitization of dairy products.

Text Book:

- Smit, G (2003). Dairy Processing – Improving Quality. CRC-Woodhead Publ.
- Troller J.A. and Christian, H.B. (1978). Water Activity and Food, Food Science and Technology. A Series of Monograph Academic Press, London.
- Walstra, P., Geurts, T.J., Noomen, A., Jellema, A., Van Boekel, M.A.J.S. (1999). Dairy Technology – Principles of Milk Properties and Processes. Marcel Dekker.

Reference Books:

- Burton, H. (1998). Ultra-high Temperature Processing of Milk and Milk Products. Elsevier.
- Fellow, P. (1988). Food Processing Technology. Ellis Horwood Ltd. Gould GW. 1995. New Methods of Food Preservation. Blackie.
- IDF Bulletin (1981). New Monograph on UHT Milk. Document No. 133, Intern. Dairy Fed., Brussels.

Mapping of Course Outcome with Program Outcome

Course Outcome	Program Outcome							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√	√	√		√		√	√
CO2		√		√			√	√
CO3	√		√	√	√			√
CO4	√	√		√			√	
CO5	√	√	√					√