



# NEHRU ARTS AND SCIENCE COLLEGE

(An Autonomous Institution affiliated to Bharathiar University)

(Reaccredited with "A" Grade by NAAC, ISO 9001:2015 & 14001:2004, Certified Recognized by UGC with 2(f) & 12 B, Under Star College Scheme by DBT, Govt. of India)

Nehru Gardens, Thirumalayampalayam, Coimbatore - 641 105, Tamil Nadu.



## Scheme of Examination

### B. Sc. Microbiology

(Applicable to the students admitted during the academic year 2020-2021 onwards)

Semester	Part	Course Code	Name of the Course	Instruction hours / week	Duration of Examination	Examination Marks			Credits	
						CIA	ESE	Total		
I	I	18U1TAM101/ 18U1HIN101 / 18U1MAL101/ 20U1FRN101	Language I	5	3	25	75	100	4	
	II	20U2ENG101	English I	5	3	25	75	100	4	
	III		18U3MGC101	Core Paper I - Fundamentals of Microbiology	6	3	25	75	100	4
			18U3MGC102	Core Paper II – Cell Biology	3	3	20	55	75	3
			18U3MTA101	Allied Paper I – Biostatistics	4	3	20	55	75	3
			19U3MBP205	Core Paper V – Lab in Fundamentals of Microbiology & Cell Biology	4	-	-	-	-	-
	IV	18U4ENV101	Ability Enhancement Compulsory course: Environmental Studies	2	3	-	50	50	2	
IV	18U4HVY201	Value education: Human Values and Yoga Practice – I	1	-	-	-	-	-		
<b>Sub Total</b>				<b>30</b>				<b>500</b>	<b>20</b>	
II	I	18U1TAM202/ 18U1HIN202/ 18U1MAL202/ 20U1FRN202	Language II	5	3	25	75	100	4	
	II	20U2ENG202	English II	5	3	25	75	100	4	
	III		18U3MGC203	Core Paper III – Microbial Diversity	4	3	20	55	75	3
			18U3MBC204	Core Paper IV – Analytical Microbiology	4	3	20	55	75	3
			19U3MBP205	Core Paper V – Lab in Fundamentals of Microbiology & Cell Biology	4	3	30	45	75	3
			18U3CNA202	Allied Paper II – Fundamentals of Computer Applications	3	3	20	55	75	3
			18U3CNR203	Allied Paper III – MS Office Practical	2	3	20	30	50	2
	IV	18U4HRC202	Ability enhancement compulsory course : Human Rights and Constitution of India	2	3	-	50	50	2	
IV	18U4HVY201	Value education: Human Values and Yoga Practice – I	1	2	25	25	50	2		
<b>Sub Total</b>				<b>30</b>				<b>650</b>	<b>26</b>	
III	I	20U1TAM303/ 19U1HIN303 / 20U1MAL303/ 20U1FRN303	Language III	5	3	25	75	100	4	
	II	20U2ENG303	English III	5	3	25	75	100	4	
	III		20U3MBC306	Core Paper VI – Microbial Physiology and Metabolism	3	3	20	55	75	3
			20U3MBP307	Core Paper VII – Lab in Microbial Physiology and Metabolism	4	3	40	60	100	4

		20U3BYA304	Allied Paper IV – Biochemistry	3	3	20	55	75	3
		20U3BYR406	Allied Paper VI – Biochemistry & Biotechniques Practical	2	-	-	-	-	-
	IV	20U4MBS301	Skill Based Paper I – Fundamentals of Bioinformatics	3	3	20	55	75	3
		19U4NM3BT1 / 19U4NM3AT1 / 19U4NM3CAF / 19U4NM3GTS / 19U4NM3WRT	# @Basic Tamil / ##Advanced Tamil / * NME: Consumer Affairs / Gandhian Thoughts / Women’s Rights	2	3	50		50	2
		20U4MB3ED1/ 20U4MB3ED2	EDC – Extra Departmental Course	2	3	-	50	50	2
		18U4HVY402	Value Education: Human Values and Yoga Practice II	1	-	-	-	-	-
		20U4MBVALC	Skill Enhancement Add on course – Institute Industry Linkage	-	-	-	-	-	-
			<b>Sub Total</b>		<b>30</b>				<b>625</b>
IV	I	20U1TAM404/ 19U1HIN404 / 20U1MAL404/ 20U1FRN404	Language IV	5	3	25	75	100	4
		20U2ENG404	English IV	5	3	25	75	100	4
	III	20U3MBC408	Core Paper – VIII Microbial Genetics and Molecular Biology	4	3	25	75	100	4
		20U3MBP409	Core Paper IX – Lab in Microbial Genetics and Molecular Microbiology	4	3	40	60	100	4
		20U3BYA405	Allied Paper V – Instrumentation and Biotechniques	3	3	20	55	75	3
		20U3BYR406	Allied Paper VI – Biochemistry & Biotechniques Practical	2	3	20	30	50	2
	IV	20U4MBS402	Skill Based Paper II – Biofertilizers and Biopesticides	4	3	20	55	75	3
		19U4NM4BT2/ 19U4NM4AT2/ 19U4NM4GEN	# @Basic Tamil / ##Advanced Tamil / General Awareness	2	3	50		50	2
		18U4HVY402	Value Education : Human Values and Yoga Practice - II	1	2	25	25	50	2
		20U4MBVALC	Skill Enhancement Add on course – Institute Industry Linkage	-	-	-	-	-	Grade
		<b>Sub Total</b>		<b>30</b>				<b>700</b>	<b>28</b>
V	III	20U3MBC510	Core Paper X– Soil and Agricultural Microbiology	5	3	25	75	100	4
		20U3MBC511	Core Paper XI – Industrial Microbiology	5	3	25	75	100	4
		20U3MBC512	Core Paper XII– Immunology	5	3	25	75	100	4
		20U3MBP513	Core Paper XIII – Lab in Applied Microbiology	6	6	40	60	100	4
		20U3MBE 501/ 20U3MBE 502/ 20U3MBE 503	Discipline Specific Elective Paper I	5	3	20	55	75	3
	IV	20U4MBS503	Skill Based Paper III – Management of Human Microbial Diseases	4	3	20	55	75	3
		<b>Sub Total</b>		<b>30</b>				<b>550</b>	<b>22</b>
VI	III	20U3MBC614	Core Paper XIV –Medical Microbiology	5	3	25	75	100	4
		20U3MBC615	Core Paper XV – Food and Dairy Microbiology	5	3	25	75	100	4
		20U3MBP616	Core Paper XVI – Lab in Medical & Food Microbiology	6	9	40	60	100	4

	20U3MBE604/ 20U3MBE605/ 20U3MBE606	Discipline Specific Elective Paper II	5	3	20	55	75	3
	20U3MBE607/ 20U3MBE608/ 20U3MBE609	Discipline Specific Elective Paper III	5	3	20	55	75	3
IV	20U4MBZ604	Skill Based Paper IV Lab in Microbiological Analysis of Air and Water	4	3	30	45	75	3
V	19U5EXT601	Extension Activities	-	-	50	-	50	2
<b>Sub Total</b>			<b>30</b>				<b>575</b>	<b>23</b>
<b>Total</b>							<b>3600</b>	<b>144</b>
Additional Credit (Optional)			Semester II-VI				3725	8\$

# **Basic Tamil** -Students who have not studied Tamil upto 12<sup>th</sup> standard.

##**Advance Tamil** – Students who have studied Tamil language upto 12<sup>th</sup> standard and chosen other languages under part I of the programme but would like to advance their Tamil language skills.

\* **NME** – Student shall choose any one course out of three courses.

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

\$ - Not included in Total marks & CGPA Calculation

#### LIST OF DISCIPLINE SPECIFIC ELECTIVE PAPERS:

Discipline Specific Elective Papers	Course code	Group	Name of the Course
Discipline Specific Elective Paper I / Sem. V	20U3MBE501	A	Recombinant DNA Technology
	20U3MBE502	B	Environmental Microbiology
	20U3MBE503	C	Advances in Microbiology
Discipline Specific Elective Papers I I/Sem. VI	20U3MBE604	A	Biosafety and Intellectual Property Rights (IPR)
	20U3MBE605	B	Plant Pathology
	20U3MBE606	C	Microbial Quality Control in Food and Pharmaceutical Industries
Discipline Specific Elective Papers III /Sem. VI	20U3MBE607	A	Nanobiotechnology
	20U3MBE608	B	Microbiology and Entrepreneurship
	20U3MBE609	C	Microbial Diagnosis in Health Clinics

#### Extra Departmental Course

S. No.	Course Code	Name of the Course
1	20U4MB3ED1	Mushroom Cultivation Technology
2	20U4MB3ED2	Vermitechnology

#### Additional Credit Course

Earning Additional credit course is not mandatory for Course Completion

Additional credits: 8

S. No.	Course	Credit/ Course	Total Credits
1	Completion of Certificate Course	1	1
2	Hindi/ other Foreign languages	1	1
3	Self-Study Papers	1	2
4	MOOC Courses/Spoken Tutorial prescribed by the Departments	1	3

5	Representation - Sports/ Social Activities/ Co curricular/ Extracurricular Activities at University/ District/ State/ National/ International levels	1	1
		<b>Total</b>	8

**Rules:** The Students can earn additional credits only if they complete the above during the course period (II to V Sem.) and based on the following criteria. Proof of Completion must be submitted to the Office of Controller of Examinations before the commencement of the VI Semester. (Earning Additional credit course is not mandatory for Course Completion).

1. Students can complete Certification Courses for a minimum of 30hrs (II to V Sem. only) from reputed centers and the same certificate shall be produced to earn a credit. They shall be guided by the Department if needed.
2. Students can opt Hindi/ any Foreign Language approved by Certified Institutions to earn one credit. The certificate of Hindi must be obtained from Dakshin Bharat Hindi Prachar Sabha and He/She has to enroll and complete during their course period (II to V Sem only).
3. Students can earn one credit, if they complete one self study Paper prescribed by the Department. The Departments shall offer two Self Study Papers.
4. Students can earn one Credit, if they complete any one MOOC courses/ Spoken Tutorial prescribed by the Department. Students shall earn a maximum of 3 Additional Credits by completing 3 online courses.

**Self-Study Paper offered by Microbiology Department**

S. No.	Semester	Course code	Course Title
1	Semester II to V	20UMBSS01	Solid Waste Management
2		20UMBSS02	Human Anatomy and Physiology

**Chairman Board of Studies in  
Microbiology Nehru Arts and Science College  
Coimbatore**

Course Code	Title		
20U1TAM101	PART – I TAMIL - I		
Semester: I	Credits: 4	CIA: 25 Marks	ESE : 75 Marks

(Common to all UG Programmes)

Course Objective : மொழி இலக்கியத்தின் வாயிலாக அறம்சார் பண்பு மற்றும் ஆளுமைமிக்க மாணவர்களை உருவாக்குதல்.

Course Outcome : தமிழ் இலக்கியங்கள் வாயிலாக சமூகச் சீர்திருத்தச் சிந்தனைகள் பெறப்படும்

Offered by : தமிழ்த்துறை

Course Content

Instructional Hours / Week: 5

Unit	Description	Instructional Hours
I	அற இலக்கியம் - திருக்குறள் அறன்வலியறுத்தல் (31 - 40 குறள்) நடுவு நிலைமை (111 - 120 குறள்) ஈசை (221 - 230 குறள்) புகழ் (231 - 240 குறள்) வாய்மை (291 - 300 குறள்)	15
II	புதுக்கவிதைகள் பாரதியார்- நிலவு, வானம் , காற்று பாரதிதாசன் - வான் ஆரூர் தமிழ்நாடன்- கரிக்கிறது தாய்ப்பால் காகிதப்பக்கள் - நா. காமராசன் மரங்கள் - மு. மேத்தா சுவாசம் - சல்மா	15
III	பெண்ணியம் வாழ்க்கை — ஆண்டாள் பிரியதர்சனி ( சுயம் பேசும் கிளி) தொட்டிச்செடி — கவிஞர் இளம்பிறை அம்மா — சுகிர்தராணி நீரில் அலையும் முகம் - அ.வெண்ணிலா	15
IV	சிறுகதைகள் புதுமைப்பித்தன் சிறுகதைகள் (மூன்றாம் பாகம்)	15
V	இலக்கண - இலக்கிய வரலாறு 1. மாணக்கர்களுக்குரிய இலக்கணம் (நன்னூல் மூன்று நூற்பா)	15


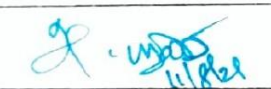


பதினெண்கீழ்க்கணக்கு நூல்கள் - அறிமுகமபுதுக்கவிதையின் தோற்றமும் வளர்ச்சியும் சிறுகதையின் தோற்றமும் வளர்ச்சியும்	
<b>Instructional Hours</b>	<b>15</b>
<b>Total Hours</b>	<b>75</b>

பார்வை நூல்கள்

1. பாரதியார் கவிதைத் தொகுப்பு, அபிராமி பதிப்பகம், 7-பி, கொடிமரத் தெரு, சென்னை - 600013.
2. பாரதிதாசன் - அழகின் சிரிப்பு, அபிராமி பதிப்பகம், 7-பி, கொடிமரத் தெரு, சென்னை - 600013.
3. அப்துல் ரகுமான் - அப்துல்ரகுமான் கவிதைகள், விஜயா பதிப்பகம், கோவை-641001.
4. மு. மேத்தா - கண்ணீர்ப்பூக்கள், குமரன் புத்தக நிலையம், மதுரை.
5. திருவள்ளூர் - திருக்குறள் பரிமேலழகர் உரை, சாரதா பதிப்பகம், ஜி - 4, சாந்தி அடுக்ககம், 2:3.
6. ஸ்ரீ கிருஷ்ணாபுரம் தெரு, இராயப்பேட்டை, சென்னை - 600014.  
ஆண்டாள் பிரியதர்சனி - சுயம் பேசும் கிளி கவிதைத்தொகுப்பு, ராகவேந்திரா வெளியீடு 163:2 பொன்விழா அச்சகம், பாடிக்குட்ட சாலை, அண்ணாநகர், சென்னை.
7. கவிஞர் இளம்பிறை - தொட்டிச்செடி, பொன்னி வெளியீடு, சென்னை - 91.  
சுகிர்தராணி - தீண்டப்படாத முத்தம், காலச்சுவடு பதிப்பகம், நாகர்கோயில்.
8. அ.வெண்ணிலா - நீரில் அலையும் முகம் முதல் கவிதைத் தொகுப்பு - 2000  
முனைவர் ச.சுபாஷ் சந்திரபோஸ் - புதுமைப்பித்தன் சிறுகதைகள் (மூன்றாம் பாகம்) பாவை பப்ளிகேஷன்ஸ், சென்னை - 600014.
9. மு.வ. - தமிழ் இலக்கிய வரலாறு சாகித்திய அகாதெமி, புதுதில்லி - 110001.  
தமிழண்ணல் - புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு, மீனாட்சி புத்தக நிலையம், மதுரை - 625001.  
சல்மா - ஒரு மாலையும் இன்னோரு மாலையும், காலச்சுவடு பதிப்பகம், நாகர்கோவில்.  
பவணந்தி - தென்னிந்திய சைவசித்தாந்த நூற்பதிப்புக் கழகம், திருநெல்வேலி.

#### Tools for Assessment (25 Marks)

CIA I	CIA II	Model	Assignment	Seminar	Attendance	Total
5	5	6	3	3	3	25

Course Designed by	Verified by	Checked by	Approved by
		 Convenor CDG	



Course Code	Title		
20U1FRN101	Part – I French – I		
Semester - I	Credits : 4	CIA: 25 Marks	ESE: 75 Marks

(Common to all UG Programs except B. Sc. Catering Science and Hotel Management)

**Course Objective :** To make the students know and understand the value of French language and help them to follow the culture and tradition.

**Course Outcomes (CO)**

CO1	Empowering reading skill
CO2	Translation

**Offered by :** French department

**Course Content**

**Instructional Hours / Week : 5**





Unit	Description	Instructional Hours
I	Bonjour	15
II	Rencontres	15
III	100 % questions	15
IV	Enquête	15
V	Invitations	15
		<b>Total Hours 75</b>

**Text Book:**

1. CONNEXIONS 1 Methode de Français Niveau 1 – Régine Mérieux Yves Loiseau

**Tools for Assessment (25 Marks)**

CIA I	CIA II	CIA III	Assignment	Seminar	Attendance	Total
5	5	6	3	3	3	25

Course Designed by	Verified by	Checked by	Approved by
			



Course Code	Title		
20U2ENG101	Part II- English I		
Semester: I	Credits: 4	CIA: 25	ESE : 75

(Common to all UG Programmes)

**Course Objective:**

To help students to imbibe, develop, practice and use the LSRW skills and fine tune their productive skills.

**Course Outcomes:**

CO1	Recognize listening, and reading proficiency through the prose discourses
CO2	Use and interpret imaginative, and creative skills through the poetic genre
CO3	Enhance the students to use English effectively
CO4	Execute and exercise LSRW skills in academic and career
CO5	Evaluate the language skills through literature

Offered by: English

Instructional Hours / Week: 5

Unit	Description	Text Book	Chapter
I	<b>Prose</b> Leigh Hunt – Getting Upon Cold Morning Rajagopalachari – Tree Speaks Swami Vivekananda – The Secret of Work	1	1-3
	<b>Instructional Hours</b>		
II	<b>Poetry</b> DG Rossetti – The Blessed Damozel Maya Angelou -Phenomenal Women A. K. Ramanujan – A River	1	4-6
	<b>Instructional Hours</b>		
III	<b>Short Stories</b> O. Henry – The Last Leaf R. K. Narayan – The Missing Mail Oscar Wilde - The Happy Prince	1	7-9
	<b>Instructional Hours</b>		
IV	<b>Grammar and Vocabulary</b> Parts of speech Tenses – Present, past, Vocabulary of the specific domain, Punctuations, Kinds of Sentences.	1	10-15
	<b>Instructional Hours</b>		
V	<b>Oral &amp; Written Communication</b> <b>Listening</b> : (UNIT I – IV) <b>Listening</b> – Comprehension practice from Poetry, Prose, Short-stories, observing/viewing E-content (with subtitles), Guest/Invited Lectures, Conference/Seminar Presentations & Tests and DD National News Live, BBC, CNN, VOA etc <b>Speaking</b> – In Group Discussion Forum, speak about Tongue Twisters, Critical Thinking, and Seminar Presentations on Classroom-Assignments, and Peer-	1	14-17
	<b>Instructional Hours</b>		

<p>Team interactions.</p> <p><b>Reading</b> – Pronunciation practice and enhancement from Poetry, Prose, Short-stories, Magazines, News Paper etc</p> <p><b>Writing</b> – Asking &amp; Giving Directions/Instructions, Developing Hints, and Filling Forms.</p>	
<b>Instructional Hours</b>	<b>15</b>
<b>Total Hours</b>	<b>75</b>

**Books for study:**


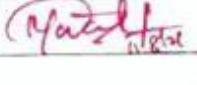



**Unit I – V : Compiled by the Department of English**

**Books for Reference:**

1. CLIL ( Content & Language Integrated Learning ) – Module by TANSCHENOTE:  
(Text: Prescribed chapters or pages will be given to the students by the department and the college)

**Tools for Assessment (25 Marks)**

CIA I	CIA II	CIA III	Assignment	Seminar	Attendance	Total
5	5	6	3	3	3	25

Course Designed by	Verified by HOD	Checked by	Approved by
		 	

Course Code	Title		
18U3MGC101	Core Paper I - Fundamentals of Microbiology		
Semester: I	Credits: 4	CIA: 25 Marks	ESE: 75 Marks

**Course Objective:**

This subject aims to introduce the history and development of Microbiology. The contents of this course will help students understand history, biology of microorganisms, growth and control of microbes. Thus the beginners are rightly exposed to foundation of Microbiology which would lead them towards progressive advancement of the subject.

**Course Outcomes (CO):**

On completion of the course, students are able to:

CO1	Get an idea about the historical events and diversity in microbiology
CO2	Understand different methods of staining and culture techniques
CO3	Acquainted with various sterilization techniques and Use various method to control microbes.
CO4	Know parts of microscope, type and its principal
CO5	Understand the Estimation, Maintenance and Preservation

**Offered by: Microbiology****Course Content****Instructional Hours / Week: 6**

Unit	Description	Text Book	Chapter
I	<b>History and Scope of Microbiology</b> – Spontaneous generation theory-conflict	1	1&2
	Contribution of Leuvenhoek, Louis Pasteur		
	Robert Koch, Edward Jenner		
	Joseph Lister, Winogradsky, Waksman, John Tyndall		
	Classification systems -Whittaker's five kingdom - six kingdom and eight kingdom approach.	2	2
<b>Instructional Hours</b>			<b>18</b>
II	<b>Culture &amp; Staining techniques</b> -Media preparation	1	6
	Media and It's Types		
	Anaerobic culture technique – Wright's tube, Roll tube, McIntostfildes jar method	2	3
	Pure culture technique – Tube dilution, Pour, Spread, Streak plate.	1	8
	Stains and staining techniques	4&5	2
<b>Instructional Hours</b>			<b>18</b>
III	<b>Sterilization and Disinfection</b> - Principles- Methods of Sterilization – Physical methods – Dry heat- Moist heat, Filtration (Membrane & HEPA) - Radiation – Chemical Sterilization -Chemical agents Mode of action	2	19
	Phenol coefficient test	2	2
	Sterility testing		
<b>Instructional Hours</b>			<b>18</b>
IV	<b>Microscopy</b> - Bright field - Dark Field - Phase contrast and Fluorescence microscope. Electron Microscope - Specimen preparation -TEM and SEM.	3&5	2
<b>Instructional Hours</b>			<b>18</b>

V	<b>Estimation of Microbes</b> - Direct Microscopic count, Turbidometric assay, TVC- Indirect Method- CO <sub>2</sub> liberation	3	7
	<b>Maintenance and Preservation</b> - Short term – Slant, Stab, Mineral oil overlay - Long term – Lyophilization, Cryo preservation, Storage in sterile soil, Storage in silica gel.	2	20
<b>Instructional Hours</b>			<b>18</b>
<b>Total Hours</b>			<b>90</b>

**Text Book(s):**

1. Pelczar MJ, Chan ECS and Kreig NR (2008). Microbiology, 5<sup>th</sup> Edition, Tata McGraw Hill-Hill Education Pvt. Ltd., New Delhi.
2. Dubey RC and Maheswari DK (2005). A Textbook of Microbiology, Revised Multicolour Edition. S Chand and Company Limited, New Delhi.
3. Prescott, L.M J.P. Harley and C.A. Klein (1995). Microbiology, 2<sup>nd</sup> Edition Wm, C.Brown.
4. Harley (2002). Laboratory Excercises in Microbiology, 5<sup>th</sup> Edition, The McGraw – Hill
5. <http://www.nptel.ac.in/courses/102103015/pdf/mod3.pdf>  
 Unit I: Text book 1&2, Chapter 1&4 (3-34), Chapter 2 (26-58)  
 Unit II: Text book 1&2, Chapter 6 (99 - 103) & 8(133), Chapter 3 (59- 64), Chapter 2 (31-74)  
 Unit III: Text book 2, Chapter 19 (540 - 585)  
 Unit IV: Text book 3, Chapter 2(22-39)  
 Unit V: Text book 2, Chapter 20(578 - 585)

**Reference Book(s):**

1. Willey, J.M., Sherwood, L and Wool Verton C.J. (2011), Prescott's Microbiology. 8<sup>th</sup> Edition, McGraw Hill, New York.
2. Jacquelyn G. Black (2005), Microbiology: Principles and Explorations. 6<sup>th</sup> Edition. John Wiley and Sons Australia Limited.
3. Kathleen Park Talaro (2009), Foundations in Microbiology: Basic Principles, 7<sup>th</sup> Edition.McGraw-Hill Higher Education

**Tools for Assessment (25 Marks)**

CIA I	CIA II	CIA III	Assignment	Model Preparation	Attendance	Total
5	5	6	3	3	3	25

**Mapping**

PSO CO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	L	L	M	M	M	H
CO2	L	M	L	L	L	L
CO3	L	L	L	M	M	L
CO4	L	M	L	L	M	H
CO5	L	M	L	L	M	H

H – High; M- Medium; L - Low

Course designed by	Verified by HoD	Checked by	Approved by
Dr. S. ESATH NATHEER	Dr. T. M. SUKITHA	Consent COG	

Course Code	Title		
18U3MGC102	Core Paper II – Cell Biology		
Semester: I	Credits: 3	CIA: 20	ESE: 55

**Course Objective:**

This subject aims to introduce the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, organelles, Transport mechanisms and cellular components underlying mitotic cell division.

**Course Outcomes (CO):**

On completion of course the students will be able to

CO1	Understand the characteristics and basic structure of Eubacteria
CO2	Understand the characteristics and basic structure of Eukaryotic cell
CO3	Understood the transport mechanisms of cell.
CO4	Understand concepts of Cell division in Bacteria
CO5	Understand the basic concepts of Cell death mechanism, Stem cells

Offered by: Microbiology

**Course Content**

Instructional Hours / Week: 3

Unit	Description	Text Book	Chapter
I	<b>Ultrastructure of Eubacteria</b> - Cell membrane- Extra mural layer - Slime – Capsule	1	2
	Cytoplasmic inclusions – Mesosomes – Nuclear material Reserve materials - Pigment – Cell appendages – Flagella – Pili.		
<b>Instructional Hours</b>			<b>9</b>
II	<b>Ultrastructure and functions of Eukaryotic cell</b> organelles – Cell wall – Cell membrane -	1	5
	Mitochondria – Chloroplast – Endoplasmic reticulum – Golgi complex – Nucleus – Ribosomes, Other cell inclusions and Flagella.		
<b>Instructional Hours</b>			<b>9</b>
III	<b>Transport mechanisms</b> – Diffusion - Facilitated diffusion	1	20
	Active transport – Group translocation – phagocytosis– Pinocytosis		
<b>Instructional Hours</b>			<b>9</b>
IV	<b>Cell division in Bacteria</b> – Binary fission– Mitosis and Meiosis. Cell division of Eukaryotes -Mitosis and Meiosis	2	6
	Ultra structure of algae ,Cyanobacteria, protozoa, fungi		26
<b>Instructional Hours</b>			<b>9</b>

V	<b>Cell Cycle, Cell Death and Cell Renewal</b> Eukaryotic cell cycle and its regulation	3	11
	Development of cancer, causes and types Programmed cell death, Stem cells - Embryonic stem cells induced pluripotent stem cells.		
<b>Instructional Hours</b>			<b>9</b>
<b>Total Hours</b>			<b>45</b>

**Text Book(s):**

1. Pelczar MJ, Chan ECS and Kreig NR (2008). Microbiology, 5<sup>th</sup> Edition, Tata McGraw Hill-Hill Education Pvt. Ltd., New Delhi.
2. Prescott, L.M J.P. Harley and C.A. Klein (1995). Microbiology, 2<sup>nd</sup> Edition Wm, C.Brown.
3. Ivan M.Roitt's & Peter J Delves. (2001). Essential of Immunology, 10<sup>th</sup> Edition, Blackwell Science, UK.  
 Unit I: Text book 1, Chapter 2 (73 -97)  
 Unit II: Text book 1, Chapter 5 (333-389)  
 Unit III: Text book 1, Chapter 20(171-176)  
 Unit IV: Text book 2, Chapter 6(119 - 138), Chapter 26(607 - 629)  
 Unit V: Text book 3, Chapter 11(203 - 207)

**Reference Book(s):**

1. Stainer R.Y. Ingraham J.L. Wheelis H.H and Painter P.R. (1986), The Microbial world, 5<sup>th</sup> Edition, Eagle Works Cliffs N.J. Prentica Hall.
2. Jain V.K. (2000), Fundamentals of Plant Physiology, 5<sup>th</sup> edition, S. Chand & Co Ltd; New Delhi.

**Tools for Assessment (20 Marks)**

CIA I	CIA II	CIA III	Assignment	Model Preparation	Attendance	Total
4	4	5	2	2	3	20

**Mapping**

PSO CO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	L	M	M	M	M	H
CO2	L	M	M	L	M	H
CO3	L	M	H	M	H	H
CO4	L	M	L	M	M	H
CO5	L	M	L	M	M	H

H – High; M- Medium; L - Low

Course designed by <i>Dr. P. V. R. K. K. K.</i>	Verified by HoD <i>Dr. T. H. S. S. S.</i>	Checked by <i>Convenor PCDC</i>	Approved by <i>T. H. S. S.</i>
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Course Code	Title		
18U3MTA101	Allied Paper I – Biostatistics		
Semester: I	Credits : 3	CIA : 20 Marks	ESE: 55 Marks

**Course Objective:**

This course introduces the basic Statistical concepts that are applied in Biosciences to enable the students to learn the Statistical measures and their applications.

**Course Outcomes (CO):**

CO1	To remember the basic concepts of Biostatistics
CO2	To understand the concepts of measures of Central tendency and Dispersion,
CO3	To analyze different statistical situations using the concepts of sampling techniques and experimental designs.
CO4	To apply the methods of ANOVA and Experimental Designs to solve biological problems.
CO5	To solve biological problems using Correlation and Regression.

**Offered by:** Mathematics

**Course Content**

**Instructional Hours / Week: 4**

Unit	Description	Text Book	Chapter
I	<b>Introduction to Biostatistics:</b> Definition – Application – Characteristics – Limitation - Data collection – Classification - Tabulation and frequency distribution.	1	1,3
	Sampling Techniques - Diagrammatic and Graphical representation of data.	2	2,3
<b>Instructional Hours</b>			<b>12</b>
II	<b>Measures of Central tendency:</b> Mean Median and Mode.	2	4
	<b>Measures of dispersion:</b> Range, Standard deviation - Co-efficient of variation.	2	5
<b>Instructional Hours</b>			<b>12</b>
III	<b>Sampling Techniques:</b> Introduction - Methods of Sampling – Sampling and Non-Sampling errors.	2	2
	<b>Hypothesis Tests:</b> Standard Error – Tests of Significance based on Large samples, 't', 'F' and Chi square Tests.	1	12-15
<b>Instructional Hours</b>			<b>12</b>
IV	<b>Analysis of Variance:</b> One way and Two way Classifications.	2	9
	<b>Experimental Design</b> – Introduction – Basic Concepts and Principles - Completely Randomized Design (CRD) -	2	10
	Randomized Complete Block Design(RCBD).		
<b>Instructional Hours</b>			<b>12</b>
V	<b>Correlation:</b> Introduction – Types of correlation – Scatter diagram – Karl Pearson's co-efficient of Correlation – 1 Coefficient of determination – Spearman's Rank Correlation. Regression Analysis - Regression Coefficients – Properties 1 - Linear Regression.	1	8, 9
<b>Instructional Hours</b>			<b>12</b>
<b>Total Hours</b>			<b>60</b>

**Text Book(s):**

1. Dr. P.N. Arora and Dr. P.K. Malhan, **Biostatistics**, Himalaya Publishing House., Revised Edition, 2006
  2. Irfan Ali Khan and AtiyaKhanum, **Fundamentals of Biostatistics, Ukaaz publications**, Second Revised Edition, 2004
    - Unit I: Book 1, Chapter 1, Section: 1.1, 1.3 to 1.9, 1.11 to 1.13, Chapter3. Book 2, Chapter 2 and 3.
    - Unit II: Book 2, Chapter 4, Section: 4.1 to 4.4 Chapter 5, Section: 5.1, 5.2, 5.3.1, 5.3.3
    - Unit III: Book 2, Chapter 2. Book 1, Chapter 12-15
- Unit IV: Book 2, Chapter 9, Section: 9.3 to 9.3.5 Book 2, Chapter 10, Section: 10.1 to 10.4.2.3
- Unit V: Book 1, Chapter 8 and 9

**Reference Book(s):**

1. John Wiley W.W, **Biostatistics: A foundation for Analysis in health sciences**, 6<sup>th</sup> Edition, 1995





**Tools for Assessment (20 Marks)**

CIA I	CIA II	CIA III	Assignment	Quiz	Attendance	Total
4	4	5	2	2	3	20

**Mapping**

CO \ PSO	PSO1	PSO2	PSO3	PSO4
CO1	L	M	M	M
CO2	M	M	M	M
CO3	M	H	M	M
CO4	M	H	M	M
CO5	M	M	M	H

H – High; M- Medium; L - Low

Course Designed by	Verified by HOD	Checked by	Approved by
			
T. CHANDRAPUSHPAN	T. CHANDRAPUSHPAN	Converter ECDD	



Course Code	Title	
18U4ENV101	Ability Enhancement Compulsory course (AECC) Environmental Studies	
Semester: I	Credits: 2	ESE : 50 Marks

(Common to all UG Programmes)

**Course Objective:** This course enables the students to recognize the interconnectedness of multiple factors in environmental challenges and communicate clearly and competently matters of environmental concern.

**Course Outcome:**

CO 1	To understand key concepts from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.
CO 2	To understand concepts and methods from ecological and physical sciences and their application in environmental problem solving.
CO 3	To solve the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
CO 4	To reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.
CO5	To apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.

**Course Content**

**Instructional Hours / Week : 2**

Unit	Description	Text Book	Chapter
I	<b>Natural Resources:</b> Forest resources, Water resources, Mineral resources Food resources and Energy resources.	1	5
<b>Instructional Hours</b>			<b>6</b>
II	<b>Ecosystems:</b> Concept of an ecosystem, Structure and function; Introduction, types characteristic features, structure and function of ecosystem <b>Activity: Prepare an album on types of Ecosystem.</b>	1	3
<b>Instructional Hours</b>			<b>6</b>
III	<b>Environmental Pollution:</b> Definition Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution and Noise pollution, Solid waste management <b>Activity: Discuss the solutions for water pollution.</b>	1	8,9,11, 10,12,15
<b>Instructional Hours</b>			<b>6</b>

IV	<b>Social Issues and the Environment</b> Water conservation, rain water harvesting, watershed management, Environmental ethics : Issue summits' and possible solutions and Public awareness <b>Activity: Identify and analyze a Social Issue and an Environment issue in your locality.</b>	1 2	17 9
	<b>Instructional Hours</b>		<b>4</b>
V	<b>Disaster Management:</b> Floods, Earthquakes, Cyclones, Landslides: From management to mitigation of disasters: The main elements of a mitigation and measures of strategy: Floods, Earthquakes, Cyclones and Landslides	3	16
	<b>Instructional Hours</b>		<b>6</b>
<b>Case Studies:</b> Use Social media for e-networking and dissemination of ideas on environmental issues. (Or) Visit to a Nearby biome / Wildlife Sanctuary/ our own campus & study the various bioresources.			<b>2</b>
<b>Total hours</b>			<b>30</b>

**Text Book(s):**

1. Agarwal, K.M., Sikdar, P.K., Deb, S.C. (2002). A Textbook of Environment. Macmillan India Ltd. Kolkata, India.
2. Dash, M.C. (2004). "Ecology, Chemistry & Management of Environmental Pollution". Published By Rajiv Beri For Macmillan India Ltd. 2/10 Ansari Road, Daryaganj, New Delhi – 110002.
3. From UGC website: <https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf>

**Reference Book(s):**

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Public Ltd Bikaner.
2. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws Himalaya Pub. House, Delhi 284 p.
3. McKinney, M.L. & Schoch R.M. 1996. Environmental Science systems & Solutions
4. Odum, E.P. 1971 Fundamentals of Ecology. W.B. Saunders Co. USA. 574 p
5. Rao MN & Datta, A.K. 1987 Waste Water treatment, Oxford & IBH Publication Co. Pvt. Ltd 345 p.

Course designed by	Verified by	Checked by	Approved by
Dr. J. K. Prasad 11/21/21	Dr. J. H. Sukiraha 11/21/21	Convenor 11/21/21 CDG	

Course Code	Title		
20U1FRN202	Part I : French – II		
Semester: II	Credits: 4	CIA : 25 Marks	ESE: 75 Marks

**Course Objective :** To make the students know and understand the value of French language and help them to follow the culture and tradition.

#### Course Outcomes

CO1	Empowering reading skill
CO2	Translation

**Offered by :** French Department

#### Course Content

**Instructional Hours / Week : 5**

Unit	Description	
I	À table!	
	<b>Instructional Hours</b>	<b>15</b>
II	Rallye	
	<b>Instructional Hours</b>	<b>15</b>
III	Chez moi	
	<b>Instructional Hours</b>	<b>15</b>
IV	Les Vacances	
	<b>Instructional Hours</b>	<b>15</b>
V	Au jour le jour	
	<b>Instructional Hours</b>	<b>15</b>
	<b>Total Hours</b>	<b>75</b>

Text Book :

1. CONNEXIONS 1 Methode de Français Niveau 1 – Régine Mérieux

Yves Loiseau

#### Tools for assessment (25 marks)

CIA I	CIA II	CIA III	Assignment	Seminar	Attendance	Total
5	5	6	3	3	3	25

<b>Course Designed by</b> D. B. 11/18/21	<b>Verified by</b> D. B. 11/18/21	<b>Checked by</b> D. B. 11/18/21	<b>Approved by</b> D. B. 11/18/21
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Course Code	Title		
20U2ENG202	Part II - English II		
Semester: II	Credits: 4	CIA: 25	ESE : 75

(All UG Programmes)

**Course Objective**

To equip the students with the Language Skills, Functional usage. Facilitate the insight and taste of Literature

**Course Outcome (CO)**

CO1	Remember the themes of literary pieces
CO2	Understand the authors context
CO3	Comprehend the writing skills and practice it
CO4	Enhance fluency over language with self confidence.
CO5	Assess the language skills using literature

Offered by: English

Instructional Hours / Week: 5

Unit	Description	Text Book	Chapter
I	<b>Prose</b> Learning the Game - Sachin Tendulkar Women Not the Weaker Sex – Mahatma Gandhi The fun they had – Issac Asimov	2	15
	<b>Instructional Hours</b>		
II	<b>Poetry</b> Stopping by Woods on a Snowy Evening – Robert Frost A Poison Tree – William Blake The Village School Master – Oliver Goldsmith	2	15
	<b>Instructional Hours</b>		
III	<b>Short Stories</b> The Cat and the Pain Killer – Mark Twain The Envious Neighbour – Japanese Folk Tale Karma – Khushwanth Singh	1	15
	<b>Instructional Hours</b>		
IV	<b>Grammar</b> Active and Passive Voices Direct and Indirect Speech Sentence Connectors and Linkers	1	15
	<b>Instructional Hours</b>		

V	<p><b>Oral &amp; Written Communication (Unit I–IV)</b></p> <p><b>Listening</b> – Comprehension practice from Poetry, Prose, Online Voice Practice, observing/viewing E-content (with subtitles), Guest/Invited Lectures, Conference/Seminar Presentations &amp; Tests, and DD National News Live, BBC, CNN, VOA etc</p> <p><b>Speaking</b> – In Group Discussion Forum, participate in the Turn Taking, and Conversation Management, Debating, Defending/Mock Viva-Voice, Seminar Presentations on Classroom-Assignments, and Peer-Team-interactions.</p> <p><b>Reading</b> – Different Reading Strategies in Poetry, Prose, Novel, Newspaper etc</p> <p><b>Writing</b>– Dialogue/Conversation Writing, Advertisement Writing, and Creative Writing (autobiography, article etc,) for publication in Mass Media.</p>	2
	<b>Instructional Hours</b>	<b>15</b>
	<b>Total Hours</b>	<b>75</b>

**Books for study:**

**Unit I – V : Compiled by the Department of English**

**Books for Reference:**

- CLIL ( Content & Language Integrated Learning ) – Module by TANSICHE  
NOTE: (Text: Prescribed chapters or pages will be given to the students by the department and the college)

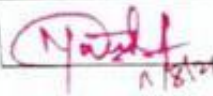




**Tools for Assessment (25 Marks)**

CIA I	CIA II	CIA III	Assignments	Seminars	Attendance	Total
5	5	6	3	3	3	25

**Mapping**

CO \ PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	H
CO2	H	M	M	H	H
CO3	H	M	M	M	M
CO4	H	M	M	H	M
CO5	S	H	M	M	M

S: Strong, H: High, M: Medium, L: Low

Course Designed by	Verified by HOD	Checked by	Approved by
		 	

Course Code	Title		
18U3MGC203	Core Paper III – Microbial Diversity		
Semester: II	Credits: 3	CIA: 20	ESE : 55

**Course Objective:**

- To differentiate the common groups of bacteria in different ecosystems and their role in biogeochemical key processes in these environments
- To study the composition of microbial communities and occurrence of individual groups
- To study genomic based methods in the microbial diversity
- To analyse the important interactions within microbial communities

**Course Outcomes (CO):**

On completion of the course, students learn about

CO1	Microbial taxonomy – concepts and techniques for identification
CO2	Concept related to extremophilic microbes and archaea
CO3	Characters and significance of fungi
CO4	Characters and significance of algae and Protozoa
CO5	Characters and significance of virus

**Offered by: Microbiology**

**Course Content**

**Instructional Hours/Week: 4**

Unit	Description	Text Book	Chapter
I	Taxonomy – Principles – Taxonomic Ranks– Types - Numerical, Genetic, Serotaxonomy and Chemotaxonomy	1	19
	Introduction to Microbial Classification and Taxonomy Species and Speciation.		
	Organization of II edition of Bergey’s Manual of Systematic Bacteriology.		
<b>Instructional Hours</b>			<b>12</b>
II	Outline classification and characteristics of Archaeobacteria, Proteobacteria, Methanogens, Halophiles, Thermoacidophiles – commercial uses.	1	20
	Actinobacteria – commercial uses.		
<b>Instructional Hours</b>			<b>12</b>
III	General Characteristics of Fungi – Detailed classification of Fungi	1	25
	Life Cycle of Aspergillus, Penicillium - Modes of reproduction & its economic importance.		
<b>Instructional Hours</b>			<b>12</b>
IV	Algae – Morphology & General Characters – Classification - Basic knowledge on its reproduction & its economic importance.	2	26
	Protozoa – General characteristics – Detailed classification and its economic importance.		
<b>Instructional Hours</b>			<b>12</b>

V	Virus - Morphology, General characteristics, Classification (Baltimore classification) and Multiplication of viruses.	2	16
	The structure of viruses- virion size- General structure properties- helical capsids, icosohedral capsid- nucleic acids- Viral envelopes and enzymes.		
<b>Instructional Hours</b>			<b>12</b>
<b>Total Hours</b>			<b>60</b>

**Text Book(s):**

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 McGraw Hill Book R. Krieg, 1986 Company

Unit I :	Text Book 1, Chapter 19(471-494)
Unit II :	Text Book 1, Chapter 20 (503-513)
Unit III:	Text Book 1, Chapter 25 (629-635)
Unit IV:	Text Book 2, Chapter 26 (365-388 & 389-414)
Unit V :	Text Book 2, Chapter 16 (415-435)

**Reference Book(s):**

1. 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.
2. Atlas & Atlas. Microbiology. Pearson Publications. 4th Edition.
3. Willey, J.M., Sherwood, L and Wool Verton C.J. (2011). Prescott's Microbiology. 8th edition, McGraw Hill, New York.

**Tools for Assessment (20 Marks)**

CIA I	CIA II	CIA III	Assignment	Model Preparation	Attendance	Total
4	4	5	2	2	3	20

**Mapping**

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	L	M	M	M	H
CO2	L	M	M	M	H	H
CO3	L	L	M	M	M	H
CO4	L	M	M	M	H	H
CO5	L	L	M	M	M	H

H – High; M- Medium; L – Low

<b>Course designed by</b> Dr. S. ESATH NATHEER	<b>Verified by HoD</b> Dr. T. H. SURIKHA	<b>Checked by</b> Consent COG	<b>Approved by</b>
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Course Code	Title		
18U3MBC204	Core Paper IV - Analytical Microbiology		
Semester: II	Credits:3	CIA: 20 Marks	ESE: 55 Marks

**Course Objective:**

To make the students understand about various instrumentation techniques related to microbiology. They will also gain a sound knowledge about the industrial related instruments like centrifuges and their principles and working methodology

**Course Outcomes (CO):****On completion of course the students will be able to**

CO1	Separate different types of protein and DNA fragments
CO2	Understand the Principles and Applications of sterilization instruments.
CO3	Attain technical knowledge on quantitative analysis of pharmaceutical substances
CO4	Get knowledge about the principles of colorimetry and spectroscopy
CO5	Operate high level instruments like Column chromatography, HPLC

**Offered by: Microbiology****Course Content****Instructional Hours / Week: 4**

Unit	Description	Text Book	Chapter
I	Principle and working of pH meter, pH electrodes – colomel and glass electrode.	1	6&5
	Centrifugation: Principle- Types of Centrifuges – Low speed, High speed, Ultra centrifuge. Applications of Centrifuge.		
<b>Instructional Hours</b>			<b>12</b>
II	Principles and Applications of Autoclave, Hot air oven, Incubator.	3	3
	Laminar air flow chamber / Biosafety cabinets, BOD incubator	4	4
<b>Instructional Hours</b>			<b>12</b>
III	Metabolic shaker, Incinerator, Lyophilizer,	4	4
	BACTEC, MALDI ToF		36,59
<b>Instructional Hours</b>			<b>12</b>
IV	Colorimetry, Turbidometry,	1	11
	Spectrometry – UV & Visible Spectrophotometer and Atomic absorptive spectroscopy.		
<b>Instructional Hours</b>			<b>12</b>
V	Chromatography – Paper, Thinlayer, Column, Ion-exchange, Gas and HPLC.	1	9
	Electrophoresis – SDS – PAGE and Agarose gel electrophoresis, Pulsed field gel electrophoresis		
<b>Instructional Hours</b>			<b>12</b>
<b>Total Hours</b>			<b>60</b>



**Text Book(s):**

1. L. Veerakumari (2006), Bioinstrumentation, 1<sup>st</sup> Edition, MJP.
2. Boyer, Rodney (1992), Modern Experimental Biochemistry, 2<sup>nd</sup> Edition, F. Benjamin and Cummins.
3. Subhash Chandra Parija (2009), Textbook of Microbiology and Immunology, 2<sup>nd</sup> Edition, Elsevier.
4. Betty A. Forbes, Daniel F. Sahn, Alice S. Weissfeld (2007) , Bailey and Scott's Diagnostic Microbiology, 14<sup>th</sup> Edition, Elsevier Mosby.

Unit I: Text book 1, Chapter 6&5 (141-153, 113-138)

Unit II: Text book 3&4, Chapter 3&4

Unit III: Text book 4, Chapter 4,36 &59

Unit IV: Text book 1, Chapter 4(301-312,362-367) Unit

V: Text book 1, Chapter 9(186-254)

**Reference Book(s):**

1. L. A. Geddes, L. E. Baker (1968), Principles of applied Biomedical instrumentation, 3<sup>rd</sup> Edition, John Wiley and Sons
2. Avinash Upadhyay (2009), Biophysical Chemistry, 1<sup>st</sup> Edition, Himalaya Publishing House.
3. Hobart Hurd Willard, Lynne Lionel Merritt (1986) , Instrumental Methods of analysis, 6<sup>th</sup> Edition, CBS.


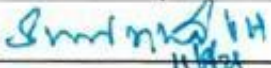


**Tools for Assessment (20 Marks)**

CIA I	CIA II	CIA III	Assignment	Model Preparation	Attendance	Total
4	4	5	2	2	3	20

**Mapping**

CO \ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	H	M	M	H	L	L
CO2	H	M	L	H	L	L
CO3	H	M	M	M	M	L
CO4	L	M	M	H	L	L
CO5	H	M	M	H	L	L

H - High; M- Medium; L- Low.

Course Designed by	Verified by HOD	Checked by	Approved by
			
Dr. B. David Jeyaraj	Dr. P. H. SURIKIRIHA	Convener	

Course Code	Title		
19U3MBP205	Core Paper V : Lab in Fundamentals of Microbiology and Cell Biology		
Semester: I & II	Credits: 3	CIA: 30 Marks	ESE: 45 Marks

**Course Objective:**

To make the students to gain knowledge on the distribution, morphology and physiology of microorganisms and to understand the laboratory skills, techniques, control of infectious microbes in addition to skills in aseptic procedures.

**Course Outcomes (CO):**

Students will be able to demonstrate,

CO 1	The sterilization and staining techniques.
CO 2	The culture media and culture techniques & The Cell shape, size and division
CO 3	The preservation and maintenance of culture with safety measurements
CO 4	The Cell division (Mitotic & Meiotic).
CO 5	The Micrometry & Microtome – Temporary & permanent slide preparation

**Offered by: Microbiology**

**Course Content**

**Instructional Hours / Week: 4 + 4**

Description
<b>Fundamentals of Microbiology</b>
Laboratory precautions
<b>Basic Lab glassware:</b> Test tubes, screw capped tubes, pipette, Pasteur pipettes, Erlenmeyer flask, Eppendorf tubes, pipette tips, cover slip and slides.
<b>Basic Lab instrumentation:</b> Autoclave, incubator, Hot air oven, pH meter, Centrifuge, Laminar air flow. Separatory funnel, centrifuge, pH meter, Electric balance, hot plate
<b>Methods of sterilization</b> (Principles and methods – physical (moist heat, dry heat, filtration, pasteurization, tyndallization, radiations) and chemical (alcohols, aldehydes, phenols, halogens and hypochlorites).
<b>Culture media preparation</b> – Liquid and Solid medium, Types of media simple, defined, enriched and transport media with specific examples for each type and their preparation and differential media
Pure culture techniques – Pour plate, Spread plate and Looping method
Enumeration of Bacteria, Fungi and Actinomycetes from soil
Cultural characteristics of Microorganisms - Colony morphology on Nutrient agar slants, Nutrient broth
<b>Maintenance and preservation of microbes by Lyophilizer-Subzero</b>
<b>Bacterial Staining</b> – Simple, Negative, Gram, Spore and Fungal wet mount -LCB.
<b>Cell Biology</b>
Structure observation - Prokaryotic & Eukaryotic cell
Observation – Different types of cells – parenchyma, collenchymas, sclerenchyma, epithelium
Motility of an organism – Hanging drop
Cell Staining – Cytochemical methods - Demonstration of Cellular and sub-cellular components
Cell division - Mitotic stages - Preparation of Onion Root Tip
Cell division - Meiotic stages - Preparation of Tradescantia Flower bud
Cell division – Binary fission of yeast
<b>Measurement of microbial Cell load by Load cell tester</b>
<b>Cultivation of Anaerobic Microorganism by Anaerobic chamber</b>
Microtome – Temporary & permanent slide preparation
Micrometry -Size and shape of an organism (prokaryote) – simple staining, use of ocular micrometer
<b>Total hours : 120</b>

**Text Book(s):**

1. Dubey RC and Maheshwari DK (2002). Practical Microbiology. S Chand and Co. Ltd., New Delhi.
2. Aneja KR (2010). Experiments in Microbiology, Plant Pathology and Biotechnology. New Age International (P) Limited Publishers.
3. James G Cappuccino and Natalie Sherman (2005). Microbiology: A Laboratory manual. 7<sup>th</sup> Edition, Pearson Education, Inc.
4. David A. Thompson. 2011. Cell and Molecular Biology Lab. Manual.
5. P.Gunasekaran. 2007. Laboratory Mannual in Microbiology. New Age International.
6. D O Hall, S E Hawkins. 1974. Laboratory Manual of Cell Biology. British Society for Cell Biology, Published by Crane, Russia.
7. Mary L. Ledbetter. 1993. Cell Biology: Laboratory Manual. Edition: 2. Published by RonJon Publishing. Incorporated.

**Tools for Assessment (30 Marks)**

Laboratory performance I	Laboratory performance II	Test I	Test II	Observation Note Book	Attendance	Total
5	5	5	5	7	3	30

**Mapping**

PSO CO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	L	M	H	M	M	H
CO2	L	M	H	M	M	H
CO3	L	M	H	L	L	H
CO4	L	M	H	L	L	H
CO5	L	M	H	L	L	H

H – High; M- Medium; L – Low

Course designed by	Verified by HoD	Checked by	Approved by
<i>Dr. P. V. K. K. K.</i>	<i>Dr. T. H. S. S. S.</i>	<i>Convener PCDC</i>	<i>T. T. T.</i>

Course Code	Title		
18U3CNA202	Allied Paper II : Fundamentals of Computer Applications		
Semester: II	Credits: 3	CIA : 20 Marks	ESE:55 Marks

**Course Objective:**

To make the students understand the basic concepts of Information Technology and MS office Application.

**Course Outcomes (CO):**

CO1	Understand the essential concepts of Information Technology
CO2	Define document, formatting in word
CO3	Understand worksheet and workbook
CO4	Understand formula basics
CO5	Demonstrate slide presentation

Offered by: Computer Science

Course Content

Instructional Hours / Week: 3

Unit	Description	Text Book	Chapter
I	<b>The Computer Era- An Introduction:</b> Introduction to Information concepts and processing – Data - Information – Need for Information – Human being as information processor - Need for Computerization – Information technology- Components of information technology – hardware – software – data – user – storage – communication	1	1
	<b>Fundamentals of Computer System:</b> What is a Computer? – Characteristics of a computer- Intangible benefits	1	2
<b>Instructional Hours</b>			<b>9</b>
II	<b>Creating documents with Word:</b> Creating blank file – Saving a file – file formats. <b>Formatting:</b> Character formatting – formatting techniques- the font group – the font dialog box – page setup basics – Table setup basics – Inserting picture from a file	2	4, 5, 8, 9
<b>Instructional Hours</b>			<b>9</b>
III	<b>Using Excel Worksheets and Work Book:</b> Understanding workbooks and worksheets – moving around a worksheet – Entering text – entering date – modifying cell content – applying number formatting. <b>Essential worksheet and cell range:</b> Learning the fundamentals of excel worksheet – working with rows and columns – understanding cells and range – copying or moving ranges	2	12,13,14
<b>Instructional Hours</b>			<b>9</b>
IV	<b>Introducing formulas and functions:</b> Understanding formula basics – entering the formula – editing the formula – Basic counting formula – summing formula – <b>Getting started making charts:</b> What is a Chart? – Creating a Chart - Working with charts – Understanding chart types.	2	15,17, 18
<b>Instructional Hours</b>			<b>9</b>

V	<b>Creating a Presentation, Slides and Text:</b> Starting a new presentation – Closing and reopening presentation – creating new slides – managing Slides. <b>Working with table and Charts :</b> Creating tables, Understanding Charts and chart types	2	21,23
<b>Instructional Hours</b>			<b>9</b>
<b>Total Hours</b>			<b>45</b>

**Text Book(s):**

- Chetan Srivastava, “**Fundamentals of Information Technology**”, Kalyani Publishers, New Delhi, Edition 2002.
- John Walkenbach, Herb Tyson, et al., “Office 2007 Bible”, Wiley India Pvt. Ltd, 2008  
 Unit I: Text Book 1, Chapter 1 (1-6), Chapter 2 (7 – 30)  
 Unit II: Text Book 2, Chapter 4 (81 – 84, 87 - 90) – 5 (112 – 123), 8 (159 – 170, 173 – 179), 9 (181- 189, 205-209)  
 Unit III: Text Book 2, Chapter 12 (277-281) – 13(289,290, 297-299), 14(303-327)  
 Unit IV: Text Book 2, Chapter 15 (337 – 348), 17(387-391), 18(411-423)  
 Unit V : Text Book 2, Chapter 21 (469 – 472,484-491,497 - 500), 23 (551-554, 573-577, 584)

**Reference Book(s):**

- John Walkenbach “**Excel 2007 Bible**”, Wiley Publications, 2007
- Amy Romanoff, Sherry Bonelli, “**Microsoft Office 2000 Complete Reference**”, BPB Publication, New Delhi. 3.Sanjay Saxena “**MS Office 2007 in a Nutshell**”, Vikas Publishing House, Noida, 2001.
- Dinesh Maidasani, “**Learning Computer Fundamentals, Ms Office and Internet & Web Tech**”, Firewall Media, 2005

**Tools for Assessment (20 Marks)**

CIA I	CIA II	CIA III	Assignment	Quiz	Attendance	Total
4	4	5	2	2	3	20

**Mapping**

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO5
CO1	M	L	M	L	M	M
CO2	L	M	M	L	M	M
CO3	M	M	M	M	M	M
CO4	M	M	M	M	M	M
CO5	M	M	M	H	M	H

Course designed by	Verified by HoD	Checked by	Approved by
D. D. Vimal Kumar	D. D. Vimal Kumar	D. D. Vimal Kumar	D. D. Vimal Kumar
(D. D. Vimal Kumar)	D. D. Vimal Kumar	D. D. Vimal Kumar	D. D. Vimal Kumar

Course Code	Title		
18U3CNR203	Allied Paper III : MS Office Practical		
Semester: II	Credit: 2	CIA : 20 Marks	ESE: 30 Marks

**Course Objective:**

To enable the students to learn and gain knowledge about MS Office

**Course Outcomes (CO):**

CO1	Understand the functions of Word, Excel and Power point.
CO2	Apply built in functions and formulas in Excel.
CO3	Use chart representation for data

Offered by: Computer Science

**Course Content**

Instructional Hours / Week: 02

S. No.	List of Practical
1	Create a Ms – Word document to prepare your resume
2	Create a MS – Word Table to prepare student Mark list
3	Calculate the Mean, Median and Mode for the given data using Microsoft Excel Worksheet.
4	Find the Range, Quartile Deviation, Standard Deviation and Co-efficient of Variance for the given data using Microsoft Excel Worksheet.
5	Find Pearson product moment correlation coefficient for the given data using Microsoft Excel Worksheet.
6	Find t-test, f-test and Chi-square test for the given data using Microsoft Excel Worksheet.
7	Create a MS - Power point presentation to demonstrate Chart
8	Prepare a PowerPoint presentation. Presentation should contain 5 slides with proper heading and content (use picture, Table, Charts)

**Tools for Assessment (20)**

Program Execution	Creativity	Test I	Test II	Observation	Attendance	Total
3	3	4	4	3	3	20

**Mapping**

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	M	M	M	H
CO2	L	M	M	M	H	H
CO3	L	M	M	M	H	H

H- High; M-Medium; L-Low.

Course designed by	Verified by HoD	Checked by	Approved by
D. D. Vimal Kumar	D. D. Vimal Kumar	D. D. Vimal Kumar	D. D. Vimal Kumar
(D. D. Vimal Kumar)	Dr. D. HAVIR	Dr. D. HAVIR	Dr. D. HAVIR

Course Code	Title	
18U4HRC202	Ability Enhancement Compulsory Course : <b>Human Rights and Constitution of India</b>	
Semester: II	Credits: 2	Max. Marks : 50

**Course Objective:**

Understand the concept of human rights and the importance of Indian Constitution.

**Course Outcome:**

CO1	Understand the principal aspects of human rights and duties in a broad sweep.
CO2	Understand the fundamental duties and rights of Indian Citizen

**Offered by:****Course Content****Instructional Hours / Week: 2**

Unit	Description	Instructional Hours	6
I	<b>Human Rights and Conceptual Background of Human Rights</b> Definition, Meaning Inherent, inalienable, Universal, indivisible Values: Dignity, liberty, equality and justice.	Instructional Hours	6
II	<b>Philosophical and Historical Perspectives</b> : Theories of Human Rights -Human Rights Movements- History of Human Rights Civilization	Instructional Hours	6
III	HR for target population: Refugees, War victims, Prisoners, Custodial Violence Women and Children, Senior Citizens.	Instructional Hours	6
IV	Human Rights and Duties in India Evolution : Independence Movement , Making of the constitution Indian Constitution : Fundamental Rights –directive Principles –Fundamental Duties.	Instructional Hours	6
V	Enforcement and Protection Mechanism of Human Rights in India. Judiciary, National Human Rights Commission and other Commissions and Committees. Non-Governmental Organizations, Information Media and Education.	Instructional Hours	6
		<b>Total Hours</b>	<b>30</b>

**Text Book:**

“Human Rights and Constitution of India”, compiled by the Department of Social Work, Nehru Arts and Science College

Course designed by	Verified by	Checked by	Approved by
<i>Dr. J. H. Sankar</i> Dr. J. H. Sankar	<i>Dr. J. H. Sankar</i> Dr. J. H. Sankar	<i>Dr. J. H. Sankar</i> Convenor / CDC	<i>Dr. J. H. Sankar</i>

Course Code	Title		
18U4HVVY201	Value Education : Human Values and Yoga Practice I		
Semester: I& II	Credits: 2	CIA: 25 Marks	ESE: 25 Marks

(Common to all UG programmes)

**Course Objective:**

- To help the students appreciate the essential complementarity between 'values' and 'skills' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings
- To prepare and distribute standardized Yoga teaching and training materials with reference to institute health

**Course Outcomes (CO):**

CO 1	To inculcate in students, a sense of respect towards harnessing values of life and spirit of fulfilling social responsibilities.
CO 2	To inspire individuals to choose their own personal, social, moral and spiritual values and be aware of practical methods for developing and deepening.
CO 3	To inculcate cultural behavioral patterns
CO 4	To understand physical body and Health concepts

**Course Content****Instructional Hours / Week: 1**

Unit	Description
I	<b>Human Values</b> -Introduction-Definition of Ethics and Values-Character and Conduct - Nature and Scope of Ethics.
	<b>Instructional Hours 6</b>
II	<b>Individual and Society</b> -Theories of Society-Social Relationships and Society-Empathy: Compassion towards other being -Environmental Ethics and Nature.
	<b>Instructional Hours 6</b>
III	Cultural Education - Purity India - Patriotism - Time management. Greatness of Womanhood - Food is medicine- Individual peace -World Peace.
	<b>Instructional Hours 6</b>
IV	Power of Meditation- Development of mind in stages - Mental Frequencies - Methods for Concentration - Meditation Practices - Surya namaskar.
	<b>Instructional Hours 6</b>
V	Simplified Physical Exercise – Kayakalpa Practices - Training for Potentialising the Mind.
	<b>Instructional Hours 6</b>
	<b>Total Hours 30</b>

**Textbook:**

- “Value Education”, compiled by Centre for Human Excellence, Nehru Arts and Science College.

Course designed by	Verified by	Checked by	Approved by
<i>Dr. K. Praveen Kumar</i> Dr. K. PRAVEEN KUMAR	<i>Dr. J. H. Suresh</i> Dr. J. H. SURESH	<i>Dr. J. H. Suresh</i> Convenor CDC	<i>Dr. J. H. Suresh</i>



Course Code	Title		
20U1FRN 303	Part - I FRENCH - III		
Semester : III	Credits - 4	CIA Marks : 25	ESE Marks: 75

**Course Objective:** To make the students know and understand the value of French language and help them to follow the culture and tradition.

### COURSE OUTCOMES

CO 1	Empowering reading skill
CO 2	Translation

**Offered by:** The French Department

### Course Content

**Instructional Hours /Week: 5**

UNIT	DESCRIPTION	
I	Roman	
	<b>Instructional Hours</b>	<b>15</b>
II	Je teretrouverai	
	<b>Instructional Hours</b>	<b>15</b>
III	Au quotidien	
	<b>Instructional Hours</b>	<b>15</b>
IV	L'amour de l'art	
	<b>Instructional Hours</b>	<b>15</b>
V	Toujours plus!	
	<b>Instructional Hours</b>	<b>15</b>
	<b>Total Hours</b>	<b>75</b>

### Text Book:

1. CONNEXIONS Méthode de Français Niveau 1 – Régine Mérieux  
Yves Loiseau
2. CONNEXIONS Méthode de Français Niveau 2 – Régine Mérieux  
Yves Loiseau

### Tools for Assessment (25 marks)

CIA I	CIA II	CIA III	Assignment	Seminar	Attendance	Total
5	5	6	3	3	3	25

Course Designed by <i>[Signature]</i>	Verified by <i>[Signature]</i>	Checked by <i>[Signature]</i>	Approved by <i>[Signature]</i>
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Course Code	Title		
20U2ENG303	Part II- English III		
Semester: III	Credits: 4	CIA: 25	ESE : 75

(Common to all UG Programmes)

**Course Objective:**

To help students to imbibe, develop, practice and use the LSRW skills and fine tune their productive skills.

**Course Outcomes:**

CO1	Recognize listening, and reading proficiency through the prose discourses
CO2	Use and interpret imaginative, and creative skills through the poetic genre
CO3	Enhance the students to use English effectively
CO4	Execute and exercise LSRW skills in academic and career
CO5	Evaluate the language skills through literature

Offered by: English

Instructional Hours / Week: 5

Unit	Description	Text Book	Chapter
I	<b>Prose</b>		
	J.B Priestley - Travel by Train	1	1-3
	R.K.Narayan - Headache		
	E.M.Forster - Tolerance		
<b>Instructional Hours</b>			<b>15</b>
II	<b>Poetry</b>		
	William Blake – The School Boy	1	4-6
	Rudyard Kipling – IF		
	Sarojini Naidu - The Queen’s Rival		
<b>Instructional Hours</b>			<b>15</b>
III	<b>Short Stories</b>		
	O. Henry –After Twenty Years	1	7-9
	Edgar Allan Poe-Tell-Tale Heart		
	Frank R. Stockton -The Lady or The Tiger?		
<b>Instructional Hours</b>			<b>15</b>
IV	Herman Melville : The Condensed Moby Dick	1	10-13
	<b>Instructional Hours</b>		

V	<p><b>Oral &amp; Written Communication (Unit I–IV)</b>  <b>Listening</b> – Comprehension practice from Poetry, Prose, Online Voice Practice, observing/viewing E-content (with subtitles), Guest/Invited Lectures, Conference/Seminar Presentations &amp; Tests, and DD National News Live, BBC, CNN, VOA etc  <b>Speaking</b> – In Group Discussion Forum, participate in the Turn Taking, and Conversation Management, Debating, Defending/Mock Viva-Voice, Seminar Presentations on Classroom-Assignments, and Peer-Team-interactions.  <b>Reading</b> – Different Reading Strategies in Poetry, Prose, Novel, Newspaper etc  <b>Writing</b>– Modals,Concord, E-Mail&amp; Report Writing, Spotting the Errors and How to avoid them, Sentence Completion,Prepositions, Idioms and Phrases, Collocation.</p>	1	14-17
	<b>Instructional Hours</b>	<b>15</b>	
<b>Total Hours</b>			<b>75</b>

**Books for study:**

Unit I – V : Compiled by the Department of English

**Books for Reference:**

- CLIL ( Content & Language Integrated Learning ) – Module by TANSCHÉ

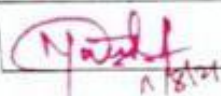
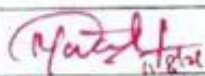

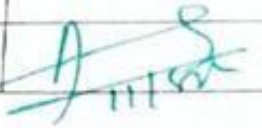
NOTE: (Text: Prescribed chapters or pages will be given to the students by the department)

**Tools for Assessment (25 Marks)**

CIA I	CIA II	CIA III	Assignment	Seminar	Attendance	TOTAL
5	5	6	3	3	3	25

**Mapping**

PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO					
CO1	H	H	H	H	H
CO2	H	M	M	H	H
CO3	H	M	M	M	M
CO4	H	M	M	H	M
CO5	S	H	M	M	M

Course Designed by	Verified by HOD	Checked by	Approved by
		 Convener NASC	

Course Code	Title		
20U3MBC306	Core Paper VI – Microbial Physiology and Metabolism		
Semester: III	Credits: 3	CIA : 20 Marks	ESE: 55 Marks

**Course Objective:** Microbial Physiology is an intensive course with the goal of integrating biochemistry and genetics to enhance the understanding of the microbial cell and the robust and diverse nature of life.

**Course Outcomes (CO):**

On successful completion of this course the students will be able to

CO1	Know the growth characteristics of the microorganisms capable of growing under unusual environmental condition.
CO2	Understand the growth characteristics of the microorganisms which require different nutrient for growth.
CO3	Recognize the associated mechanisms of energy generation for their survival.
CO4	Know the chemoheterotrophic metabolism- anaerobic respiration and fermentation.
CO5	Gain knowledge on different metabolic pathways in microorganisms.

**Offered by: Microbiology**

**Course Content**

**Instructional Hours / Week: 3**

Unit	Description	Text Book	Chapter
I	<b>Microbial Growth and Effect of Environment on Microbial Growth:</b> Definitions of growth, Batch culture, Continuous culture, generation time and specific growth rate, Effect of temperature and pH on microbial growth. Effect of solute and water activity on growth. Effect of oxygen concentration on growth. Nutritional categories of microorganisms.	2	1
<b>Instructional Hours</b>			<b>10</b>
II	<b>Nutrient uptake and Transport:</b> Passive and facilitated diffusion. Primary and secondary active transport, concept of uniport, symport and antiport Group translocation. Iron uptake.	1	3
<b>Instructional Hours</b>			<b>10</b>
III	<b>Chemoheterotrophic Metabolism - Aerobic Respiration:</b> Concept of aerobic respiration, sugar degradation pathways i.e. EMP, ED, Pentose phosphate pathway TCA cycle. Electron transport chain: components of respiratory chain, comparison of mitochondrial and bacterial ETC, electron transport phosphorylation, uncouplers and inhibitors.	2	8 & 9
<b>Instructional Hours</b>			<b>10</b>
IV	<b>Chemoheterotrophic Metabolism- Anaerobic respiration and fermentation:</b> Anaerobic respiration with special reference to dissimilatory nitrate reduction (Denitrification; nitrate /nitrite and nitrate/ammonia respiration; fermentative nitrate reduction). Fermentation - Alcohol fermentation and Pasteur effect; Lactate fermentation (homofermentative and heterofermentative pathways), concept of linear and branched fermentation pathways.	1	8 & 9
<b>Instructional Hours</b>			<b>5</b>
V	<b>Chemolithotrophic and Phototrophic Metabolism:</b> Introduction to aerobic and anaerobic chemolithotrophy with an example each. Hydrogen oxidation (definition and reaction) and methanogenesis	1 & 2	10 & 12, 14

(definition and reaction). Introduction to phototrophic metabolism - groups of phototrophic microorganisms, anoxygenic vs. oxygenic photosynthesis with reference to photosynthesis in green bacteria and cyanobacteria. <b>Nitrogen Metabolism:</b> Introduction to biological nitrogen fixation. Ammonia assimilation. Assimilatory nitrate reduction.		
<b>Instructional Hours</b>		<b>10</b>
<b>Total Hours</b>		<b>45</b>

**Text Book(s):**

1. Kim B. H., Gadd G.M., **Bacterial Physiology and Metabolism**. Cambridge University Press, Cambridge, 2008.
2. Albert G. Moat, John W. Foster, Michael P. Spector., **Microbial Physiology**, Wiley – Liss, Inc., New York, 4<sup>th</sup> Edition, 2003.
  - Unit I : Text Book 2, Chapter 1 - (19-26)
  - Unit II : Text Book 1, Chapter 3 – (35-41)
  - Unit III: Text Book 2, Chapter 8 (351-365) & 9 (368-393)
  - Unit IV: Text Book 1, Chapter 8 & 9 (252 - 345)
  - Unit V : Text Book 1 & 2, Chapter 10(354-379) & 12 (434-446); 14 (475 – 502)

**Reference Book(s):**

1. Robert K. Poole., **Advances in Microbial Physiology**, Elsevier Academic Press, New York, Volume 49, 2004.
2. Cohen, G. N., **Microbial Biochemistry**, Springer, New York, 3<sup>rd</sup> Edition, 2014.
3. Rose A.H., **Chemical Microbiology: An Introduction to Microbial Physiology**, Butterworth & Co., USA, 3<sup>rd</sup> Edition, 2014.
4. Daniel R. Caldwell, **Microbial Physiology & Metabolism**, Wm. C. Brown, Germany, 1995.
5. <https://sites.google.com/site/microbialphysiologyoddsem/Teaching-Contents>
6. [https://web.iitd.ac.in/~amittal/2007\\_Addy\\_Enzymes\\_Chapter.pdf](https://web.iitd.ac.in/~amittal/2007_Addy_Enzymes_Chapter.pdf)
7. <http://nsdl.niscair.res.in/jspui/bitstream/123456789/803/1/CarbonMetabolism.pdf>

**Tools for Assessment (20 Marks)**

CIA I	CIA II	CIA III	Assignment	Quiz	Attendance	Total
4	4	5	2	2	3	20

**Mapping**

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	L	L	H	M	M
CO2	L	L	L	H	L	M
CO3	L	L	L	H	M	M
CO4	L	L	L	H	M	M
CO5	L	L	M	H	H	H

H-High; M-Medium; L-Low

Course designed by	Verified by HoD	Checked by	Approved by
Dr. S. ESATH NATHEER	Dr. T. M. SURIKHA	COO	

Course Code	Title		
20U3MBP307	Core Paper VII – Lab in Microbial Physiology and Metabolism		
Semester: III	Credits: 4	CIA : 40 Marks	ESE: 60 Marks

**Course Objective:**

Students are able to estimate Protein, Carbohydrates etc. They acquire skill on bacterial growth curve and identification of fungi, algae & parasites.

**Course Outcomes (CO):**

On successful completion of this course the students will be able to

<b>CO1</b>	Know the techniques for the identification of Fungi, Algae and Parasites.
<b>CO2</b>	Acquire practical skills on bacterial growth curve.
<b>CO3</b>	Acquire practical skills on Factors affecting the growth curve.
<b>CO4</b>	Acquire knowledge on cultivation of anaerobic microorganisms.
<b>CO5</b>	Demonstration of the thermal death time & Starch Hydrolysis.

**Offered by: Microbiology**

**Course Content**

**Instructional Hours / Week: 4**

S.No.	Experiments
1	Winogradsky column
2	<b>Microscopic examinations of</b> a. Algae: Diatoms, Chlamydomonas, Volvox . -Wet mount b. Cyanobacteria: Oscillatoria, Nostoc, Anabaena.-Wet mount c. Fungi- Mucor sp., Aspergillus sp., Penicillium spp, Alternaria sp.& Yeast. LPCB d. Parasites: Entamoeba spp., Giardia spp., Plasmodium, Taenia, Ascaris
3	Estimation of Carbohydrates (DNSA method)
4	Culture characteristics of Microorganisms- colony morphology, shape, margin.
5	To study and plot the growth curve of <i>E. coli</i> using turbid metric method and to calculate specific growth rate and generation time.
6	Factors affecting the growth curve: pH, Salt concentration & temperature
7	Cultivation of anaerobic Microorganisms – Wrights tube –McIntosh Fildesjar
8	Demonstration of the thermal death time and decimal reduction time of <i>E. coli</i> .
9	Starch hydrolysis test
<b>Total Hours 60</b>	

**Text Book(s):**

1. Willey JM, K. Sandman and D. Wood. **Prescott's Microbiology**, 11<sup>th</sup> Edition. McGraw Hill Higher Education, USA, 2019.
2. Madigan MT and J.M. Martinko. **Brock Biology of Microorganisms**, 15<sup>th</sup> Edition. Prentice Hall International Inc., USA, 2017.

**Reference Book(s):**

1. Cohen GN., **Microbial Biochemistry**, 2<sup>nd</sup> Edition. Springer, Germany, 2014.
2. White D, J. Drummond and C. Fuqua. **The Physiology and Biochemistry of Prokaryotes**, 4<sup>th</sup> Edition. Oxford University Press, UK, 2011.
3. Stanier RY, J.I. Ingrahm, M.L. Wheelis and P.R. Painter. **General Microbiology**, 5<sup>th</sup> Edition. McMillan Press, UK, 1987.

**Tools for Assessment (40 Marks)**

Lab Performance -1	Lab Performance-2	Test I	Test II	Observation	Attendance	Total
5	5	10	10	7	3	40

**Mapping**

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	L	L	M	H	H
CO2	L	L	L	M	H	H
CO3	L	L	L	M	H	H
CO4	L	L	L	M	H	H
CO5	L	L	L	M	H	H

H-High; M-Medium; L-Low

Course designed by	Verified by HoD	Checked by	Approved by
<i>S. Esath Natheer</i> Dr. S. ESATH NATHEER	<i>S. M. S. S. S. S. S.</i> Dr. T. M. SUNKIHA	<i>S. M. S. S. S. S.</i> S. M. S. S. S. S.	<i>S. M. S. S. S. S.</i> S. M. S. S. S. S.

Course Code	Title		
20U3BYA304	Allied Paper IV – Biochemistry		
Semester: III	Credits: 3	CIA :20 Marks	ESE:55 Marks

**Course Objective:**

On successful completion of the course, the students understood the significance of the complex bio-molecules, polysaccharides, lipids, proteins and nucleic acids.

**Course Outcomes (CO):**

On successful completion of this course the students will be able to

CO1	Describe structures and functions of basic biomolecules.
CO2	Understand the theories of enzyme kinetics, the mechanisms of enzyme catalysis, and the mechanisms of enzyme regulation in the cell.
CO3	Know the fundamental energetics of biochemical processes, chemical logic of metabolic pathways.
CO4	Apply safety standards and select disposal method and procedures for electrical diagnostic equipment.
CO5	Apply basic principles of chemistry to biological systems and molecular biology.

**Offered by: Microbiology****Course Content****Instructional Hours / Week:3**

Unit	Description	Text Book	Chapter
I	<b>Major Macromolecules:</b> Biochemistry definition, outline classification and general characteristics of carbohydrates (Monosaccharides, Disaccharides and polysaccharides). General characteristics of amino acids and proteins, Structure of nitrogenous bases, nucleotides, nucleic acids. Fatty acids (Saturated and Unsaturated). Lipids (Spingolipids, phospholipids and sterols).	1	3
<b>Instructional Hours</b>			<b>05</b>
II	<b>Enzymology:</b> Classification of enzymes, Co-enzymes, Mode of action of enzymes, Michaelis-Menten theory, Fischer's template theory, Koshland's induced fit theory, Michaelis constant, Km value, Vmax, Factors influencing enzyme activity, Enzyme activation, Inhibition, competitive, non-competitive, Allosteric inhibition, suicide inhibition, Covalent modification, Iso-enzymes.	2	5
<b>Instructional Hours</b>			<b>10</b>
III	<b>Metabolism:</b> Basic concepts, Glycolysis, regulation of glycolysis, gluconeogenesis and its regulation, Pentose phosphate pathway. Aerobic metabolism (TCA cycle and Oxidative phosphorylation).	3	8-10
<b>Instructional Hours</b>			<b>10</b>
IV	<b>Bioinstrumentation:</b> Principles and applications of colorimetry, spectrophotometry (Uv-vis), Chromatography (Paper, Thin layer, Column and HPLC), Centrifugation and gel electrophoresis.	4	3-6
<b>Instructional Hours</b>			<b>10</b>



V	<b>Bioanalytics:</b> Qualitative analysis: Analysis of individual proteins, Analysis of Carbohydrates, Analysis of urea. Quantitative analysis: Estimation of glucose in urine, Estimation of blood sugar, Haemoglobin in blood, Estimation of total cholesterol in serum.	5	3-22
<b>Instructional Hours</b>			<b>10</b>
<b>Total Hours</b>			<b>45</b>

**Text Book(s):**

1. Eldon Enger, Frederick C Ross, **Concepts in Biology**, McGraw-Hill ScienceEngineering, 2002.
2. Vasudevan D.M., Sreekumari S., KannanVaidyanathan, **Textbook of Biochemistry**, Jaypee Brothers Medical Publishers, 6<sup>th</sup> edition, 2011.
3. Trudy McKee, James R. McKee, **Biochemistry The Molecular Basis of Life**, Oxford University Press, 6<sup>th</sup> edition, 2016.
4. MahinBasha, **Analytical Techniques in Biochemistry**, Springer Protocols Handbooks, 2020.
5. Vasudevan D.M., Das S.K. - **Practical Textbook of Biochemistry for Medical Students**, Jaypee Brothers Medical Publishers, 2<sup>nd</sup> edition, 2013.  
 Unit I : Text Book 1, Chapter 3:40-57.  
 Unit II : Text Book 2, Chapter 5: 55-74.  
 Unit III: Text Book 3, Chapter 8-10: 271-381.  
 Unit IV: Text Book 4, Chapter 3-6: 13-76.  
 Unit V : Text Book 5, Chapter 3-22:11-57.

**Reference Book(s):**

1. Benjamin F. Lasseter, **Biochemistry in the Lab - A Manual for Undergraduates**, CRC Press, 2020.
2. Thomas Millar, **Biochemistry Explained - A Practical Guide to Learning Biochemistry**, CRC Press, 2020.
3. Keith Wilson, John Walker, **Principles and Techniques of Biochemistry and Molecular Biology**, Cambridge University Press, 7<sup>th</sup> edition, 2010.
4. <https://www.chem.purdue.edu/courses/chm333/>
5. <https://www.uwo.edu/molecbio/courses/molb-3610/files/3610%20chpts%201-2%20notes.pdf>
6. <https://www.cliffsnotes.com/study-guides/biology/biochemistry-i/the-scope-of-biochemistry/introduction-to-biochemistry>

**Tools for Assessment (20 Marks)**

CIA I	CIA II	CIA III	Assignment	Quiz	Attendance	Total
4	4	5	2	2	3	20

## Mapping

PSO CO	PSQ1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	H	L	H	M	M
CO2	L	H	H	M	M	M
CO3	L	M	H	L	H	M
CO4	M	M	M	M	H	H
CO5	H	M	H	H	H	H

H-High; M-Medium; L-Low

Course designed by	Verified by	Checked by	Approved by
<i>A. Jayaraj Nair</i> 11/2/21 Dr. K. PRANAV MOHAN	<i>Dr. S. H. Sankar</i> 11/2/21 Dr. S. H. SANKAR	<i>Dr. S. H. Sankar</i> 11/2/21 Convenor CDG	<i>[Signature]</i> 11/2/21

Course Code	Title		
20U4MBS301	Skill Based Paper I – Fundamentals of Bioinformatics		
Semester: III	Credits: 3	CIA :20 Marks	ESE:55 Marks

**Course Objective:**

Organize vast reams of molecular biology data in an efficient manner, develop tools that aid in the analysis of such data and interpret the results accurately and meaningfully.

**Course Outcomes (CO):**

On successful completion of this course the students will be able to

CO1	Develop knowledge and awareness of the basic principles and concepts of biology and computer science.
CO2	Interpret the data storage format as required for data submission and retrieval.
CO3	Use research-based knowledge including design of experiments, analysis and interpretation of data.
CO4	Understand the intersection of life and information sciences.
CO5	Know how to apply these complementary methods in structural biology to study different aspects of protein structure and function.

Offered by: Microbiology

**Course Content**

Instructional Hours / Week:3

Unit	Description	Text Book	Chapter
I	<b>Definition of Bioinformatics:</b> Scope applications and limitations. Biological databases – Types of Databases, pitfalls and information Retrieval from biological databases.	1	1
<b>Instructional Hours</b>			<b>05</b>
II	Database of metabolic pathways, Mode of data storage - File formats - FASTA, Genbank and Uniprot, Data submission & retrieval from NCBI, EMBL, DDBJ, Uniprot, PDB	3	3
<b>Instructional Hours</b>			<b>10</b>
III	<b>Sequence Alignment:</b> Global Alignment, Local Alignment, parametric and Multiple Alignment, Profile. <b>Phylogeny:</b> Introduction, Molecular clock, additive distance trees, Parsimony, Heuristics	2	7, 8
<b>Instructional Hours</b>			<b>10</b>
IV	<b>Genome organization and analysis:</b> Diversity of Genomes: Viral, prokaryotic & eukaryotic genomes Genome, transcriptome, proteome, 2-D gel electrophoresis, MalDI ToF spectroscopy.	2	19
<b>Instructional Hours</b>			<b>10</b>
V	<b>Structural Bioinformatics:</b> Protein Structure basics. Protein Secondary and Tertiary Structure Prediction. RNA structure Prediction.	1	12,14,15, 16
<b>Instructional Hours</b>			<b>10</b>
<b>Total Hours</b>			<b>45</b>

**Text Book(s):**

1. Jin Xiong, **Essential Bioinformatics**, Cambridge University Press First Edition 2006.
2. VittalR.Srinivas, **Bioinformatics : A Modern Approach**, PHI Learning Private Limited, New Delhi, 2005.
3. Arthur M. Lesk, **Introduction to Bioinformatics**, Oxford University Press, New York, 2002.

Unit I : Text Book 1, Chapter 1:3-18.

Unit II : Text Book 3, Chapter 3: 107-152.

Unit III: Text Book 2, Chapter 7: 65-101, Chapter 8: 102-121.

Unit IV: Text Book 2, Chapter 19: 213-224.

Unit V : Text Book 1, Chapter 12: 173-182. Chapter 14: 200-211. Chapter 15: 214-228, Chapter 16: 231-239.

**Reference Book(s):**

1. Teresa K. Attwood and David J. Parry-Smith, **Introduction to Bioinformatics**, Prentice Hall. Pearson Education Limited, England, 1999.
1. Stephen Misener and Stephen A.Krawetz, **Bioinformatics – Methods and Protocols**, Humana Press Inc. New Jersey, 2000.
2. <https://nptel.ac.in/content/storage2/courses/102103044/pdf/mod6.pdf>

**Tools for Assessment (20 Marks)**

CIA I	CIA II	CIA III	Assignment	Quiz	Attendance	Total
4	4	5	2	2	3	20

**Mapping**

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	L	L	H	M
CO2	H	H	L	L	M	M
CO3	H	H	H	L	H	H
CO4	H	M	M	M	L	M
CO5	M	H	H	H	H	H

H-High; M-Medium; L-Low

Course designed by	Verified by HoD	Checked by	Approved by
Dr. S. ESATH NATHEER	Dr. T. M. SURIKHA	COO	

Course Code	Title	
19U4NM3CAF	Non Major Elective : Consumer Affairs	
Semester: III	Credits : 2	ESE: 50 Marks

**Course Outcome:**

CO1	Know their rights and responsibilities as a consumer
CO2	Gain knowledge about Legal framework of protecting consumer rights
CO3	Understand the procedure about redressal of consumer complaints
CO4	Learn about Consumer related regulatory
CO5	Comprehend business firms ,interface with consumers

**Course Content****Instructional Hours / Week : 2**

Unit	Description	Instructional Hours
I	<b>Conceptual Framework</b> <b>Consumer and Markets:</b> Concept of Consumer, Nature of markets: Liberalization and Globalization of markets with special reference to Indian Consumer Markets, Concept of Price in Retail and Wholesale, Maximum Retail Price (MRP), Fair Price, GST, labeling and packaging along with relevant laws, Legal Metrology.	6
	Consumer Complaining Behaviour: Alternatives available to Dissatisfied Consumers; Complaint Handling Process	
II	<b>The Consumer Protection Law in India</b> <b>Objectives and Basic Concepts:</b> Consumer rights and UN Guidelines on consumer protection, Consumer goods, defect in goods, spurious goods and services, deficiency in service, unfair trade practice.	6
III	<b>Grievance Redressal Mechanism under the Indian Consumer Protection Law</b> Who can file a complaint? Grounds of filing a complaint; Limitation period; Procedure for filing and hearing of a complaint; Disposal of cases, Relief/Remedy available; Temporary Injunction, Offences and penalties.	6
IV	<b>Role of Industry Regulators in Consumer Protection</b> i. Telecommunication: TRAI ii. Food Products: FSSAI iii. Insurance : IRDA and Insurance Ombudsman	6
		<b>Instructional Hours</b> 6

V	<b>Contemporary Issues in Consumer Affairs</b> <b>Consumer Movement in India:</b> Formation of consumer organizations and their role in consumer protection, Misleading Advertisements and sustainable consumption, National Consumer Helpline, Comparative Product testing.
	<b>Quality and Standardization:</b> Voluntary and Mandatory standards; Role of BIS, Indian Standards Mark (ISI), Ag-mark, Hallmarking, Licensing and Surveillance.
	<b>Instructional Hours</b> <b>6</b>
	<b>Total Hours</b> <b>30</b>

**Text book :**

“Consumer Affairs”, Compiled by Department of Business Administration, Nehru Arts and Science College.

**Suggested Readings:**

1. Khanna, Sri Ram, Savita Hanspal, Sheetal Kapoor, and H.K. Awasthi. (2007) Consumer Affairs, Universities Press.
2. Choudhary, Ram Naresh Prasad (2005). Consumer Protection Law Provisions and Procedure, Deep and Deep Publications Pvt Ltd.
3. G. Ganesan and M. Sumathy. (2012). Globalisation and Consumerism: Issues and Challenges, Regal Publications
4. Suresh Misra and Sapna Chadah (2012). Consumer Protection in India: Issues and Concerns, IIPA, New Delhi
5. Rajyalaxmi Rao (2012), Consumer is King, Universal Law Publishing Company
6. Girimaji, Pushpa (2002). Consumer Right for Everyone , Penguin Books.

Course Designed by	Verified by	Checked by	Approved by
Dr. T. SUDHA	(Dr. N. Shan)	Convent CDC	IIPAS

Course Code	Title	
19U4NM3GTS	Gandhian Thoughts	
Semester: III	Credits : 2	ESE: 50 Marks

**Course Objective:** To make them understand the philosophies of Gandhi better and fulfill their duties and responsibilities towards the society.

**Course Outcome :** To upgrade the knowledge and skills of the students in Gandhian Thoughts and to encourage patriotism among the new generation, to put light on social issues and value of life.

**Course Content**

**Instructional Hours/Week: 02**

Unit	Description	Instructional Hours
I	<b>Educational Philosophy of Gandhiji :</b> Definitions on Education - What is True Education? - Gandhiji's New Scheme of Education - Wardha Scheme of Education - Main Aims of Gandhian Education - Why Gandhiji's Scheme of Education was Called „Basic Education?“ - Features of the Wardha Scheme of Education - Features of Basic Education - The Methodology of Basic Education - The Content of Basic Education - Routine Work of a Basic School	6
II	<b>Gandhian Concept of Correlation of Studies -</b> Technique of Correlation - The Place of Teacher in Basic Education - Merits of Basic Education - Educational Scenario after Independence - Influences of Gandhiji on Education Commissions - Basic Schools in the Present Society - Education for Peace – A Gandhian View - Why Basic Education is called a Holistic Model	6
III	<b>Gandhiji's View on Truth and Non-Violence :</b> Gandhiji's Words about Truth - Meaning of Truth, Truth is God - Truth and God - The Importance of Truth in Human Life - Absolute and Relative Truth - Realisation of the Self - Liberation.	6
IV	<b>Mahatma Gandhi's Views on Women :</b> Status of Women in Pre Independence India - Gandhi's Perception of Women - Role of Women in Family – Perception of Gandhi - Value of Equality - Women in Politics - Gandhiji's Vision to Abolish Social Evils against Women - Role of Women as Envisaged by Gandhi.	6
V	<b>Gandhiji's View on Democracy (Gram Swaraj) :</b> City and Village - Gram Swaraj - Critique of Industrialisation - Critique of Machinery	6
		<b>Total Hours</b>
		<b>30</b>

Course Designed by	Verified by	Checked by	Approved by
A. JON YDHIWAHAR	(Dr. H. Subrata)	Convener	

**Text Book(s):**

1. “Gandhian Thoughts”, Compiled by Nehru Arts and Science College.



Course Code	Title	
19U4NM3WRT	Women's Rights	
Semester: III	Credits: 2	ESE : 50 Marks

**Course Objective:**

To facilitate the awareness on the social, economic, political, intellectual or cultural contributions of one or more women

**Course Outcome:**

- Examine the similarities and differences among women within and across cultures and at various moments
- Describe gender socialization and its consequences in a particular society
- Analyze how these factors with the privileges and disadvantages they confer have shaped one's own experiences, presumptions, viewpoints, and sense of identity
- Read and respond to feminist scholarship

**Course Content****Instructional Hours / Week : 2**

Unit	Description	Text book	Chapter
<b>I</b>	<b>Laws, Legal System and Change</b> Definition - Constitutional law, CEDAW and International Human Rights - Laws and Norms – Laws and Social Context - Constitutional and Legal Framework	2	2
<b>Instructional Hours</b>			<b>6</b>
<b>II</b>	<b>Politics of land and gender in India</b> Land as Productive Resources	1	5
	Locating Identities – Women's Claims to Land – Right to Property - Case Studies	1	6,7
<b>Instructional Hours</b>			<b>6</b>
<b>III</b>	<b>Women's Rights: Access to Justice</b> Introduction – Criminal Law – Crime Against Women Domestic Violence – Dowry Related Harassment and Dowry Deaths- Molestation – Sexual Abuse and Rape Loopholes in Practice – Law Enforcement Agency	3	7
<b>Instructional Hours</b>			<b>6</b>
<b>IV</b>	<b>Women's Rights</b>		
	Violence Against Women – Domestic Violence The Protection of Women from Domestic Violence Act, 2005, The Marriage Validation Act, 1982 - The Hindu Widow Re-marriage Act, 1856- The Dowry Prohibition Act, 1961	3	5
<b>Instructional Hours</b>			<b>6</b>

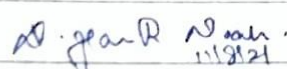



V	<b>Special Women Welfare Laws</b> Sexual Harassment at Work Places, Rape and Indecent Representation , The Indecent Representation (Prohibition) Act, 1986 , Immoral Trafficking , The Immoral Traffic (Prevention) Act, 1956 - Acts Enacted for Women Development and Empowerment , Role of Rape Crisis Centers. Protection of Children from sexual Offences Act 2012	3	9
<b>Instructional Hours</b>			<b>6</b>
<b>Total Instructional Hours</b>			<b>30</b>

**Text Books:**

1. Nitya Rao **Good Women do not Inherit Land** Social Science Press and Orient Blackswan 2008
2. International Solidarity Network **Knowing Our Rights** An imprint of Kali for Women 2006
3. P. D. Kaushik **“Women Rights”** Bookwell Publication 2007 UN Centre for Human Rights, Discrimination against Women (Geneva: World Campaign for Human Rights, 1994).

**Reference Books:**

1. Aruna Goal **Violence Protective Measures for Women Development and Empowerment**, Deep and Deep Publications Pvt. 2004
2. Monica Chawla **Gender Justice**, Deep and Deep Publications Pvt. Ltd.2006
3. Preeti Mishra **Domestic Violence Against Women**, Deep and Deep Publications Pvt. 2007
4. Clair M. Renzetti, Jeffrey L. Edleson, Raquel Kennedy Bergen, Source Book on **Violence Against Women** Sage Publications 2001

Course designed by	Verified by	Checked by	Approved by
 Dr. K. FRANKLIN NOAH	 Dr. J. H. SUKIRITHA	 Convenor CDG	

Course Code		Title	
18U4HVY402		Human Excellence: Human values and Yoga Practice II	
Semester: III & IV	Credit: 2	CIA: 25 Marks	ESE: 25 Marks

### Course Objective

- To help the students appreciate the essential complementarity between 'values' and 'skills' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings
- To prepare and distribute standardized Yoga teaching and training materials with reference to institute health

### Course Outcome (CO):

At the end of the course, students are expected

<b>CO 1</b>	To become more aware of their self and their relationships and would have better reflective and discerning ability.
<b>CO 2</b>	It is hoped that they would be able to apply what they have learnt to their own self in different ordinary day-to-day settings in real life with higher commitment and courage.
<b>CO 3</b>	To enable students to lead a practical life adding value to human relations.
<b>CO 4</b>	To have the basic Knowledge on Simplified Physical Exercises and Asanas and Meditation

### Course Content

Instructional Hours / Week: 1

Unit	Description	Text Book	Chapter
<b>I</b>	<b>Self-realization and Human Values-</b> Self-realization and Harmony-Rules and Regulations-Rights and Duties-Good and Obligation-Integrity and Conscience. <b>Obligation to Family-</b> Trust and Respect -Codes of Conduct -Citizens Charter - Emotional Intelligence.	1	1,4
<b>Instructional Hours</b>			<b>6</b>
<b>II</b>	Impact of Modern Education and Media on Values: Impact of Science and Technology on Values; Effects of computer aided media on Values (Internet, e-mail, Chat etc.); Role of teacher in the preservation of tradition and culture;	1	5
<b>Instructional Hours</b>			<b>6</b>
<b>III</b>	Eradication of worries - Maintaining youthfulness - Greatness of friendship – Refinement of worries - Neutralization of anger- Intelligent quotient (IQ), Emotional quotient (EQ), Spiritual Quotient (SQ)	1	2,3
<b>Instructional Hours</b>			<b>6</b>

IV	Standing Posture: Tadasana, Padahasthasana, Virabhadrasana; Sitting posture: Ustrasana, Ardha Matsyendrasana, Paschimottanasana.	2	4,5
<b>Instructional Hours</b>			<b>6</b>
V	Supine posture: Sarvangasana, Halasana, Chakrasana. Prone posture: Bhujangasana, shalabhasana; Dhanurasana; Balancing postures: Vrikshasana, Natarajasana, Utkatasana; Pranayama: Bhastrika, Bhramari, NadiShodhan.	2	6,9
<b>Instructional Hours</b>			<b>6</b>
<b>Total Hours</b>			<b>30</b>

**Textbook(s):**

1. Kiran, D.R. "Professional Ethics & Human Values", TATA McGraw Hill Education.
2. Chandrasekaran, 1999. Sound Health through yoga, Prem Kalyan Publications, Madurai.

**Reference Books :**

1. Vethathiri Maharishi, 2011, "Value Education", Vethathiri Publication, Erode
2. Thathuvagnani Vethathiri Maharishi, 2014, "Simplified Physical Exercises". Vethathiri Publications

Course designed by	Verified by	Checked by	Approved by
<i>Dr. J. K. Franklin Noah</i> Dr. K. Franklin Noah	<i>Dr. J. H. Sukirtha</i> Dr. J. H. Sukirtha	<i>Dr. J. H. Sukirtha</i> Convenor CCG	<i>Dr. J. H. Sukirtha</i>

Course Code	TITLE		
20U1FRN404	Part - I French - IV		
Semester - IV	Credits - 4	CIA Marks : 25	ESE Marks: 75

**Course Objective:** To make the students know and understand the value of French language and help them to follow the culture and tradition.

**Course Outcomes:**

CO 1	Empowering reading skill
CO 2	Translation

**Offered by:** French Department

**Course Content**

**Instructional Hours /Week: 5**

Unit	Description	
I	Le tour du monde en 80 jours	
	<b>Instructional Hours</b>	<b>15</b>
II	Ici et Ailleurs	
	<b>Instructional Hours</b>	<b>15</b>
III	Projets	
	<b>Instructional Hours</b>	<b>15</b>
IV	Savoir-vivre	
	<b>Instructional Hours</b>	<b>15</b>
V	Sans voiture	
	<b>Instructional Hours</b>	<b>15</b>
	<b>Total Hours</b>	<b>75</b>

**Text Book :**

1. CONNEXIONS Méthode de Français Niveau 2 – Régine Mérieux  
Yves Loiseau

**Tools for Assessment (25 marks)**

CIA I	CIA II	CIA III	Assignment	Seminar	Attendance	Total
5	5	6	3	3	3	25

<b>Course Designed by</b> [Signature]	<b>Verified by</b> [Signature]	<b>Checked by</b> [Signature]	<b>Approved by</b> [Signature]
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Course Code	Title		
20U2ENG404	Part II- English IV		
Semester: IV	Credits: 4	CIA: 25	ESE : 75

(All UG Programmes)

**Course Objective**

To equip the students with the Language Skills, Functional usage. Facilitate the insight and taste of Literature

**Course Outcome (CO)**

CO1	Remember the themes of literary pieces
CO2	Understand the authors context
CO3	Comprehend the writing skills and practice it
CO4	Enhance fluency over language with self confidence.
CO5	Assess the language skills using literature

Offered by: English

Instructional Hours / Week: 5

Unit	Description	Text Book	Chapter
I	<b>Poetry</b> Sarojini Naidu - The Soul's Prayer Emily Dickinson - Death in the Opposite House William Blake - London	2	
	<b>Instructional Hours</b>		
II	<b>Prose</b> Francis Bacon - Of Adversity Dr. Radhakrishnan - Character is Destiny Oliver Goldsmith - An Account of West Minster Abbey	2	
	<b>Instructional Hours</b>		
III	<b>Short Stories</b> W. Somerset Maugham - Mr. Know-All Edgar Allan Poe - The Purloined Letter Ruskin Bond - The thief story	1	
	<b>Instructional Hours</b>		
IV	<b>Drama</b> William Shakespeare -As You Like It	1	
	<b>Instructional Hours</b>		

V	<b>GRAMMAR AND COMPOSITION</b> <b>Oral &amp; Written Communication (Unit I–IV)</b> <b>Listening</b> – Comprehension practice from Poetry, Prose, Online Voice Practice, observing/viewing E-content (with subtitles), Guest/Invited Lectures, Conference/Seminar Presentations & Tests, and DD National News Live, BBC, CNN, VOA etc <b>Speaking</b> – In Group Discussion Forum, participate in the Turn Taking, and Conversation Management, Debating, Defending/Mock Viva-Voice, Seminar Presentations on Classroom-Assignments, and Peer-Team-interactions. <b>Reading</b> – Different Reading Strategies in Poetry, Prose, Novel, Newspaper etc <b>Writing</b> – Clauses – Conditional, Relative, Restrictive, Non-Restrictive, Denotation and Connotations Précis Writing, One word substitution.	2
	<b>Instructional Hours</b>	<b>15</b>
<b>Total Hours</b>		<b>75</b>

**Books for study:**

Unit I – V : Compiled by the Department of English

**Books for Reference:**

1. CLIL ( Content & Language Integrated Learning ) – Module by TANSCHÉ

NOTE: (Text: Prescribed chapters or pages will be given to the students by the department)

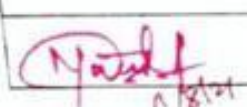
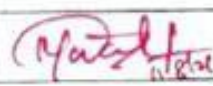


**Tools for Assessment (25 Marks)**

CIA I	CIA II	CIA III	Assignment	Seminar	Attendance	Total
5	5	6	3	3	3	25

**Mapping**

PSO	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO</b>					
<b>CO1</b>	H	H	H	H	H
<b>CO2</b>	H	M	M	H	H
<b>CO3</b>	H	M	M	M	M
<b>CO4</b>	H	M	M	H	M
<b>CO5</b>	S	H	M	M	M

S: Strong, H: High, M: Medium, L: Low

Course Designed by	Verified by HOD	Checked by	Approved by
		 Convener SCOG	

Course Code	Title		
20U3MBC408	Core Paper – VIII Microbial Genetics and Molecular Biology		
Semester: IV	Credits: 4	CIA :25Marks	ESE:75 Marks

**Course Objective:**

To make the students understand on mechanism of gene transfer, recombination, regulation and expression.

**Course Outcomes (CO):**

On successful completion of this course the students will be able to

CO1	Acquire a fairly good understanding mechanisms of genetic transformation and their implications.
CO2	Describe gene exchange mechanism, the nature of the transposable elements in the cells.
CO3	Understand about the biology of bacteriophages.
CO4	Develop knowledge on gene, their expression and regulation of expression.
CO5	Outline the basic steps involved in central dogma of gene expression.

**Offered by: Microbiology****Course Content****Instructional Hours / Week: 4**

Unit	Description	Text Book	Chapter
I	<b>Gene transfer mechanisms:</b> Bacterial transformation (detection of transformation, development of competence, mechanism of transformation, transfection); conjugation-effective contact and piliin conjugation, F-factor, the conjugal transfer process; high frequency recombination (Hfr) strains; the order of chromosome transfer; formation of F prime (F'); transduction – generalized transduction; abortive transduction; specialized transduction. Sexduction.	2	4
<b>Instructional Hours</b>			<b>12</b>
II	<b>Genetic recombination:</b> Mechanism of recombination. General recombination (Holiday model); General conversion; site specific recombination; Transposable elements – Classes of transposable elements; nomenclature of transposable elements, insertion sequence (IS elements).	4	11-12
<b>Instructional Hours</b>			<b>12</b>
III	<b>Bacteriophages:</b> Stages in the Lytic Life Cycle of a typical phage, Properties of a phage infected bacterial culture, Specificity in phage infection, <i>E. coli</i> Phage T4, <i>E. coli</i> Phage T7, <i>E. coli</i> phage lambda, Immunity to infection, Prophage integration, Induction of prophage, Induction & Prophage excision, Repressor, Structure of the operator and binding of the repressor and the Cro product, Decision between the lytic and lysogenic Cycles, Transducing phages, <i>E. coli</i> phage phiX174, filamentous DNA phages, Single stranded RNA phages, The lysogenic Cycle.	2	5
<b>Instructional Hours</b>			<b>12</b>
IV	<b>Gene regulation:</b> Negative regulation – <i>E. coli</i> lac operon (structural, operator, promoter and repressor genes), Positive regulation – <i>E. coli</i> trp operon; Regulation by small molecules e.g. ppGpp and cAMP Post-translational processing (removal of fmet from polypeptide; ribosome editing: protein folding); Gene silencing (RNAi): An introduction and its application.	3	8
<b>Instructional Hours</b>			<b>12</b>



V	<b>Replication, Transcription and Translation:</b> Chemistry of DNA synthesis, general principles – bidirectional replication, Semiconservative, Semi discontinuous, Various models of DNA replication including rolling circle. Mechanism of Transcription (Prokaryotes and Eukaryotes) – RNA Polymerase and the transcription unit, Translation (Prokaryotes and Eukaryotes).	1	19-22
<b>Instructional Hours</b>			<b>12</b>
<b>Total Hours</b>			<b>60</b>

**Text Book(s):**

1. Jeff Hardin, Gregory Paul Bertoni, Lewis J. Kleinsmith - **Becker's world of the cell**, Pearson Benjamin Cummings, 8<sup>th</sup> edition, 2012.
2. Stanley R Maloy, John E. Cronan, Jr., David Freifelder, **Microbial Genetics**, Jones and Bartlett Publishers, 2<sup>nd</sup> edition, 1994.
3. Verma P.S., Agarwal V.K., **Cell Biology, Genetics, Molecular Biology, Evolution and Ecology**, S. Chand & Company Ltd., 2005.
4. James D. Watson, **Molecular Biology of the Gene**, Cold Spring Harbor Laboratory Press, 7<sup>th</sup> edition, 2013.

Unit I : Text Book 2, Chapter 4:213-377.

Unit II : Text Book 4, Chapter 11-12: 341-377.

Unit III: Text Book 2, Chapter 5: 81-95.

Unit IV: Text Book 3, Chapter 8: 91-108.

Unit V : Text Book 1, Chapter 19--22:549-690

**Reference Book(s):**

1. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., **Molecular Biology of the Gene**, Cold Spring Harbour Lab. Press, Pearson Pub., 7<sup>th</sup> edition, 2017.
2. De Robertis, E.D.P. and De Robertis, E.M.F., **Cell and Molecular Biology**, Lippincott Williams and Wilkins, Philadelphia, 8<sup>th</sup> edition, 2006.
3. <https://www.easybiologyclass.com/molecular-biology-online-tutorials-lecture-notes-study-materials/>

**Tools for Assessment (25 Marks)**

CIA I	CIA II	CIA III	Assignment	Quiz	Attendance	Total
5	5	6	3	3	3	25

**Mapping**

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	L	M	M	M
CO2	L	M	H	H	M	M
CO3	L	M	H	L	H	H
CO4	M	H	H	M	M	M
CO5	M	H	H	H	H	H

H-High; M-Medium; L-Low

Course designed by <i>Dr. S. Esath Natheer</i> 11/12/21	Verified by HoD <i>Dr. T. M. Sukidha</i> 11/12/21	Checked by <i>COG</i> 11/12/21	Approved by <i>[Signature]</i> 11/12/21
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Course Code	Title		
20U3MBP409	Core Paper IX – Lab in Microbial Genetics and Molecular Biology		
Semester: IV	Credits: 4	CIA :40Marks	ESE:60Marks

**Course Objective:**

To develop the ability to think critically and devise genetic strategies that might be used to address interesting biological problems.

**Course Outcomes (CO):**

On successful completion of this course the students will be able to

CO1	Get hands on exposure on microbial mutation studies.
CO2	Acquire knowledge to isolate and titre bacteriophages.
CO3	Gain Practical knowledge on DNA isolation.
CO4	Assess the concentration of DNA.
CO5	Gain Practical skill on DNA molecular weight determination.

**Offered by: Microbiology****Course Content****Instructional Hours / Week:4**

S. No.	Description
1.	Determination of antibiotic resistance of a given bacterial culture by replica plating.
2.	Lactose utilization in bacteria lac+ and Lac-.
3.	Titration of phages.
4.	Isolation of auxotrophic mutant.
5.	Genomic DNA isolation from <i>E. coli</i>
6.	Plasmid DNA isolation
7.	Quantification of DNA using spectrophotometric method
8.	Transformation of bacteria using CaCl <sub>2</sub> heat shock method
9.	Molecular weight estimation of fragmented DNA using agarose gel electrophoresis
<b>Total Hours 60Hours</b>	

**Text Book(s):**

1. James G. Cappuccino, Chad T. Welsh., **Microbiology: A Laboratory Manual**, Benjamin-Cummings Publishing Company, 2016.
2. Gunasekaran P., **Laboratory Manual in Microbiology**, New Age International, 2007.
3. Reddy CA., Terry J. Beveridge, John A. Breznak. **Methods for General and Molecular Bacteriology**, ASM Press, 2007.

**Reference Book(s):**

1. KannanN, 3. Laboratory Manual in General Microbiology, Panima Publishers, 2002.
2. Keith Wilson, John Walker, **Principles and Techniques of Biochemistry and Molecular Biology**, Cambridge University Press, 7<sup>th</sup> edition, 2010.

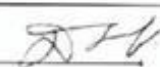
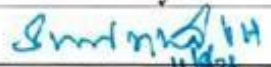


**Tools for Assessment (40 Marks)**

Laboratory Performance I	Laboratory Performance II	CIAI	CIA II	Observation	Attendance	Total
5	5	10	10	7	3	40

**Mapping**

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	H	H	H	H
CO2	L	M	M	H	H	H
CO3	M	H	H	H	H	H
CO4	M	H	H	H	H	M
CO5	M	H	H	H	H	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
			
Dr. B. David Jeyedra	Dr. P. H. SURIKUNTA	Convener	

Course Code	Title		
20U3BYA405	Allied Paper V – Instrumentation and Biotechniques		
Semester: IV	Credits: 3	CIA : 20 Marks	ESE: 55 Marks

**Course Objective:**

The major objective of this paper is to develop understanding of the key concepts of basic as well as some advanced experimental techniques in biological sciences.

**Course Outcomes (CO):**

On successful completion of this course the students will be able to

CO1	Identify and understand the principle components of various microscope.
CO2	Apply the principles of chromatography.
CO3	Understand how electrophoresis facilitates the separation of molecules.
CO4	Achieve advance knowledge about the interactions of electromagnetic radiation and matter and their applications in spectroscopy.
CO5	Understand the separation of biomolecules based on centrifugation techniques.

**Offered by: Microbiology****Course Content****Instructional Hours / Week: 3**

Unit	Description	Text Book	Chapter
I	<b>Microscopy:</b> Bright field and dark field microscopy, Fluorescence Microscopy, Phase contrast Microscopy, Electron Microscopy (Scanning and Transmission Electron Microscopy) and Micrometry.	1	11
<b>Instructional Hours</b>			<b>9</b>
II	<b>Chromatography:</b> Principles and applications of paper chromatography (including Descending and 2-D), Thin layer chromatography. Column packing and fraction collection. Gel filtration chromatography, ion-exchange chromatography and affinity chromatography, GLC, HPLC.	1	5
<b>Instructional Hours</b>			<b>9</b>
III	<b>Electrophoresis:</b> Principle and applications of native polyacrylamide gel electrophoresis, SDS- polyacrylamide gel electrophoresis, 2D gel electrophoresis Isoelectric focusing, Zymogram preparation and Agarose gel electrophoresis.	2	3
<b>Instructional Hours</b>			<b>9</b>
IV	<b>Spectrophotometry:</b> Principle and use of study of absorption spectra of biomolecules. Analysis of biomolecules using UV and visible range. Colorimetry and turbidometry	1	15
<b>Instructional Hours</b>			<b>9</b>
V	<b>Centrifugation:</b> Preparative and analytical centrifugation, fixed angle and swinging bucket rotors. RCF and sedimentation coefficient, differential centrifugation, density gradient centrifugation and ultracentrifugation. Analytical centrifugation – introduction, sedimentation velocity, sedimentation equilibrium and their applications.	1	12
<b>Instructional Hours</b>			<b>9</b>
<b>Total Hours</b>			<b>45</b>

**Text Book(s):**

1. Wilson K and Walker J. **Principles and Techniques of Biochemistry and Molecular Biology**. 8<sup>th</sup> Ed., Cambridge University Press, 2018.
2. Nelson DL and Cox MM. **Lehninger Principles of Biochemistry**, 7<sup>th</sup> Ed., W.H. Freeman and Company, 2017.

Unit I: Text Book 1, Chapter 11: 381 - 420.

Unit II: Text Book 1, Chapter 5: 179 - 281.

Unit III: Text Book 2, Chapter 3: 293 - 301.

Unit IV: Text Book 1, Chapter 15: 535 - 557.

Unit V: Text Book 1, Chapter 12: 424 - 452.

**Reference Book(s):**

1. Kathleen Talaro and Arthur Talaro. **Foundation in Microbiology**. WCB Publishers. 1993.
2. Willey MJ, Sherwood LM. & Woolverton C J. **Prescott, Harley and Klein's, Microbiology**. 9<sup>th</sup> Ed., McGraw Hill, 2013.
3. Karp G. **Cell and Molecular Biology: Concepts and Experiments**. 6<sup>th</sup> Edition. John Wiley & Sons. Inc., 2010
4. <https://www.saylor.org/site/wp-content/uploads/2012/07/Chapter121.pdf>

**Tools for Assessment (20 Marks)**

CIA I	CIA II	CIA III	Assignment	Quiz	Attendance	Total
4	4	5	2	2	3	20

**Mapping**

CO \ PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	L	M	M	M
CO2	L	M	H	H	M	M
CO3	L	M	H	L	H	H
CO4	M	H	H	M	M	H
CO5	M	H	H	H	H	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Dr. B. David Jureddin	Dr. P. H. SURIKTHA	Convener	

Course Code	Title		
20U3BYR406	Allied Paper VI – Biochemistry & Biotechniques Practical		
Semester: IV	Credits: 2	CIA :20 Marks	ESE:30Marks

**Course Objective:**

To introduce the modern and emerging approaches in techniques and its applications in Biochemistry.

**Course Outcomes (CO):**

On successful completion of this course the students will be able to

CO1	Understand different techniques used in biochemistry.
CO2	Recognize the theory and practice of protein purification, chromatography, electrophoresis, centrifugation, and other essential methods in modern molecular bioscience.
CO3	Acquire how to read and analyse the methods sections of primary research articles in biochemistry.
CO4	Acquire knowledge in the quantitative and qualitative estimation of biomolecules.
CO5	Train the students to gain concepts of assessing the human physiology using biological fluid.

**Offered by: Microbiology****Course Content****Instructional Hours / Week:2**

S. No.	Description
1.	Principles and Operation of Spectrophotometer
2.	Preparation of Buffer- Phosphate, Acetate, Tris
3.	Estimation of Proteins by Lowry's Method
4.	Estimation of DNA by DPA Method
5.	Estimation of Sugars by Anthrone Method
6.	Estimation of Total Free Amino Acids
7.	Estimation of Lipids
8.	Paper Chromatography
9.	Separation of Plant Pigments by Column Chromatography
10.	Estimation of Sugar in Urine
11.	Estimation of Protein in Urine
12.	Analysis of Sugar Level in Blood
<b>Total Hour 30Hours</b>	

**Text Book(s):**

1. Sadasivam S., Manickam, A. **Biochemical Methods**, New Age International, 2008
2. Jayaraman J., **Laboratory Manual in Biochemistry**. New Age International (P)Ltd. Publishers, 2005.

**Reference Book(s):**

1. Benjamin F. Lasseter, **Biochemistry in the Lab - A Manual for Undergraduates**, CRC Press, 2020.
2. Thomas Millar, **Biochemistry Explained - A Practical Guide to Learning Biochemistry**, CRC Press, 2020.
3. Keith Wilson, John Walker, **Principles and Techniques of Biochemistry and Molecular Biology**, Cambridge University Press, 7<sup>th</sup> edition, 2010.

**Tools for Assessment (20 Marks)**

Laboratory Performance I	Laboratory Performance II	Test I	Test II	Observation	Attendance	Total
3	3	4	4	3	3	20

**Mapping**

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO6
CO1	L	M	L	H	H	H
CO2	L	M	L	H	H	H
CO3	L	M	M	H	H	H
CO4	L	M	M	H	H	H
CO5	L	M	M	H	H	H

H-High; M-Medium; L-Low

Course designed by	Verified by	Checked by	Approved by
<i>D. Jayaraj</i> 11/2/21 Dr. K. FRANKLIN NOAH	<i>Dr. J. H. SURIATHA</i> 11/2/21	<i>[Signature]</i> 11/2/21 Convenor / CDC	<i>[Signature]</i> 11/2/21

Course Code	Title		
20U4MBS402	Skill Based Paper II Biofertilizers and Biopesticides		
Semester: IV	Credits : 3	CIA : 20 Marks	ESE : 55 Marks

**Course Objective:**

To be aware of production technology and usage of biofertilizers and biopesticides related to organic farming.

**Course Outcomes (CO):**

On successful completion of this course the students will be able to

CO1	Develop Knowledge and awareness of bacterial biofertilizers for sustainable agriculture.
CO2	Understand the usage of cyanobacteria and Azolla in wetland for crop improvement.
CO3	Understand the role of mycorrhizae in crop improvement.
CO4	Analyse the mechanism of solubilisation by phosphobacteria.
CO5	Know about the benefits of using biopesticides to prevent environmental pollution.

**Offered by: Microbiology****Course Content****Instructional Hours / Week:4**

Unit	Description	Text Book	Chapter
I	<b>Bacterial biofertilizers:</b> General account of the microbes used as biofertilizers for various crop plants and their advantages over chemical fertilizers. Isolation, characteristics, types, inoculum production and field application - <i>Rhizobium</i> , <i>Azotobacter</i> , <i>Azospirillum</i> and <i>Frankia</i> .	1 & 2	23 – 29 & 3
<b>Instructional Hours</b>			<b>12</b>
II	<b>Algal biofertilizers:</b> Isolation, characteristics, types, inoculum production and field application of Cyanobacteria (Blue Green Algae) and Azolla: Azolla and <i>Anabaena azollae</i> association, nitrogen fixation, factors affecting growth, blue green algae and Azolla in rice cultivation.	1	3 – 5 & 18
<b>Instructional Hours</b>			<b>12</b>
III	<b>Fungal biofertilizers:</b> Isolation, characteristics, types, taxonomy, occurrence and distribution, colonization of VAM, inoculum production and field application of Fungal Biofertilizers: Mycorrhizae – ecto and endomycorrhiza.	3	4 - 8
<b>Instructional Hours</b>			<b>12</b>
IV	<b>Phosphate Solubilizers:</b> Phosphate solubilizing microbes – Isolation, characterization, mechanism of phosphate solubilization, mass inoculum production, field application.	1	40 - 42
<b>Instructional Hours</b>			<b>12</b>
V	<b>Biopesticides:</b> History and concept, Definition, Classification, Concept, scope, production and field application - <i>Bacillus thuringiensis</i> , <i>Trichoderma viride</i> and Viruses; Biosafety. Advantages of biopesticides over synthetic pesticides.	4	4-7
<b>Instructional Hours</b>			<b>12</b>
<b>Total Hours</b>			<b>60</b>



**Text Book(s):**

1. Kannaiyan, S. **Bioetchnology of Biofertilizers**, CHIPS, Texas. 2003.
2. Mahendra K. Rai. **Hand Book of Microbial Biofertilizers**, The Haworth Press, Inc. New York, 2005.
3. Reddy, S.M. *et al.*, **Bioinoculants for Sustainable Agriculture and Forestry**, Scientific Publishers, 2002.
4. Saleem, F. and A. R. Shakoori. **Development of Bioinsecticide**, Lap Lambert Academic Publishing GmbH KG, 2012.

Unit I : Text Book 1, Chapter 23 - 29: 221-264

Text Book 2: Chapter 3: 32-57

Unit II : Text Book 1, Chapter 3-5: 41-83, Chapter 18: 193-204.

Unit III: Text Book 3, Chapter 4-8: 48-97

Unit IV: Text Book 1, Chapter 40 - 42: 329-347.

Unit V : Text Book 5, Chapter 4-7:47-130.

**Reference Book(s):**

1. Deshmukh, A. M., P. P. Dixit and R. M. Khobragade. **Handbook of Biofertilizers and Biopesticides**. Oxford Book Co., Jaipur, India, 2007.
2. Giri, B., Ram Prasad, Qiang-Sheng Wu and AjitVarma. **Biofertilizers and Sustainable Agriculture**, Springer Nature Switzerland, 2019.
3. Aggarwal SK. **Advanced Environmental Biotechnology**, APH publication, 2005.
4. <https://www.slideshare.net/vanithagopal/biofertilizer-40950247>
5. <https://www.slideshare.net/santoshpathak817/biopesticides-50835900>

**Tools for Assessment (20 Marks)**

CIA I	CIA II	CIA III	Assignment	Quiz	Attendance	Total
4	4	5	2	2	3	20

**Mapping**

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	H	M	H	M	M
CO2	H	H	H	M	M	M
CO3	M	L	H	H	H	H
CO4	H	M	M	H	H	M
CO5	M	M	H	H	H	H

H-High; M-Medium; L-Low

Course designed by	Verified by HoD	Checked by	Approved by
Dr. S. ESATH NATHEER	Dr. T. H. SUKIHA	Convenor COO	

Course Code	Title	
19U4NM4GEN	General Awareness	
Semester: IV	Credits : 2	ESE : 50 Marks

**Course Objective:**

Enable the students to learn General knowledge and prepare different competitive exams.




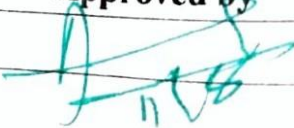
**Course Outcome:**

- Analysis the Verbal and Numerical Aptitude
- Understood the General Science and Technology and Education
- Gain Knowledge in Computer aids and Social Studies
- Develop Aptitude and problem solving skills

**Course Content****Instructional Hours / Week : 2**

S. No.	Topics
1	Verbal Aptitude
2	Numerical Aptitude
3	Abstract Reasoning
4	Tamil and Other Literature
5	General Science and Technology
6	Computer
7	Economics and Commerce
8	History and Freedom Struggle
9	Sports
10	Current Affairs
<b>Total Hours : 30</b>	

**Text Book :** "General Awareness", compiled by Nehru Arts and Science College, Coimbatore

Course Designed by	Verified by	Checked by	Approved by
		 Convenor CBC	

Course Code		Title	
18U4HVY402		Human Excellence: Human values and Yoga Practice II	
Semester: III & IV	Credit: 2	CIA: 25 Marks	ESE: 25 Marks

### Course Objective

- To help the students appreciate the essential complementarity between 'values' and 'skills' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings
- To prepare and distribute standardized Yoga teaching and training materials with reference to institute health

### Course Outcome (CO):

At the end of the course, students are expected

<b>CO 1</b>	To become more aware of their self and their relationships and would have better reflective and discerning ability.
<b>CO 2</b>	It is hoped that they would be able to apply what they have learnt to their own self in different ordinary day-to-day settings in real life with higher commitment and courage.
<b>CO 3</b>	To enable students to lead a practical life adding value to human relations.
<b>CO 4</b>	To have the basic Knowledge on Simplified Physical Exercises and Asanas and Meditation

### Course Content

### Instructional Hours / Week: 1

Unit	Description	Text Book	Chapter
<b>I</b>	<b>Self-realization and Human Values-</b> Self-realization and Harmony-Rules and Regulations-Rights and Duties-Good and Obligation-Integrity and Conscience. <b>Obligation to Family-</b> Trust and Respect -Codes of Conduct -Citizens Charter - Emotional Intelligence.	1	1,4
<b>Instructional Hours</b>			<b>6</b>
<b>II</b>	Impact of Modern Education and Media on Values: Impact of Science and Technology on Values; Effects of computer aided media on Values (Internet, e-mail, Chat etc.); Role of teacher in the preservation of tradition and culture;	1	5
<b>Instructional Hours</b>			<b>6</b>
<b>III</b>	Eradication of worries - Maintaining youthfulness - Greatness of friendship – Refinement of worries - Neutralization of anger- Intelligent quotient (IQ), Emotional quotient (EQ), Spiritual Quotient (SQ)	1	2,3
<b>Instructional Hours</b>			<b>6</b>

IV	Standing Posture: Tadasana, Padahasthasana, Virabhadrasana;	2	4,5
	Sitting posture: Ustrasana, Ardha Matsyendrasana, Paschimottanasana.		
<b>Instructional Hours</b>			<b>6</b>
V	Supine posture: Sarvangasana, Halasana, Chakrasana.	2	6,9
	Prone posture: Bhujangasana, shalabhasana; Dhanurasana; Balancing postures: Vrikshasana, Natarajasana, Utkatasana; Pranayama: Bhastrika, Bhramari, NadiShodhan.		
<b>Instructional Hours</b>			<b>6</b>
<b>Total Hours</b>			<b>30</b>

**Textbook(s):**

1. Kiran, D.R. "Professional Ethics & Human Values", TATA McGraw Hill Education.
2. Chandrasekaran, 1999. Sound Health through yoga, Prem Kalyan Publications, Madurai.

**Reference Books :**

1. Vethathiri Maharishi, 2011, "Value Education", Vethathiri Publication, Erode
2. Thathuvagnani Vethathiri Maharishi, 2014, "Simplified Physical Exercises". Vethathiri Publications

Course designed by	Verified by	Checked by	Approved by
Dr. J. K. Franklin NDAH 11/8/21	Dr. J. H. Sukirtha 11/8/21	Convent / CDG 11/8/21	

CourseCode	Title		
20U3MBC510	CorePaperX- Soil and Agricultural Microbiology		
Semester:V	Credits:4	CIA:25 Marks	ESE:75Marks

**CourseObjective:**

On successful completion of the course, the students will gain knowledge on the various aspects of soil and agricultural microbiology including bio-remediation, biogeochemical cycles, bio-fertilizers, and bio-insecticides.

**CourseOutcomes (CO):**

On successful completion of this course the students will be able to

CO1	Develop knowledge on soil type and the factors that limit microbial growth in soil.
CO2	Understand on microbial decomposition and bio-remediation processes.
CO3	Know about biogeochemical cycles, bio-fertilizers, and bio-Insecticides.
CO4	Understand the application of microbial ecological principles for industrial, environmental, agriculture or public health benefits.
CO5	Comprehend the important processes pertaining to soil and agricultural microbiology.

**Offeredby:Microbiology****CourseContent****InstructionalHours/Week: 5**

Unit	Description	Text Book	Chapter
I	<b>Introduction to soil microbiology</b> – properties of soil(structure, texture & formation).Types and significance of soil microbes– bacteria, fungi, algae, protozoa, nematodes, actinomycetes, viruses. Factors affecting microbial population.	1	2, 3
<b>InstructionalHours</b>			<b>15</b>
II	<b>Microbial decomposition;</b> Cellulose, Hemicellulose, Lignin, Pectin and Chitin; Bioconversion of organic wastes – sugarcane wastes-coir pith composition- composting, principles and Applications-conversion process.	1	10
<b>InstructionalHours</b>			<b>15</b>
III	<b>Biofertilizer</b> - <i>Rhizobium</i> , <i>Azotobacter</i> , Cyanobacteria, <i>Azolla</i> , VAM - Mass multiplication and crop response. Biopesticide - Classification, mode of action - Bacterial insecticides ( <i>Bacillus thuringiensis</i> ) and Viral insecticides (NPV) and Fungal: <i>T.viride</i> , PGPR.	1	4-9
<b>InstructionalHours</b>			<b>15</b>
IV	<b>Plant pathology:</b> symptoms, characters of pathogens and control measures: Bacterial diseases - Citrus canker, Blight of rice. Fungal diseases - Red rot of sugarcane, Tikka leaf spot of ground nut. Viral diseases - TMV, Vein clearing disease of Bhendi ( <i>Abelmoschusesculentus</i> ).	2	3-5
<b>InstructionalHours</b>			<b>15</b>
V	<b>Enumeration of bacteria:</b> Rhizosphere and non-rhizosphere region. Cultivation of free-living and symbiotic N <sub>2</sub> fixing bacteria. Isolation of cellulose degrading organisms. Isolation of phosphate solubilizing bacteria.	1	4
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book(s):**

1. Rao Subba, Rao. **Soil Microbiology**. Oxford & IBH Publishing Co. Pvt., Ltd., 2017.
2. Agrios, G. N. **Plant Pathology**. Amsterdam: Elsevier Acad. Press, 2009.
  - Unit I: TextBook1, Chapter 2, 3, Page 11 - 79
  - Unit II: TextBook1, Chapter 10, Page 252-270
  - Unit III: TextBook1, Chapter 4-9, Page 82-249
  - Unit IV: Text Book 2, Chapter 3-5, Page 31-50
  - Unit V: Text Book 1, Chapter 4, Page 82-112

**Reference Book(s):**

1. Ainsworth, G.C. **Introduction to the History of Plant Pathology**, Cambridge, Univ. Press, Cambridge, 1981.
2. Prescott, L.M, Harley, J.P, Klein, D.A. **Microbiology**, WCB Mc. GrawHill, 1999.
3. Mishra R. R. **Soil Microbiology**. CBS Publishers and distributors, New Delhi, 2004.
4. Rangaswami. G. **Diseases of crop plants in India**. Third edition. Published by prentice hall of India. Pvt.limited, New Delhi, 1997.
5. Elsas, J. D., Jansson, J. K., & Trevors, J. T. **Modern Soil Microbiology**. Boca Raton, FL: CRC Press/Taylor & Francis, 2007.

**Tools for Assessment (25 Marks)**

CAI	CAII	CAIII	Assignment	Quiz	Attendance	Total
5	5	6	3	3	3	25

**Mapping**

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	L	M	M	M
CO2	L	M	H	H	M	H
CO3	L	M	H	L	H	H
CO4	M	H	H	M	M	H
CO5	M	H	H	H	H	H

H-High; M-Medium; L-Low

Course designed by	Verified by	Checked by	Approved by
<i>Dr. J. H. Sankar</i> Dr. J. H. Sankar	<i>Dr. J. H. Sankar</i> Dr. J. H. Sankar	<i>Dr. J. H. Sankar</i> Convenor / CDC	<i>Dr. J. H. Sankar</i>

Course Code	Title		
20U3MBC511	Core Paper XI – Industrial Microbiology		
Semester: V	Credits: 4	CIA: 25 Marks	ESE: 75 Marks

**Course Objective:**

To assimilate knowledge across industry and microbiology discipline.

**Course Outcomes (CO):**

On successful completion of this course the students will be able to

CO1	Develop knowledge and awareness of the basic principles and concepts of fermentation.
CO2	Interpret the sources, media and fermenter design and types.
CO3	Use research-based knowledge on downstream processing.
CO4	Understand the ecology and factors of industrially important microorganisms.
CO5	Apply the knowledge of production of extract of products.

**Offered by: Microbiology****Course Content****Instructional Hours / Week: 5**

Unit	Description	Text Book	Chapter
I	<b>Introduction and Scope:</b> Historical development of Industrial Microbiology, Industrially important microorganisms, sources and characters; Primary and secondary screening and preservation of industrially important strains, Major classes of products and processes. Strain improvement.	1	1,2
<b>Instructional Hours</b>			<b>15</b>
II	<b>Fermenter:</b> Design, types and basic functions. Characteristics of production media, Fermentation media - formulation strategies, economical means of providing energy, carbon, nitrogen, vitamin and mineral sources, role of buffers, precursors, inhibitors, inducers and antifoams. Sterilization of fermentation equipment, air and media. Types of fermentation.	1,2	2, 4
<b>Instructional Hours</b>			<b>15</b>
III	<b>Downstream processing:</b> Recovery and purification of fermentations products (intracellular and extracellular), cell disruption, precipitation, filtration, centrifugation, solvent recovery, chromatography, Ultra filtration and drying, Quality assurance (QC) of finished product. Immobilization of cell and enzymes.	2	10, 11
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Ecology of microorganisms affecting industries:</b> Atmosphere-water-raw materials- packaging- equipment. Factors affecting microbial spoilage of products - Control of contamination during manufacture-good manufacturing process. Quality control of products. Manufacture of sterile pharmaceutical products- injections and ophthalmic preparations.	1	15,16
<b>Instructional Hours</b>			<b>15</b>
V	<b>Microbial products of pharmaceutical value:</b> Raw materials, organism and industrial processes involved in the production of Penicillin, Streptomycin, insulin, interferons, B cell growth factors, Vitamin B12, Riboflavin and rabies vaccine. Microbial products of industrial value –	1	3

raw materials, organism and industrial processes involved in the production of ethanol, vinegar, amylase, protease, glutamic acid. Recycling and disposal of industrial wastes through microbes.		
<b>Instructional Hours</b>		<b>15</b>
<b>Total Hours</b>		<b>75</b>

**Text Book(s):**

1. Casida LE Jr. **Industrial Microbiology**, 5<sup>th</sup> edition, Wiley Eastern Ltd., New Delhi. 1993.
2. Stanbury, P.F., Whitaker, A. and Hall, S.J. **Principles of Fermentation Technology**, 2<sup>nd</sup> Edn. Pergamon Press, Oxford, 1999.
3. Patel AH. **Industrial Microbiology**. Published by Mac Millan India Ltd., Chennai. 2005.

Unit I : Text Book 1, Chapter 1, 2 1-114.

Unit II : Text Book 1, Chapter 2: 117-218. Text Book 2, Chapter 4: 93-145

Unit III: Text Book 2, Chapter 10: 277-308, Chapter 11: 313-.327

Unit IV: Text Book 1, Chapter 15-16: 175-218.

Unit V : Text Book 1, Chapter 3: 219-416

**Reference Book(s):**

1. Crueger W and Crueger A. **Biotechnology: A Text Book of Industrial Microbiology**, 2<sup>nd</sup> edition. Panima Publishing Corporation, New Delhi. 2000.
2. Glazer NA and Nikaido H. **Microbial Biotechnology: Fundamentals of Applied Microbiology**. 2<sup>nd</sup> edition, Cambridge University Press. 2007.
3. Waites MJ, Morgan, NL, Rockey JS, and Higton G. **Industrial Microbiology: An Introduction**, Blackwell Science, London. 2001
4. [https://bio.libretexts.org/Bookshelves/Microbiology/Book%3A\\_Microbiology\\_\(Boundless\)/17%3A\\_Industrial\\_Microbiology](https://bio.libretexts.org/Bookshelves/Microbiology/Book%3A_Microbiology_(Boundless)/17%3A_Industrial_Microbiology)
5. [http://www.lcwu.edu.pk/ocd/cfiles/Biotechnology/Maj/Biotech-402/Industrial-Microbiology-An-Introduction-0632053070-Wiley\\_compressed.pdf](http://www.lcwu.edu.pk/ocd/cfiles/Biotechnology/Maj/Biotech-402/Industrial-Microbiology-An-Introduction-0632053070-Wiley_compressed.pdf)
6. <https://microbiologynotes.org/category/industrial-microbiology/>

**Tools for Assessment (25 Marks)**

CIA I	CIA II	CIA III	Assignment	Quiz	Attendance	Total
5	5	6	3	3	3	25

**Mapping**

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	L	M	M	H	H
CO2	L	L	M	M	H	H
CO3	L	L	M	M	H	H
CO4	L	M	M	H	H	H
CO5	L	M	M	H	H	H

H-High; M-Medium; L-Low

Course Designed by <i>P. KASIMAN</i>	Verified by HOD <i>S. M. M. K. J. H. S. U. K. I. E. T. H.</i>	Checked by <i>[Signature]</i>	Approved by <i>[Signature]</i>
		Convenor COG	



Course	Title		
20U3MBC512	Core Paper XII Immunology		
Semester: V	Credits: 4	CIA: 25 Marks	ESE: 75 Marks

**Course Objective:**

To give a basic knowledge to the students of Microbiology on immune system, immunology and immunology related techniques.

**Course Outcomes (CO):**

On successful completion of this course the students will be able to

CO1	Recall the developments in immunology.
CO2	Understand knowledge on types and structure and function of Immunoglobulins.
CO3	Know about antigen antibody reactions.
CO4	Gain knowledge on autoimmune diseases.
CO5	Acquire knowledge on blood transfusion and tissue transplantation.

Offered by: Microbiology

**Course Content**

Instructional Hours/ Week: 5

Unit	Description	Text Book	Chapter
I	<b>A Historical Perspective of Immunology</b> - Innate and Adaptive immunity; Cells and organs of immune system.	1	1,2
<b>Instructional Hours</b>			<b>15</b>
II	<b>Antigens</b> - Characteristics of an antigen (Foreignness, Molecular size and Heterogeneity); Haptens; Epitopes (T & B cell epitopes); T-dependent and T-independent antigens; Adjuvants. <b>Antibodies</b> - Structure, Types, Functions and Properties of antibodies; Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic); Monoclonal and Chimeric antibodies.	2	11, 12
<b>Instructional Hours</b>			<b>15</b>
III	<b>Complement System</b> - Components of the Complement system; Activation pathways (Classical, Alternative and Lectin pathways); Biological consequences of complement Activation. <b>Major Histocompatibility Complex</b> - Structure and Functions of MHC I & II molecules; Antigen processing and presentation (Cytosolic and Endocytic pathways)	1	6, 8
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Auto Immune Diseases</b> - Types and mechanisms. Hypersensitivity reactions - types, Antibody mediated (Type- I, Type II, Type III) and Cell mediated (Type- IV).	2	18,19
<b>Instructional Hours</b>			<b>15</b>
V	<b>Immuno Hematology</b> - Blood group, Rh - incompatibilities. Transplantation Immunology - HLA Tissue Typing - mechanism of acceptance and rejection. Vaccines - Types, Immunization schedule.	2	21
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book(s):**

1. Kuby. **Immunology**. 7<sup>th</sup> Edition. W. H. Freeman and Company. New York, 2013.
2. Paniker, C. K., and Ananthanarayan, R. **Ananthanarayan and Paniker's Textbook of Microbiology**. Himayatnagar, Hyderabad: Orient Longman, 2005.

Unit I: Text Book 1, Chapter 1 (1 - 14)

Text Book 1, Chapter 2 (27 - 64)

Unit II : Text Book 2 Chapter 11 (80 – 83)

Text Book 2 Chapter 12 (84 – 91)

Unit III: Text Book 1, Chapter 6 (187 - 224)

Text Book 1, Chapter 8 (161 - 298)

Unit IV: Text Book 2 Chapter 18, 19 (159 - 171)

Unit V : Text Book 2, Chapter 21 (184 – 191)

**Reference Book(s):**

1. Tizard IR. **Immunology: An Introduction**. Saunders College Publishers, USA. 4<sup>th</sup> Edition. 1995.
2. Riott IM. **Essentials of Immunology**, ELBS and Black Well Scientific Publishers, London. 1988.

**Tools for Assessment (25Marks)**

CIA I	CIA II	CIA III	Assignment	Model Preparation	Attendance	Total
5	5	6	3	3	3	25

**Mapping**

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	M	L	M	M
CO2	L	L	M	L	M	M
CO3	L	L	M	M	M	M
CO4	H	M	M	L	H	H
CO5	H	M	M	M	H	H

H - High; M- Medium; L- Low.

Course designed by	Verified by HoD	Checked by	Approved by
<i>Dr. S. Esath Natheer</i> 11/1/21	<i>Dr. T. M. Sukirtha</i> 11/1/21	<i>Dr. S. Esath Natheer</i> 11/1/21	<i>Dr. S. Esath Natheer</i> 11/1/21
Dr. S. ESATH NATHEER	Dr. T. M. SUKIRTHA	Dr. S. ESATH NATHEER	Dr. S. ESATH NATHEER

Course Code	Title		
20U3MBP513	Core Paper XIII Lab in Applied Microbiology		
Semester: V	Credits: 4	CIA :40 Marks	ESE:60 Marks

**Course Objective:**

To assimilate knowledge across soil, agricultural, industrial and immunological discipline.

**Course Outcomes (CO):**

On successful completion of this course the students will be able to

CO1	Get hands on exposure, knowledge and awareness of the basic tests in soil and water analysis.
CO2	Interpret the analysis of soil microorganisms and isolate bacteria and fungi.
CO3	Acquire knowledge about the milk and their testing measurements.
CO4	Understanding of the knowledge of medically important immunological procedures.
CO5	Acquire knowledge about updated recent analysis methods.

**Offered by: Microbiology**

**Course Content**

**Instructional Hours / Week: 6**

S. No.	Experiment
1	Water analysis by MPN technique – presumptive coliform test – confirmed coliform test and completed coliform test.
2	Soil Analysis -pH, chlorides, nitrate, sulphate, phosphate, calcium, magnesium fluoride, silica and ammonia
3	Isolation of bacteria and fungi from soil
4	Isolation of cyanobacteria from water (any two)
5	Isolation of <i>Rhizobium</i> from root nodule of legumes.
6	Isolation of microbes from rhizosphere, non rhizosphere and rhizoplane
7	Isolation of free living nitrogen fixers and phosphate solubilizers
8	Assessment of milk quality by methylene blue reduction test
9	Performance of phosphatase test for pasteurized milk.
10	Isolation of bacteria from food by Standard Plate Count
11	Immobilization of yeast cell using sodium alginate
12	Alcohol fermentation by <i>Saccharomyces cerevisiae</i> .
13	Starch (Amylase), casein (Protease) and lipid (Lipase) hydrolyses tests
14	ABO Blood grouping and Rh typing
15	WIDAL Test
16	RPR and CRP
17	ASO and pregnancy test
18	Total and differential blood cell count by haemocytometer
19	Radial and Double immunodiffusion, agarose electrophoresis
20	Demonstration of ELISA, SDS PAGE, Western Blotting
	<b>Instructional Hours : 90</b>

**Text Book(s):**

1. Rajan S and Selvi Christy R. **Experimental Procedures in Life Sciences**. Anajanaa Book House, Chennai, 2015.
2. James G Cappuccino and Natalie Sherman. **Microbiology - A Laboratory Manual** (4<sup>th</sup> edition). The Benjamin publishing company, New York. 2016.

**Reference Book(s):**

1. James G. Cappuccino and Chad Welsh. **Microbiology A Laboratory Manual**. Pearson Education Limited, 2017.
2. Dubey RC and Maheshwari DK. (2002). **Practical Microbiology**. S Chand and Co. Ltd., New Delhi, 2002.
3. AnejaK.R. **Experiments in Microbiology, Plant Pathology and Biotechnology**. New Age International (P) Limited Publishers, 2010.
4. Gunasekaran P. **Laboratory Manual in Microbiology**. New Age International, 2007.
5. <https://microbenotes.com/fields-of-microbiology/>
6. [https://bio.libretexts.org/Bookshelves/Microbiology/Book%3AMicrobiology\\_\(Boundless\)/1%3AIntroduction\\_to\\_Microbiology/1.3%3AThe\\_Science\\_of\\_Microbiology/1.3B\\_Applied\\_Microbiology](https://bio.libretexts.org/Bookshelves/Microbiology/Book%3AMicrobiology_(Boundless)/1%3AIntroduction_to_Microbiology/1.3%3AThe_Science_of_Microbiology/1.3B_Applied_Microbiology)

**Tools for Assessment (40 Marks)**

Laboratory Performance I	Laboratory Performance II	Test I	Test 2	Observation Note Book	Attendance	Total
5	5	10	10	7	3	40

**Mapping**

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	L	M	M	H	H
CO2	L	L	M	M	H	H
CO3	L	L	M	H	H	H
CO4	L	L	M	H	H	H
CO5	L	M	M	H	H	H

H-High; M-Medium; L-Low

Course designed by	Verified by HoD	Checked by	Approved by
<i>(Signature)</i>	<i>(Signature)</i>	<i>(Signature)</i>	<i>(Signature)</i>
<i>(Signature)</i>	DT. T. H. SURIYATHA	Convenor PCDC	<i>(Signature)</i>

Course Code	Title		
20U3MBE501	Discipline Specific Elective Paper II – Group A – Recombinant DNA Technology		
Semester: V	Credits: 3	CIA:20 Marks	ESE:55 Marks

**Course Objective:**

Students can acquire knowledge on the gene manipulation and tools used for construction of gene cloning. The Students can understand about the construction of transgenic plants and Animals.

**Course Outcomes (CO):**

On successful completion of this course the students will be able to

CO1	Distinguish the milestones of genetic engineering.
CO2	Formulate the ideas of DNA modifying enzymes and usage of cloning vectors.
CO3	Device methods for transformation of DNA.
CO4	Categorize the products of rDNA technology.
CO5	Learn various recombinant product development.

Offered by: Microbiology

Course Content

Instructional Hours / Week:5

Unit	Description	Text Book	Chapter
I	<b>Gene Manipulation:</b> Definition and Applications. Milestones in genetic engineering and biotechnology. Restriction modification systems: Types I, II and III. Mode of action, nomenclature.	1	3
<b>Instructional Hours</b>			<b>15</b>
II	<b>DNA modifying enzymes and their applications:</b> DNA polymerases. Terminal deoxynucleotidyltransferase, kinases and phosphatases and DNA ligases. <b>Cloning Vectors:</b> Definition and Properties. <b>Plasmid vectors:</b> pBR and pUC series Bacteriophage lambda and M13 based vectors	2	4
<b>Instructional Hours</b>			<b>15</b>
III	<b>Transformation of DNA:</b> Chemical method, Electroporation, Gene delivery: Microinjection, electroporation, biolistic method (gene gun), liposome and viral mediated delivery, <i>Agrobacterium</i> - mediated delivery.	2	5
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Genomic and cDNA libraries:</b> Preparation and uses, Screening of libraries: Colony hybridization and colony PCR, Chromosome walking and chromosome jumping.	1	7
<b>Instructional Hours</b>			<b>15</b>
V	<b>Products of recombinant DNA technology:</b> Products of human therapeutic interest - insulin, hGH, antisense molecules. Bt transgenic - cotton, brinjal, Gene therapy, recombinant vaccines, protein engineering and site directed mutagenesis.	2	15-17
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book(s):**

1. Sandy B Primrose, Richard Twyman and Robert H Old. **Principles of Gene Manipulation**, Wiley-Blackwell Publications, 7<sup>th</sup> Edition, 2013.
2. T.A. Brown, **Gene cloning and DNA Analysis – An Introduction**, Blackwell Publishing, 8<sup>th</sup> Edition. Blackwell Publishing Ltd., 2020.

Unit I : Text Book 1, Chapter 3:26-42.

Unit II : Text Book - 2, Chapter 2: 53-81.

Unit III: Text Book - 2, Chapter 5: 83-99.

Unit IV: Text Book - 1, Chapter 7: 120-138.

Unit V : Text Book 2, Chapter 15-17: 301-374.

**Reference Book(s):**

1. A. Brown, **Genomes III**. 4<sup>th</sup> Edition, Garland Science Publishing, 2017.
2. Klug, Cummings, Spencer, Palladino, Killan, **Concepts of Genetics**, 12<sup>th</sup> Edition Pearson Education, Inc., 2018.
3. Leland H. Hartwell, Leroy Hood, Michael L. Goldberg Ann E. Reynolds, Lee M. Silver, **Genetics – From Genes to Genomes**, 4<sup>th</sup> Edition, McGraw-Hill, Publishing, 2016.


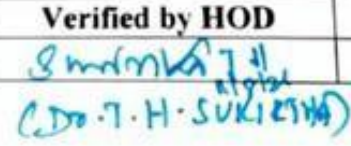


**Tools for Assessment (20 Marks)**

CIA I	CIA II	CIA III	Assignment	Quiz	Attendance	Total
4	4	5	2	2	3	20

**Mapping**

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	M	M	M
CO2	H	M	L	L	L	M
CO3	H	M	L	L	L	M
CO4	M	M	L	L	M	H
CO5	H	H	M	H	M	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
		 Convenor COCOM	

Course Code	Title		
20U3MBE502	Discipline Specific Elective Paper II – Group B - Environmental Microbiology		
Semester: V	Credits: 3	CIA : 20 Marks	ESE: 55 Marks

**Course Objective:**

The main objective of this paper is to learn major principles of environmental microbiology and the relationship of microbes to environmental processes and other living organisms.

**Course Outcomes (CO):**

On successful completion of this course the students will be able to

CO1	Acquainted with natural habitats of diverse microbial population.
CO2	Understand how microbes interact among them selves and with other living organisms.
CO3	Become aware of the important role micro organisms in bio-geochemical cycles.
CO4	Gain in-depth knowledge of different types of solid wastes and their management.
CO5	Acquire knowledge about liquid waste and water treatment.

**Offered by: Microbiology****Course Content****Instructional Hours / Week: 4**

Unit	Description	Text Book	Chapter
I	<b>Microorganisms in different habitats:</b> Terrestrial environment: Soil texture, profile and its microflora. Aquatic environment: Stratification and microflora of fresh water and marine habitats, Atmosphere: Aeromicroflora and dispersal of microbes. Animal environment: Microbes in/on animal (ruminants) body. Extreme habitats: microbes (extremophiles) thriving at high and low temperatures, pH, high hydrostatic and osmotic pressures, salinity and low nutrient levels. Concept of metagenomics (non-culturable microorganisms). Microbial succession in decomposition of plant organic matter.	2	4
<b>Instructional Hours</b>			<b>14</b>
II	<b>Microbial interactions:</b> Microbe-microbe interactions: mutualism, synergism, commensalism, competition, amensalism, parasitism, predation. Microbe-plant interactions: microbes associated with roots and aerial plant surfaces, Rhizobium symbiosis, Anabaena-Azolla symbiosis, mycorrhizal associations, actinorhizal associations. Microbe-animal interactions: termite gut microflora, nematophagus fungi and symbiotic luminescent bacteria.	1	5
<b>Instructional Hours</b>			<b>12</b>
III	<b>Biogeochemical cycling:</b> Carbon cycle: microbial degradation of cellulose, lignin and chitin. Nitrogen cycle: nitrogen fixation, ammonification, nitrification, denitrification and nitrate reduction, nitrate pollution. Phosphorus cycle: phosphate immobilization and solubilisation. Sulphur cycle: microbes involved in sulphur cycle.	2	10
<b>Instructional Hours</b>			<b>10</b>

<b>IV</b>	<b>Microbial bioremediation:</b> Bioremediation of contaminated soils and marine oil pollutants. Degradation of pesticides (DDT and Propanil). Role of microbes in e-waste management. Plastic degrading microbes. Solid waste management- Sources and types of solid waste, methods of solid waste disposal: incineration, sanitary landfill, composting.	2	13
<b>Instructional Hours</b>			<b>11</b>
<b>V</b>	<b>Liquid waste management and water potability:</b> Liquid waste management: composition and strength of sewage (BOD and COD). Primary, secondary (aerobic: oxidation ponds, trickling filter, activated sludge process; anaerobic: septic tank, Imhoff tank, anaerobic sludge digester) and tertiary sewage treatment. Water potability: treatment and safety of drinking (potable) water. Methods to detect potability of water samples: standard qualitative procedure - presumptive test/MPN test, confirmed and completed tests for faecal coliforms; membrane filter technique and Presence/Absence tests for coliforms.	3	10
<b>Instructional Hours</b>			<b>13</b>
<b>Total Hours</b>			<b>60</b>

**Text Book(s):**

1. Atlas, R.M. and Bartha, R. **Microbial Ecology: Fundamentals and Applications**, Pearson Education, Singapore, 2005.
2. Larry L. Barton, Diana E. Northup. **Microbial Ecology**. New York: J. Wiley, 2011.
3. NdukaOkafor. **Environmental Microbiology of Aquatic and Waste Systems**, Springer, 2011.  
 Unit I : Text Book 2, Chapter 4 (103-129)  
 Unit II : Text Book 1, Chapter 5 (95-110)  
 Unit III: Text Book 2, Chapter 10 (273-297)  
 Unit IV: Text Book 2, Chapter 13 (359 – 390)  
 Unit V : Text Book 3 Chapter 10 (249-269)

**Reference Book(s):**

1. Grant, W. D., & Long, P. E. **Environmental Microbiology**. Glasgow: Blackie, 1981.
2. Paul, E. A. and Clark, F. E. **Soil Microbiology and Biochemistry**. San Diego: Academic Press, 1988.
3. Subba Rao, N.S. **Biofertilizers in Agriculture and Forestry**. Oxford and IBH publication Co. Pvt.Ltd., New Delhi, 1995.
4. <https://www.jove.com/education/13/environmental-microbiology>
5. <https://microbenotes.com/category/environmental-microbiology/>

**Tools for Assessment (20 Marks)**

CIA I	CIA II	CIA III	Assignment	Quiz	Attendance	Total
4	4	5	2	2	3	20



## Mapping

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	M	L	H	H
CO2	L	M	L	L	H	H
CO3	L	M	M	M	M	H
CO4	H	M	M	L	H	H
CO5	M	M	M	H	H	H

H-High; M-Medium; L-Low

Course designed by	Verified by HoD	Checked by	Approved by
<i>Dr. S. Esath Natheer</i> 11/11/21	<i>Dr. T. M. Sukidha</i> 11/11/21	<i>Dr. S. Esath Natheer</i> 11/11/21	<i>Dr. S. Esath Natheer</i> 11/11/21
Dr. S. ESATH NATHEER	Dr. T. M. SUKIDHA	Dr. S. ESATH NATHEER	Dr. S. ESATH NATHEER

CourseCode	Title		
20U3MBE503	Discipline Specific Elective Paper I – Group C – Advances in Microbiology		
Semester:V	Credits:3	CIA:20 Marks	ESE:55 Marks

**CourseObjective:**

To provide a platform to learn various new developments in different areas of Microbiology.

**CourseOutcomes (CO):**

On successful completion of this course the students will be able to

CO1	Distinguish gene families from gene complexes.
CO2	Describe the biodiversity of any environment by analyzing of the genetic material encompassed in it.
CO3	Discuss the cellular and molecular basis of immune responses to pathogens through a critical analysis.
CO4	Acquire knowledge the areas that make up synthetic biology.
CO5	Practice using metagenomics for investigating microbial communities

**Offeredby:Microbiology****CourseContent****InstructionalHours/Week: 5**

Unit	Description	Text Book	Chapter
I	<b>Evolution of Microbial Genomes:</b> Salient features of sequenced microbial genomes, core genome pool, flexible genome pool and concept of pangenome, Horizontal gene transfer (HGT), Evolution of bacterial virulence - Genomic islands, Pathogenicity islands (PAI) and their characteristics	1	27
<b>InstructionalHours</b>			<b>15</b>
II	<b>Metagenomics:</b> Brief history and development of metagenomics, Understanding bacterial diversity using metagenomics approach, Prospecting genes of biotechnological importance using metagenomics Basic knowledge of viral metagenome, metatranscriptomics, metaproteomics and metabolomics.	3	11-12
<b>InstructionalHours</b>			<b>15</b>
III	<b>Molecular Basis of Host-Microbe Interactions:</b> Epiphytic fitness and its mechanism in plant pathogens, Hypersensitive response (HR) to plant pathogens and its mechanism, Type three secretion systems (TTSS) of plant and animal pathogens, <b>Biofilms:</b> types of microorganisms, molecular aspects and significance in environment, health care, virulence and antimicrobial resistance.	2	7
<b>InstructionalHours</b>			<b>15</b>
IV	<b>Systems and Synthetic Biology:</b> Networking in biological systems, Quorum sensing in bacteria, Co-ordinated regulation of bacterial virulence factors, Basics of synthesis of poliovirus in laboratory, Future implications of synthetic biology with respect to bacteria and viruses.	2	8
<b>Instructional Hours</b>			<b>15</b>
V	<b>Extraction of metagenomic DNA from soil:</b> Understand the impediments in extracting metagenomic DNA from soil- PCR amplification of metagenomic DNA using universal 16s ribosomal gene primers - Case study to understand how the poliovirus genome	1	27

was synthesized in the laboratory - Case study to understand how networking of metabolic pathways in bacteria takes place.		
<b>Instructional Hours</b>		<b>15</b>
<b>Total Hours</b>		<b>75</b>

**TextBook(s):**

1. Fraser CM, Read TD and Nelson KE. **Microbial Genomes**, Humana Press, 2010.
2. Bull AT. **Microbial Diversity and Bioprospecting**, ASM Press, 2004.
3. Sangdun C. **Introduction to Systems Biology**, Humana Press, 2008.

**Reference Book(s):**

1. Klipp E, Liebermeister W. **Systems Biology – A Textbook**, Wiley –VCH Verlag, 2009.
2. Caetano-Anolles G. **Evolutionary Genomics and Systems Biology**, John Wiley and Sons, 2010.
3. Madigan MT, Martink JM, Dunlap PV and Clark DP. **Brook's Biology of Microorganisms**, 14<sup>th</sup> Edition, Pearson-Benjamin Cummings, 2014.
4. Wilson BA, Salyers AA Whitt DD and Winkler ME. **Bacterial Pathogenesis- A molecular Approach**, 3<sup>rd</sup> Edition, ASM Press, 2011.
4. Bouarab K, Brisson and Daayf F. **Molecular Plant-Microbe interaction** CAB International, 2009.
5. Voit EO. **A First Course in Systems Biology**, 1<sup>st</sup> Edition, Garland Science, 2012.
6. Miller RV and Day MJ. **Microbial Evolution- Gene establishment, survival and exchange**, ASM Press, 2004.

Unit I: TextBook1, Chapter 9, Page 143 – 154.

Unit II: TextBook 2, Chapter 11, Page 109 – 119.

Unit III: TextBook 2, Chapter 2, Page 154 – 159.

Unit IV: Text Book 1, Chapter 12, Page 197 – 212.

Unit V: Text Book 3, Chapter 2, Page 14 – 36.

**ToolsforAssessment(20Marks)**

CIAI	CIaII	CIaIII	Assignment	Quiz	Attendance	Total
4	4	5	2	2	3	20

**Mapping**

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	L	M	M	M
CO2	L	M	H	H	M	H
CO3	L	M	H	L	H	H
CO4	M	H	H	M	M	M
CO5	M	H	H	H	H	H

H-High;M-Medium; L-Low

Course designed by	Verified by	Checked by	Approved by
Dr. J. K. Praveen ND4H	Dr. J. H. Suresh	Convenor / CDC	

Course Code	Title		
20U4MBS503	Skill Based Paper III – Management of Human Microbial Diseases		
Semester: V	Credits: 3	CIA: 20 Marks	ESE: 55 Marks

**Course Objective:**

To give a basic knowledge to the students about different types of Microbial Diseases and their prevention Mechanisms

**Course Outcomes(CO):**

On successful completion of this course the students will be able to

CO1	Gain knowledge on different types of human pathogens.
CO2	Acquire knowledge on Transmission pathways of Pathogens.
CO3	Achieve on Diagnosis of Infectious Diseases.
CO4	Attain knowledge on Mode of Action of Antimicrobial Drugs.
CO5	Procure knowledge on Prevention of Microbial Diseases.

Offered by: Microbiology

**Course Content**

**Instructional Hours/ Week: 4**

Unit	Description	Text Book	Chapter
I	Human Diseases Caused by Bacteria and Virus - Airborne Diseases - Arthropod-Borne Diseases -Direct Contact Diseases - Food-Borne and Waterborne Diseases - Zoonotic Diseases - Opportunistic Diseases	2	39
<b>Instructional Hours</b>			<b>8</b>
II	Human Diseases Caused by Fungi and Protists - Airborne Diseases - Arthropod-Borne Diseases -Direct Contact Diseases - Food-Borne and Waterborne Diseases - Zoonotic Diseases - Opportunistic Diseases	2	40
<b>Instructional Hours</b>			<b>16</b>
III	Diagnosis of Infectious Diseases – Laboratory Diagnosis of Bacterial, fungal, vial and Parasitic infections.	1	47
<b>Instructional Hours</b>			<b>16</b>
IV	Treatment using antibiotics: Mode of action of antimicrobial drugs - Emergence of antibiotic resistance. Mechanism of action of Antiviral and Antifungal drugs	2	9
<b>Instructional Hours</b>			<b>8</b>
V	Epidemiology and control of infectious diseases - Types OF Epidemiological Studies - Transmission of Infectious Disease - Vaccine efficacy.	3	33
<b>Instructional Hours</b>			<b>12</b>
<b>Total Hours</b>			<b>60</b>

**Text Book(s):**

- Brooks, G. F. Jawetz, Melnick and Adelbergs. **Medical Microbiology**. New York. McGraw-Hill Medical, 2007.
- Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton. **Prescott's Microbiology**. McGraw-Hill Publications, 2014.
- Goering R., Dockrell H., Zuckerman M. and Wakelin D. **Mims' Medical Microbiology**. 4<sup>th</sup> edition. Elsevier, 2007.
  - Unit I : Text Book 2, Chapter 39 (888 – 926)
  - Unit II : Text Book 2, Chapter 39 (932 – 952)
  - Unit III: Text Book 1, Chapter 47 (742 - 772)
  - Unit IV: Text Book 2, Chapter 9 (189 – 207)
  - Unit V : Text Book 3, Chapter 33 (443 – 451)

**Reference Book(s):**

- Tille, P. M. **Bailey & Scotts Diagnostic Microbiology**. St. Louis, MO: Elsevier, 2017.
- Murray, P. R. **Basic Medical Microbiology**. Philadelphia: Elsevier, 2018.
- <https://courses.lumenlearning.com/microbiology/chapter/mechanisms-of-antibacterial-drugs/>
- <https://www.msmanuals.com/en-in/home/infections/diagnosis-of-infectious-disease/diagnosis-of-infectious-disease>

**Tools for Assessment (20Marks)**

CIA I	CIA II	CIA III	Assignment	Model Preparation	Attendance	Total
4	4	5	2	2	3	20

**Mapping**

CO \ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	L	M	M	L	M	M
CO2	L	L	M	L	M	M
CO3	L	L	M	M	M	M
CO4	H	M	M	L	H	H
CO5	H	M	M	M	H	H

H - High; M- Medium; L- Low.

Course designed by	Verified by	Checked by	Approved by
Dr. K. Praveen NDAH	Dr. J. H. Sankar	Convent CDC	

Course	Title		
20U3MBC614	Core Paper XIV –Medical Microbiology		
Semester: VI	Credits: 4	CIA: 25 Marks	ESE: 75 Marks

**Course Objective:**

Students can have knowledge about different types of microbial diseases and their causative agents, pathogenesis and treatments for microbial infections.

**Course Outcomes (CO):**

On successful completion of this course the students will be able to

CO1	Relate an understanding of the basic principles of microbiology to personal health.
CO2	Know about Collection and Processing of Clinical Specimens.
CO3	Interpret of microorganisms and their relevance of infectious diseases.
CO4	Know various Microbial methods to identify their characteristics and principles for prevention, treatment of infectious diseases on their humans.
CO5	Know about morphology and pathogenesis of parasites and their treatment.

Offered by: Microbiology

**Course Content**

Instructional Hours/ Week: 5

Unit	Description	Text Book	Chapter
I	<b>Introduction to Medical Microbiology</b> - Commensal and Pathogenic Microbial Flora in Humans - Diagnosis – Collection, Transport and Processing of clinical specimens. Serology and Molecular Diagnosis. Antibio gram test.	1	6
<b>Instructional Hours</b>			<b>15</b>
II	<b>Bacteriology: Gram positive organisms</b> - Morphology, cultural characteristics, pathogenicity, laboratory diagnosis and treatment of <i>Staphylococcus aureus</i> , <i>Streptococcus pyogenes</i> , <i>Bacillus anthracis</i> , <i>Mycobacterium tuberculosis</i> . <b>Gram negative organisms</b> -Morphology, cultural characteristics, pathogenicity, laboratory diagnosis and treatment of <i>E. coli</i> , <i>Salmonella typhi</i> , <i>Vibrio cholerae</i> , <i>Pseudomonas aeruginosa</i> , <i>Neisseria gonorrhoea</i> .	2	24, 25, 27, 29, 32, 36, 39, 40, 42
<b>Instructional Hours</b>			<b>15</b>
III	<b>Virology:</b> Laboratory diagnosis of Viral infections. Morphology, cultural characteristics, pathogenicity, laboratory diagnosis and treatment of Herpes simplex viruses (HSV I & II), Hepatitis Viruses (A & B), Polio virus, Influenza Viruses (Type A, B and C), Rabies Virus and HIV.	3	33, 35, 36, 39, 42
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Mycology:</b> Laboratory diagnosis of fungal infections. Antifungal testing. Morphology, cultural characteristics, pathogenicity, laboratory diagnosis and treatment of superficial mycoses-Dermatophytes. Opportunistic mycoses-Candidiasis, Systemic mycoses - Histoplasmosis, Subcutaneous - mycosis- Sporotrichosis.	4 & 6	16, 8 & 15, 2
<b>Instructional Hours</b>			<b>15</b>
V	<b>Parasitology:</b> Laboratory techniques in parasitology. Examination of faeces for ova and cysts –Concentration methods. Blood smear examination for parasites. Morphology, Life cycle, Pathogenicity and laboratory diagnosis of <i>Entamoeba histolytica</i> , <i>Trichomonas vaginalis</i> , <i>Plasmodium malariae</i> , <i>Taenia solium</i> and <i>Ascaris lumbricoides</i> .	5	21, 3, 4, 5, 10, 17
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book(s):**

1. Mahon, C. R., Lehman, D. C., and Manuselis, G. **Textbook of Diagnostic Microbiology**. Maryland Heights, MO: Saunders Elsevier, 2015.
2. Murray, P. R. **Basic Medical Microbiology**. Philadelphia: Elsevier, 2018.
3. Brooks, G. F. Jawetz, **Melnick and Adelbergs Medical Microbiology**. New York. McGraw-Hill Medical, 2007.
4. Anaissie, E. J. **Clinical Mycology**. Churchill Livingstone: Elsevier, 2009.
5. Paniker, C. K. **Textbook of Medical Parasitology**. New Delhi: Jaypee Brothers Medical (P), 2007.
6. Malcolm. D. Richardson and David W. Warnock. **Fungal Infection Diagnosis and Management**.

Unit I: Text Book 1, Chapter 6 (111 - 124)

Unit II: Text Book 2 Chapter 24 (163-171), 25 (172 - 179), 29 (205 - 210), 32 (227 - 239), 36 (257 - 263), 39 (274 - 286), 40 (287 - 294), 42 (301 - 306), 27 (191 - 196)

Unit III: Text Book 3, Chapter 33 (467 - 475), 35 (507 - 525), 36 (531 - 533), 39 (577 - 590), 42 (619 - 625)

Unit IV: Text Book 2 & 5 Chapter 75 (519 - 521), 74 (516 - 518), 73 (513 - 514) & 2 (14 - 28)

Unit V: Text Book 4, Chapter 21(221-232), 3(14-28), 4(36-39), 5(65-95), 10(147 - 150), 17(188 - 193)

**Reference Book(s):**

1. Tille, P. M. (2017). **Bailey & Scotts Diagnostic Microbiology**. St. Louis, MO: Elsevier.
2. Paniker, C. K., and Ananthanarayan, R. **Ananthanarayan and Panikers Textbook of Microbiology**. Himayatnagar, Hyderabad: Orient Longman, 2005.
3. <https://www.msmanuals.com/en-in/home/infections/diagnosis-of-infectious-disease/diagnosis-of-infectious-disease>





**Tools for Assessment (25Marks)**

CIA I	CIA II	CIA III	Assignment	Model Preparation	Attendance	Total
5	5	6	3	3	3	25

**Mapping**

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	M	L	M	M
CO2	L	L	M	L	M	M
CO3	L	L	M	M	M	H
CO4	H	M	M	L	H	H
CO5	H	M	M	M	H	H

H - High; M- Medium; L- Low.

Course Designed by	Verified by HOD	Checked by	Approved by
			
Dr. S. David Joseph	Dr. P. H. SURIK 12/14	Convent	

Course Code	Title		
20U3MBC615	Core Paper XV – Food and Dairy Microbiology		
Semester: VI	Credits: 4	CIA: 25 Marks	ESE: 75 Marks

**Course Objective:**

To understand and enable the students to isolate the microorganisms, methods of preservation of foods, Pasteurization, processing methods in the field of food and dairy microbiology.

**Course Outcomes (CO):**

On successful completion of this subject the students will able to

CO1	Understand the history of food microbiology and various parameters affecting microbial growth.
CO2	Gain knowledge on food preservation techniques.
CO3	Diagnose specific types of microbial spoilage during various food shelf life stages in dairyfield.
CO4	Know about the use of microorganisms in food industries for public healthbenefits.
CO5	Gain knowledge on various Enforcement and control Agencies for food products.

**Offered by: Microbiology****Course Content****Instructional Hours / Week:5**

Unit	Description	Text Book	Chapter
I	<b>Microorganism in Food:</b> Common Food borne Pathogen-Bacteria, Mold and Significance of Microorganisms in Foods. Parameters Affecting Microbial Growth: Intrinsic, Extrinsic. Lactic antagonism and hurdle concept	1& 3	1, 3& 6
<b>Instructional Hours</b>			<b>15</b>
II	<b>Methods of food preservation:</b> Use of high temperatures, freezing, ionizingRadiation, , Microwave processing and aseptic packaging, Use of chemicals - organic acids, sulphur-dioxide,salts and high sugar concentration	1	4
<b>Instructional Hours</b>			<b>15</b>
III	<b>Food borne diseases:</b> Staphylococcal, <i>E. coli</i> , Salmonellosis, shigellosis,Listerial infections.Fungal toxins, Aflatoxins,Alternaria Toxins,Toxigenic Phytoplanktons and viruses.	1	7, 8
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Fermented and Microbial Food:</b> Microbiology of milk, Cheese, Yogurt (curd),Bread. Spoilage offood(Skimmed Milk, Canned food, Vegetables, fruits, fish, poultry product, meatandmeat products). Aseptic packing of food. Antimicrobial activity of Lactic acid bacteria	1& 2	8, 9 & 4, 9
<b>Instructional Hours</b>			<b>15</b>
V	<b>Enforcement and control Agencies:</b> Food quality, food safety, food adulteration, International agencies,FDA, HACCP, FSSIA,	1, 2	11, 11



	Microbiological criteria for food, Protocols for CCP Deviations.		
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book(s):**

1. Adams. M. R and M. D Moss. **Food Microbiology**. 2<sup>nd</sup> Edition, RSC Publishing International limited, 2005.
2. Adams. M. R and M. D Moss. Maurice O Mass. **Food Microbiology**. RSC publishing International limited, 2008.
3. Bibek Ray. **Fundamental Food Microbiology**. 3<sup>rd</sup> Edition, CRC Press, 2005

Unit I: Text Book 1, Chapter 1 & 3, 3: 21-45, 54-60 & 68-79.

Unit II: Text Book 2 Chapter 4: 83-93, 98-106.

Unit III: Text Book 1, Chapter 7, 8: 225-230, 237-248; 282-285.

Unit IV: Text Book 2. Chapter 5: 121-130, 131-145, 139-145, 348-356.  
Chapter 9: 317-319.

Unit V: Text Book 1, Chapter 11: 395-397, 425-429, 429-432.

Text Book 1, Chapter 11: 418, 431-436

**Reference Book(s):**

1. Roday. S. **Food Hygiene and Sanitation**. Tata Mcgraw Hill Publications, 1998
2. Pradeep Parihar and Leena Parihar. **Dairy Microbiology**. Agrobios(INDIA), 2015.
3. Jay. J.M, Loessener MJ. and Golden. D.A. **Modern Food Microbiology**, Springer, 2005. [http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp\\_content/food\\_and\\_nutrition/02\\_food\\_safety\\_and\\_quality\\_control/21\\_international\\_and\\_national\\_food\\_regulatory\\_agencies/et/7359\\_et\\_et.Pdf](http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/food_and_nutrition/02_food_safety_and_quality_control/21_international_and_national_food_regulatory_agencies/et/7359_et_et.Pdf)

**Tools for Assessment (25 Marks)**

CIA I	CIA II	CIA III	Assignment	Model Preparation	Attendance	Total
5	5	6	3	3	3	25

**Mapping**

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	M	H	H	H
CO2	L	M	L	L	M	H
CO3	L	M	M	M	M	H
CO4	H	M	M	L	H	M
CO5	M	M	H	M	H	H

H - High; M- Medium; L- Low.

Course designed by <i>(D. P. ...)</i>	Verified by HoD <i>DT. T. H. SURIYATHA</i>	Checked by <i>Convener PCDC</i>	Approved by <i>T. H. ...</i>
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Course Code	Title		
20U3MBP616	Core Paper XVI – Lab in Medical & Food Microbiology		
Semester: VI	Credits: 4	CIA: 40 Marks	ESE: 60 Marks

**Course Objective:**

Students can gain laboratory skills on food quality testing and diagnosis of infectious diseases.

**Course Outcomes (CO):**

On successful completion of this subject the students will be able to

CO1	Acquire knowledge on enumeration of bacteria and fungi from spoiled foods.
CO2	Improve knowledge on Milk quality analysis and food testing.
CO3	Investigate and interpret various pathogenic bacteria for clinical specimens.
CO4	Analyse ELISA Techniques.
CO5	Realize techniques on virus cultivation.

**Offered by: Microbiology****Course Content****Instructional Hours / Week: 6**

S. No.	Description
<b>Food Microbiology</b>	
1	Isolation and enumeration of bacteria and fungi from spoiled fruits.
2	Isolation and enumeration of bacteria and fungi from spoiled vegetables.
3	Milk Quality analysis by MBRT, Resazurin.
4	Food Adulteration.
<b>Medical Microbiology</b>	
5	Isolation and identification of bacteria from Clinical Specimens (Urine, Pus, Blood, Sputum).
6	Antibiotic susceptibility test – Kirby Bauer method and Stokes Method.
7	Serodiagnosis of HIV – ELISA.
8	Rapid Screening test for HIV – Tridot ELISA.
9	Cultivation of Viruses by Embryonated Egg Inoculation Method – Demo.
<b>Total hours : 90</b>	

**Text Book(s):**

1. Dubey, R.C and Maheswari, D.K. **Practical Microbiology**, S. Chand Ltd, 2002.
2. James G. Cappuccino and Chad Welsh. **Microbiology A Laboratory Manual**. Pearson Education Limited. 11<sup>th</sup> Edition, 2017.
3. Aneja KR. **Experiments in Microbiology**, Plant Pathology And Biotechnology. New Age International, 2003.
4. Mackie, T.J., McCartney, J.E., and Collee, J.G. **Mackie & McCartney Practical Medical Microbiology**. Churchill Livingstone, 1989.
5. Godkhar, P. B., Darshan, P. **Text book of Medical Laboratory Technology**, Bhalani Publishers, 2005.

**Reference Book(s):**

1. James G. Cappuccino and Chad Welsh. **Microbiology A Laboratory Manual**. Pearson Education Limited. 11<sup>th</sup> Edition, 2017.

**Tools for Assessment (40 Marks)**

Laboratory Performance I	Laboratory Performance II	CIA I	CIA II	Observation Note Book	Attendance	Total
5	5	10	10	7	3	40

**Mapping**

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	L	M	M	H
CO2	H	M	L	M	M	H
CO3	H	M	L	H	H	H
CO4	H	M	L	H	H	H
CO5	H	M	M	H	H	H

H – High; M- Medium; L – Low

Course designed by	Verified by HoD	Checked by	Approved by
<i>(Dr. P. S. K. Konda)</i> <i>P. S. K. Konda</i>	<i>P. S. K. Konda</i> <i>DT. T. H. S. K. K. H. A.</i>	<i>P. S. K. Konda</i> <b>Convenor</b> <b>PCDC</b>	<i>P. S. K. Konda</i> <i>T. H. S. K. K. H. A.</i>

Course Code	Title		
20U3MBE604	Discipline Specific Elective Paper II – Group A - Biosafety and Intellectual Property Rights		
Semester: VI	Credits: 3	CIA :20 Marks	ESE:55 Marks

**Course Objective:**

This course helps to adhere to the ethical practices appropriate to the discipline at all times, adopt safe working practices relevant to the industries and in research field.

**Course Outcomes (CO):**

On successful completion of this course the students will be able to

CO1	Identify potential hazardous biological materials and the risks associated with them.
CO2	Describe the biosafety regulations and ethical concepts in biotechnology.
CO3	Disseminate knowledge on patents, patent regime in India and abroad.
CO4	Understand the patent process and recognize the parts of a patent document and their significance.
CO5	Explicate patent agreements.

Offered by: Microbiology

**Course Content**

Instructional Hours / Week:5

Unit	Description	Text Book	Chapter
I	<b>Biosafety:</b> Introduction; biosafety issues in biotechnology; Biological Safety Cabinets & their types; Primary Containment for Biohazards; Biosafety Levels of Specific Microorganisms	1	8
<b>Instructional Hours</b>			<b>15</b>
II	<b>Biosafety Guidelines:</b> Biosafety guidelines and regulations (National and International); GMOs/LMOs- Concerns and Challenges; Role of Institutional Biosafety Committees (IBSC), RCGM, GEAC etc. for GMO applications in food and agriculture; Environmental release of GMOs; Risk Analysis; Risk Assessment; Risk management and communication	1	11,12
<b>Instructional Hours</b>			<b>15</b>
III	<b>Introduction to Intellectual Property:</b> Patents, Types, Trademarks, Copyright & Related Rights, Industrial Design and Rights, Traditional Knowledge, Geographical Indications- importance of IPR – patentable and non-patentables – patenting life – legal protection of biotechnological inventions – World Intellectual Property Rights Organization (WIPO).	2	1
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Grant of Patent and Patenting Authorities:</b> Types of patent applications: Ordinary, PCT, Conventional, Divisional and Patent of Addition; An introduction to Patent Filing Procedures; Patent licensing and agreement; Patent infringement- meaning, scope, litigation, case studies, Rights and Duties of patent owner.	1	4,5
<b>Instructional Hours</b>			<b>15</b>
V	<b>Agreements and Treaties:</b> GATT, TRIPS Agreements; Role of Madrid Agreement; Hague Agreement; WIPO Treaties; Budapest Treaty on international recognition of the deposit of	3	2



Course Code	Title		
20U3MBE605	Discipline Specific Elective Paper II – Group B - Plant Pathology		
Semester: VI	Credits: 3	CIA: 20 Marks	ESE:55Marks

**Course objective:**

The objectives of the Plant Pathology are the study on: the living entities that cause diseases in plants; the non-living entities and environmental conditions that cause disorders in plants; the mechanisms by which the disease causing agents that produce diseases; the interactions between the disease causing agents.

**Course Outcomes (CO):**

On successful completion of this course the students will be able to

CO1	Understand about the early development of plant disease
CO2	Recognize the etiological agents of disease.
CO3	Familiarize students with the basic plant disease spread and control of plant diseases
CO4	Gain knowledge on processes of infection and colonization of the host by the pathogen.
CO5	Describe aspects of integrated pest management and recognize the etiological agents of disease

Offered by: Microbiology

**Course Content**

Instructional Hours/ Week: 5

Unit	Description	Text Book	Chapter
I	<b>Introduction and History of plant pathology:</b> The herbalists, the systematists, beginning of the modern period, Doctrine of spontaneous generation, discovery of Bordeaux mixture, plant pathology in 20 <sup>th</sup> century, genetics of the host and pathogen, environment in relation to plant disease, nature of disease resistant, biochemistry and physiology of diseased host plant, molecular biology of pathogenesis and induced systemic resistance, tissue culture in plant pathology, history and development of plant pathology in India.	2	1
<b>Instructional Hours</b>			<b>15</b>
II	<b>Pathogenesis:</b> Penetration and entry by plant pathogens, pre-penetration, entry through natural openings, direct penetration, entry through wounds, wounds caused by other fungus, wound caused by nematodes, entry through root hairs, entry through buds, development inside host tissues.	2	3
<b>Instructional Hours</b>			<b>15</b>
III	<b>Plant disease epidemiology:</b> Introduction, theories of epidemic development, development of disease in time, development of disease in space, fitting disease progress curves to epidemiological data, the role of the pathogen, sources of inoculum, vectors, the role of the host, host-plant distribution, the effect of host resistance on inoculum multiplication, the role of the environment, the soil, the atmosphere.	1	3
<b>Instructional Hours</b>			<b>15</b>

<b>IV</b>	<p><b>Host Pathogen Interaction: Microbial Pathogenicity-</b> Virulence factors of pathogens: enzymes, toxins (host specific and non-specific) growth regulators, virulence factors in viruses (replicase, coat protein, silencing suppressors) in disease development.</p> <p><b>Genetics of Plant Diseases -</b> Concept of resistance (R) gene and a virulence (avr) gene; gene for gene hypothesis, types of plant resistance: true resistance– horizontal &amp; vertical, apparent resistance.</p> <p><b>Defense Mechanisms in Plants -</b> Concepts of constitutive defense mechanisms in plants, inducible structural defenses (histological-cork layer, abscission layer, tyloses, gums), inducible biochemical defenses [hypersensitive response (HR), systemic acquired resistance (SAR), phytoalexins, pathogenesis related (PR) proteins, plantibodies, phenolics, quinones, oxidative bursts].</p>	2	4-6
<b>Instructional Hours</b>			<b>15</b>
<b>V</b>	<p><b>Disease Management:</b> Cultural practices for disease management-pathogen free propagation material, removal of infected plants, soil treatment, hygiene, crop rotation, fertilization, quarantine, chemical plant disease control-fungicides, biological control of plant diseases.</p> <p><b>Important plant diseases giving emphasis on its etiological agent, symptoms, epidemiology and control measures-</b> Important diseases caused by fungi White rust of crucifers <i>Albugo candida</i>, Downy mildew of onion - <i>Peronospora destructor</i> Late lack stem rust of wheat - <i>Puccinia graminis tritici</i> Loose smut of wheat - <i>Ustilago nuda</i>. Wilt of tomato - <i>Fusarium oxysporum</i> f.sp. <i>lycopersici</i>. Important diseases caused by viruses: Papaya ring spot.</p>	3 4	15-17 6-8
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Textbook (S):**

1. Richard N. Strange, **Introduction to Plant Pathology**, John Wiley & Sons Ltd., 2006.
2. Mehrotra RS., Ashok Aggarwal. **Fundamentals of Plant Pathology**, McGraw Hill Education India Pvt., Ltd., 2013.
3. Anne Marte Tronsmo, David B. Collinge, Annika Djurle., **Plant Pathology and Plant Diseases**, CAB international, 2020.
4. Sambamurthy, **Text Book of Plant Pathology**, 1<sup>st</sup> Edition, I.K. International Pvt., Ltd., 2010.
  - Unit I: Text book 2, Chapter 2: 12-33
  - Unit II: Text book 2, Chapter 3: 34-46
  - Unit III: Text book 1, Chapter 3: 61-84
  - Unit IV: Text book2, Chapter 4-6: 47-97
  - Unit V: Text book3, Chapter 15-17, 265-306; Text book 4, Chapter 6-8: 95-154

**Reference Book(s):**

1. Christian Joseph R. Cumagun, **Plant Pathology**, Published by InTech., 2012.
2. Singh RS., Introduction to Principles of Plant Pathology, 4<sup>th</sup> Edition, Oxford & IBH Publishing Co. Pvt. Ltd., 2009.
3. <http://ipm.ucanr.edu/PMG/diseases/diseaseslist.html>
4. <http://www.hillagric.ac.in/edu/coa/ppath/lect/plpath111/Lect.%207%20Pl%20Path%20111-%20%20DEFENCE%20IN%20PLANTS.pdf>
5. <file:///C:/Users/Admin/Downloads/Plant-Pathogens-Principles-of-Plant-Pathology.pdf>

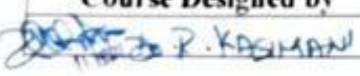
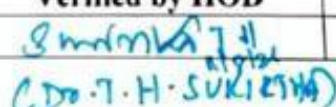


**Tools for Assessment (20 Marks)**

CIA I	CIA II	CIA III	Assignment	Model Preparation	Attendance	Total
4	4	5	2	2	3	20

**Mapping**

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	L	L	L	H
CO2	L	H	L	H	M	L
CO3	L	M	L	L	L	L
CO4	L	M	L	H	L	H
CO5	L	M	L	H	H	H

H – High; M- Medium; L – Low

Course Designed by	Verified by HOD	Checked by	Approved by
	 (Dr. S. M. H. SUKIRMAN)	 Convenor C.D.C.M.	



Course Code	Title		
20U3MBE606	<b>Discipline Specific Elective Paper II – Group C - Microbial Quality Control in Food and Pharmaceutical Industries</b>		
Semester: VI	Credits: 3	CIA : 20 Marks	ESE: 55 Marks

**Course Objective:**

This course impart skills to students in the area of Quality Control for food and pharmaceutical industries to ensure that their final products are consistent, safe, effective and predictable.

**Course Outcomes (CO):**

On successful completion of this course the students will be able to

CO1	Acquire knowledge about Good Laboratory Practices and biosafety.
CO2	Gain an in-depth knowledge in Determining Microbes in Food.
CO3	Understand the concepts of determining Microbes in Pharmaceutical.
CO4	Acquire knowledge about Pathogenic Microorganisms.
CO5	Outline the basic steps about Food Safety and Microbial Standards.

**Offered by: Microbiology****Course Content****Instructional Hours / Week: 5**

Unit	Description	Text Book	Chapter
I	<b>Microbiological Laboratory and Safe Practices:</b> Good laboratory practices, Good microbiological practices. Biosafety cabinets – Working of biosafety cabinets, using protective clothing, specification for BSL-1, BSL-2, BSL-3. Discarding biohazardous waste – Methodology of Disinfection, Autoclaving & Incineration.	1	1
<b>Instructional Hours</b>			<b>15</b>
II	<b>Methods for Determining Microbes:</b> Culture and microscopic methods - Standard plate count, Most probable numbers, Direct microscopic counts, Biochemical and immunological	1	4,5
<b>Instructional Hours</b>			<b>15</b>
III	<b>Determining Microbes in Pharmaceutical:</b> Methods: Limulus lysate test for endotoxin, geldiffusion, sterility testing for pharmaceutical products. Molecular methods - Nucleic acid probes, PCR based detection, biosensors.	1	6-9
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Pathogenic Microorganisms of importance in Food &amp; Water:</b> Enrichment culture technique, Detection of specific microorganisms - on XLD agar, Salmonella Shigella Agar, Manitol salt agar, EMB agar, McConkey Agar, Saboraud Agar. Ascertaining microbial quality of milk by MBRT, Rapid detection methods of microbiological quality of milk at milk collection centres (Resazurin assay).	2	6-9
<b>Instructional Hours</b>			<b>15</b>
V	<b>HACCP for Food Safety and Microbial Standards:</b> Hazard analysis of critical control point (HACCP) - Principles, flow diagrams, limitations Microbial Standards for Different Foods and Water – BIS standards for common foods and drinking water.	3	3
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book(s):**

1. Baird RM, Hodges NA and Denyer SP. **Handbook of Microbiological Quality Control in Pharmaceutical and Medical Devices**, Taylor and Francis Inc., 2005.
2. Cangliang Shen and Yifan Zhang, **Food Microbiology Laboratory for the Food Science Student: A Practical Approach**, Springer Publications, 2017.
3. Martin Cole, **A simplified guide to understanding and using Food Safety Objectives and Performance Objectives**, International Commission on Microbiological Specifications for Foods (ICMSF), 2002.
  - Unit I : Text Book 1, Chapter 1: 5-17
  - Unit II : Text Book 1, Chapter 4, 5: 57-90
  - Unit III : Text Book 1, Chapter 6-9: 92-123
  - Unit IV : Text Book 2, Chapter 6- 9: -31-58
  - Unit V : Text Book 3, Chapter 3: 20

**Reference Book(s):**

1. Jay JM, Loessner MJ, Golden DA. **Modern Food Microbiology**, 7<sup>th</sup> Edition, Springer, 2005.
2. Garg N, Garg KL and Mukerji KG. **Laboratory Manual of Food Microbiology**, IK International Publishing House Pvt. Ltd., 2010.

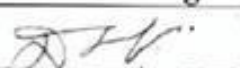
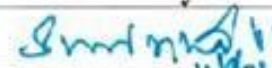



**Tools for Assessment (20 Marks)**

CIA I	CIA II	CIA III	Assignment	Quiz	Attendance	Total
4	4	5	2	2	3	20

**Mapping**

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	L	M	M	M
CO2	L	M	H	H	M	M
CO3	L	M	H	L	H	H
CO4	M	H	H	M	M	H
CO5	M	H	H	H	H	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
			
Dr. B. David Jeyarajin	Dr. P. H. SURIKITHA	Convener	

Course Code	Title		
20U3MBE607	Discipline Specific Elective Paper III- Group A – Nanobiotechnology		
Semester: VI	Credits: 3	CIA : 20 Marks	ESE: 55 Marks

**Course Objective:**

The objective is to understand nanoelectronics, DNA computer and quantum computer, nanobiometrics, natural nanocomposites, use of nanotechnology in Agriculture and nano analytics techniques.

**Course Outcomes (CO):**

On successful completion of this course the students will be able to

CO1	Understand the construction of various circuits models using the biologicalneural network.
CO2	Improve knowledge on quantum computers and Nano Machines.
CO3	Develop knowledge on Nano biometrics.
CO4	Recognize the concept of Nano based agricultural system.
CO5	Know methods on analysis of Nano particles.

Offered by: Microbiology

**Course Content**

Instructional Hours / Week: 5

Unit	Description	Text Book	Chapter
I	<b>Biological Inspired Concepts:</b> Biological Networks –Biological Neurons – The Function of Neuronal Cell –Biological neuronal cells on silicon – Modelling ofNeuronal cells by VLSI circuits.	1	4
<b>Instructional Hours</b>			<b>15</b>
II	<b>Biological and Quantum Mechanical Computers:</b> DNA Computer – Information Processing with Chemical reaction – Nanomachines – Parallel Processing – Quantum Computer.	1	5
<b>Instructional Hours</b>			<b>15</b>
III	<b>Nanobiometrics:</b> Introduction – lipids as nano-bricks and mortar- Self assembled nanolayers - the bits that do things - proteins – DNA Computer.	2	6
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Natural nanocomposites:</b> Introduction – naturalnanocomposite materials – biologically synthesizednanostructures – protein based nanostructure formation – Nanotechnology Applications in agriculture, food, medical and environment.	3	3
<b>Instructional Hours</b>			<b>15</b>
V	<b>Nanomaterial in Biotechnology:</b> Quantum dot Biolabelling – NanoparticleMolecular labels – Analysis of Biomolecular Structure byAFM.	4	22,23,24
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book(s):**

1. Goser, K., Glösekötter, P., and Dienstuhl, J. **Nanoelectronics and Nanosystems: from Transistors to Molecular and Quantum Devices**. Berlin: Springer, 2004.
2. Wilson, M. **Nanotechnology: Basic Science and Emerging Technologies**. Boca Raton: Chapman & Hall. CRC Press, 2004.
3. Ajayan, P. M., Schadler, L. S., and Braun, P. V. **Nanocomposite Science and Technology**. Weinheim: Wiley-VCH, 2005.
4. Niemeyer, C. M., & Mirkin, C. A. **Nanobiotechnology: Concepts, Applications and Perspectives**. Weinheim: Wiley-VCH, 2007.

Unit I: Text Book 1, Chapter 4 (61-75)

Unit II: Text Book 1 Chapter 5 (77-88)

Unit III: Text Book 2, Chapter 6 (140-154)

Unit IV: Text Book 3, Chapter 3 (155-207)

Unit V: Text Book 4 Chapter 22, 23, 24 (360-399)

**Reference Book(s):**

1. Chen, J. **Nanotechnology: Science and Computation**. Berlin: Springer, 2006.
2. Mirkin, C. A., and Niemeyer, C. M. **Nanobiotechnology II: More Concepts and Applications**. Weinheim: Wiley-VCH, 2007.
3. <https://drive.google.com/file/d/1AyOD15BJxRIbFf735pANFj3IR6yQkEGt/view?usp=sharing>
4. [http://www.ncabr.org/wp-content/uploads/2015/12/chapter\\_nanobiotechnology.pdf](http://www.ncabr.org/wp-content/uploads/2015/12/chapter_nanobiotechnology.pdf)

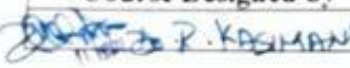
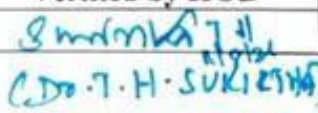


**Tools for Assessment (20 Marks)**

CIA I	CIA II	CIA III	Assignment	Quiz	Attendance	Total
4	4	5	2	2	3	20

**Mapping**

CO \ PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	M	L	H	H
CO2	L	M	L	L	H	H
CO3	L	M	M	M	M	H
CO4	H	M	M	L	H	H
CO5	H	M	M	H	H	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
			

Course Code	Title		
20U3MBE608	Discipline Specific Elective Paper III -Group B - Microbiology and Entrepreneurship		
Semester: VI	Credits: 3	CIA: 20 Marks	ESE: 55 Marks

**Course Objective:**

To gain knowledge on designing, launching and running a new business using potential microorganisms.

**Course Outcomes (CO):**

On successful completion of this course the students will be able to

CO1	Understand the basic concepts of entrepreneurship and become a young women Entrepreneur.
CO2	Get knowledge about the business opportunities on mushroom cultivation.
CO3	Attain technical knowledge on different composting technology.
CO4	Separate different types of biotechnological approaches to establish successful enterprises.
CO5	Apply for financial agencies for supporting entrepreneurship

**Offered By: Microbiology**

**Course Content**

**Instructional Hours / Week:5**

Unit	Description	Text Book	Chapter
I	<b>History and concept of Entrepreneurship:</b> Characteristics & Functions and types of Entrepreneur. Entrepreneurship – role in economic development. Women entrepreneurs: Problems of women entrepreneurs – Factors affecting entrepreneurial growth.	1	1
<b>Instructional Hours</b>			<b>15</b>
II	<b>Mushroom cultivation:</b> Edible mushroom Morphology, Nutritional and medicinal value. Preparation of spawn, types of spawning Preparation of substrate -Casing – harvesting Storage, Preservation and marketing. Mushroom diseases and its management Value added products: Cookies, Soup, Omlette, Samosa, Noodles, Pickles and Curry.	2	2-5
<b>Instructional Hours</b>			<b>15</b>
III	<b>Vermicomposting:</b> Biology and ecological classification of earthworm. Physical and chemical effects of earthworm on soil, Vermicomposting - species employed, methods and types of production – preparation of vermin wash – Field application and crop response, Storage and marketing of composts. Vermi Brick preparation.	3	3-9
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Biofertilizer:</b> Rhizobium, BGA, Azolla, VAM – bioinoculum, mass production- carriers, field application and crop response and Liquid biofertilizers. Biopesticide – bacteria and fungi. Production of SCP – Spirulina and Yeast.	4	2
<b>Instructional Hours</b>			<b>15</b>

V	<b>Patents and process:</b> History of Indian patent system, Patenting authorities, requirements of patenting, types of patent, types of patent applications in India, farmer's rights.	5	16
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book (s):**

1. Khanka S.S. **Entrepreneurial Development**. S. Chand & Company, New Delhi. 3<sup>rd</sup> Edition, 2003.
2. Kannian.S and Ramaswamy K. **A Handbook of Edible Mushrooms**. Today's and Tomorrows Printers, New Delhi, 1980.
3. Rhonda Sherman, **The Worm Farmer's Handbook**. Chelsea Green Publishing, 2018.
4. Panda H, **Manufacture of Biofertilizer and Organic Farming**, Asia Pacific Business Press, 2011.
5. Sateesh MK., **Bioethics and Biosafety**, I.K. International Publishing House Pvt. Ltd., 2008.

Unit I: Text Book 1, Chapter 1: 3-35.

Unit II: Text Book 2, Chapter 2-5: 2-27

Unit III: Text Book 3, Chapter 3-9: 36-112

Unit IV: Text Book 4, Chapter 2: 20-42

Unit V: Text Book 5, Chapter 16: 353-390

**Reference Book(s):**

1. Vasant Desai. **Dynamics of Entrepreneurial Development and Management**. Himalaya Publishing House, New Delhi, 2001.
2. Chang S.T and Hayes W.A. **Biology and Cultivation of Mushrooms**. Academic Press, New York, 1978.

**Tools for Assessment (20 Marks)**

CIA I	CIA II	CIA III	Assignment	Model Preparation	Attendance	Total
4	4	5	2	2	3	20

**Mapping**

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	M	M	H	L	M	H
CO2	M	M	L	M	H	M
CO3	L	M	M	M	M	H
CO4	H	M	M	L	H	H
CO5	M	M	L	M	M	M

H- High; M- Medium; L- Low.

Course Designed by <i>R. KASIMAN</i>	Verified by HOD <i>S. M. M. K. J. H. (Dr. T. H. SUKIRMAN)</i>	Checked by <i>M. U. U. U. U.</i> Convenor <i>PSO</i>	Approved by <i>J. J. J. J.</i>
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Course Code	Title		
20U3MBE609	Discipline Specific Elective Paper III – Group C - Microbial Diagnosis in Health Clinics		
Semester: VI	Credits: 3	CIA : 20 Marks	ESE: 55 Marks

**Course Objective:**

Provides opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases.

**Course Outcomes (CO):**

On successful completion of this course the students will be able to

CO1	Familiar with importance and challenges in detecting pathogens.
CO2	Understand of various methods used for collection, transport and storage of clinical samples.
CO3	Understand the principles of various classical and newer approaches.
CO4	Acquire knowledge on applicability of various detection methods.
CO5	Outline the basic steps involved in resistance/sensitivity of bacteria.

Offered by: Microbiology

**Course Content**

Instructional Hours / Week: 5

Unit	Description	Text Book	Chapter
I	<b>Importance of Diagnosis of Diseases:</b> Bacterial, Viral, Fungal and Protozoan Diseases of various human body systems, clinical samples for diagnosis of infectious disease.	1	9
<b>Instructional Hours</b>			<b>15</b>
II	<b>Collection of Clinical Samples:</b> How to collect clinical samples (oral cavity, throat, skin, Blood CSF, urine and faeces) and precautions required. Method of transport of clinical samples to laboratory and storage.	2	5
<b>Instructional Hours</b>			<b>15</b>
III	<b>Microscopic Examination and Culture Methods:</b> 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.	3	13
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Serological and Molecular Methods:</b> Serological Methods - Agglutination, ELISA, immunofluorescence, Nucleic acid based methods - PCR, Nucleic acid probes. Kits for rapid Detection of Pathogens: Typhoid, Dengue and HIV, Swine flu.	3	12, 13, 14
<b>Instructional Hours</b>			<b>15</b>
V	<b>Testing for Antibiotic Sensitivity in Bacteria:</b> Importance, Determination of resistance/sensitivity of bacteria using disc diffusion method, Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial double dilution method.	1	28
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book(s):**

1. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. **Jawetz, Melnick and Adelberg's Medical Microbiology**. 26<sup>th</sup> edition. McGraw Hill Publication, 2013.
2. Bailey's and Scott's **Diagnostic Microbiology**, 3<sup>rd</sup> edition, Mosby, 2013.
3. Ananthanarayan R and Paniker CKJ. **Textbook of Microbiology**, 8<sup>th</sup> edition, Universities Press Private Ltd, 2017.

Unit I: Text Book 1, Chapter 9: 149-150

Unit II: Text Book 2, Chapter 5: 53-60

Unit III: Text Book 2, Chapter 13:193-243

Unit IV: Text Book 3, Chapter 12, 13, 14: 84-110

Unit V: Text Book 1, Chapter 28, 378-399

**Reference Book(s):**

1. Randhawa, VS, Mehta G and Sharma KB. **Practicals and Viva in Medical Microbiology**, 2<sup>nd</sup> edition, Elsevier India Pvt. Ltd., 2009.
2. Collee JG, Fraser, AG, Marmion, BP, Simmons A. **Mackie and McCartney Practical Medical Microbiology**, 14<sup>th</sup> edition, Elsevier, 2007.

**Tools for Assessment (20 Marks)**

CIA I	CIA II	CIA III	Assignment	Quiz	Attendance	Total
4	4	5	2	2	3	20

**Mapping**

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	L	M	M	M
CO2	L	M	H	H	M	M
CO3	L	M	H	L	H	H
CO4	M	H	H	M	M	H
CO5	M	H	H	H	H	H

H-High; M-Medium; L-Low

Course designed by	Verified by HoD	Checked by	Approved by
<i>Dr. S. Esath Natheer</i> Dr. S. ESATH NATHEER	<i>Dr. T. H. Sukirtha</i> Dr. T. H. SUKIRTHA	<i>Consent</i> Consent	<i>[Signature]</i>



Course Code	Title		
20U4MBZ604	Skill Based Paper IV- Lab in Microbiological Analysis of Air and Water		
Semester: VI	Credits : 3	CIA: 30 Marks	ESE: 45 Marks

**Course Objective:**

The Students will gain knowledge about microbes in air, air sanitation and quality assessment. Types of water ecosystems and water-borne diseases. Effluent treatment and parameters – BOD, COD. Extremophiles in the environment.

**Course Outcomes (CO):**

On successful completion of this course the students will be able to

<b>CO1</b>	Gain knowledge on the role and infections caused by microbes in air.
<b>CO2</b>	Obtain detailed information on aquatic ecosystems.
<b>CO3</b>	Get detailed knowledge on Waste water treatment and its different methods.
<b>CO4</b>	Examine and enumerate the bacteria in spoiled foods.
<b>CO 5</b>	Analyze the potability of water.

**Offered by: Microbiology**

**Course Content**

**Instructional Hours/Week:4**

S. No.	Experiments
1	Microbial sampling of air from various sources – indoor , outdoor, hospital environment
2	Assessment of air quality by solid, liquid impingement techniques and enumeration using plating and turbidimetry.
3	Bacteriological examination of water for potability: MPN,SPC. Presumptive, confirmed, completed test.
4	Testing (water/ sewage) for physicochemical parameters including BOD, COD.
5	Measurement of chloride, phosphate and nitrate in water.
6	Enumeration and isolation of soil microorganisms : Enrichment culture technique for isolation of bacteria, fungi, protozoa, actinomycetes& algae from soil
8	Isolation of coliphages from sewage and estimation of phage titre:
9	i) Isolation of <i>E. coli</i> & identification by IMVIC
9	ii) Cultivation of phages iii) Preparation of phage stocks
10	iii) Estimation of phages w.r.t. time.
<b>Total Hours</b>	
<b>60</b>	

**Textbook(s):**

1. James G. Cappuccino, **Microbiology Laboratory manual**, 10<sup>th</sup> edition, Natalie Sherman, 2013.
2. Nicholas P. Cheremisinoff, **Biotechnology for Waste and Wastewater Treatment**, published in united states of America Noyas publication, Fair view Avenue west, New Jersey, 2002.
3. MaierRM,PepperILandGerbaCP.**EnvironmentalMicrobiology**.2<sup>nd</sup>edition,AcademicPress, 2009.

**Reference Books(s):**

1. Okafor, N. **Environmental Microbiology of Aquatic & Waste Systems**. 1<sup>st</sup> edition, Springer, New York, 2011.
2. Atlas RM and Bartha R. **Microbial Ecology: Fundamentals & Applications**. 4<sup>th</sup> edition. Benjamin/Cummings Science Publishing, USA, 2000.
3. <https://www.mpcb.gov.in/sites/default/files/water-quality/reports/LSD-NEERI-20Water%20Quality%20Analysis.pdf>
4. <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0118557>

**Tools for Assessment (30 Marks)**

Laboratory Performance I	Laboratory Performance II	Test I	Test II	Observation Note Book	Attendance	Total
5	5	5	5	7	3	30

**MAPPING**

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	L	L	L	H
CO2	L	H	L	H	M	L
CO3	L	M	L	L	L	L
CO4	L	M	L	H	L	H
CO5	L	M	L	H	H	H

H – High; M- Medium; L – Low

Course designed by	Verified by HoD	Checked by	Approved by
<i>(Dr. P. V. N. K. K. K. K.)</i> <i>P. V. N. K. K. K. K.</i>	<i>P. V. N. K. K. K. K.</i> <i>Dr. T. H. S. S. S. S.</i>	<i>P. V. N. K. K. K. K.</i> <i>Convenor</i> <i>PCDC</i>	<i>P. V. N. K. K. K. K.</i> <i>T. H. S. S. S. S.</i>

CourseCode	Title	
20U4MB3ED1	Extra Departmental Course I - Mushroom Cultivation Technology	
Semester: III	Credits: 2	ESE : 50 Marks

**Course Objective:**

To get the knowledge on the mushroom cultivation technology and significance of mushroom cultivation technology.

**Course Outcomes (CO):**

After successful completion of this course the students will be able to

CO1	Understand structure and importance of edible mushroom, differentiate edible and poisonous mushrooms.
CO2	Acquire knowledge about reproduction and cultivation of mushrooms.
CO3	Gain information on mushroom cultivation houses.
CO4	Know how to harvest and utilize the mushrooms.
CO5	Recognize various types of recipes preparation using mushroom.

Offered by: Microbiology

**Course Content**

Instructional hours / week : 2

Unit	Description	Text Book	Chapter
I	<b>Background to Mushrooms:</b> Common Features, Types and Uses, Edible Mushrooms, Non-edible and Poisonous Mushrooms, Common Features to note on Poisonous Mushrooms, Uses of Mushrooms, Importance of Mushrooms, Biological Efficiency	1	1
<b>Instructional Hours</b>			<b>05</b>
II	<b>Biology of Mushrooms:</b> Reproduction in Fungi, Fungal Growth Factors, Nutrition of Mushrooms, Types of oyster mushrooms, Types of button mushroom, Substrate Definition, Cultivation of Oyster Mushrooms: Collecting of substrate, Drying of substrate, Chopping of substrate, Watering of the substrate, Pasteurization, Spawning.	1	2-5
<b>Instructional Hours</b>			<b>10</b>
III	<b>Mushroom Houses:</b> Materials for constructing a mushroom house, Maintaining and monitoring the mushroom house, Production cycle, Waste management and recycling, Trouble shooting.	2	7-11
<b>Instructional Hours</b>			<b>07</b>
IV	<b>Harvest, Utilization:</b> Utilization of Spent Mushroom Substrate, Harvesting and Preservation of Mushrooms. Pests and Diseases. Packaging of mushrooms.	1	6, 7
<b>Instructional Hours</b>			<b>05</b>

V	<b>Mushroom Recipes:</b> Mushroom soup, Chicken Mushroom, Mushroom Curry.	2	12
<b>Instructional Hours</b>			<b>03</b>
<b>Total Hours</b>			<b>30</b>

**Text Book(s):**

1. ChenjerayiKashangura, Edna Kunjeku, Audrey Mabveni, TsungaiChirara, Arnold Mswaka, VimbaiManjonjo-Dalu. **Manual for Mushroom Cultivation.** Biotechnology Trust of Zimbabwe, 2004.
2. Nailoke Pauline Kadhila-Muandingi, Fabian SinvulaMubiana, Keumbo Lorna Halueendo. **Mushroom Cultivation: A Beginners Guide.** 2<sup>nd</sup> edition, University of Namibia, 2008.

Unit I: Text book 1, Chapter 1: 9-15

Unit II: Text book 1, Chapter 2-5: 24-47

Unit III: Text book 2, Chapter 7-11: 28-33.

Unit IV: Text book 1, Chapter 6: 59-62

Unit V: Text book 12, Chapter 12: 39-40

**Reference Book(s):**

1. GregoirePesti. **Mushrooms Cultivation, Antioxidant Properties and Health Benefits.** Nova Science Pub Inc., 2014.
2. Philip G. Miles, Shu-Ting Chang. **Mushrooms: Cultivation, Nutritional Value, Medicinal Effect, and Environmental Impact,** 2<sup>nd</sup> edition, CRC Press, 2004.
3. <https://www.biologydiscussion.com/fungi/mushrooms-meaning-values-and-cultivation-procedure/46635>
4. <https://www.yourarticlelibrary.com/mushrooms/mushrooms-cultivation-procedure-for-mushrooms-cultivation-1703-words/7268>

<b>Course Designed by</b> R. KASIMAN	<b>Verified by HOD</b> S. H. SURIKETA (D.O. T. H. SURIKETA)	<b>Checked by</b> Convenor CODG	<b>Approved by</b> JIT
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Course Code	Title	
20U4MB3ED2	Extra Departmental Course II - Vermitechnology	
Semester: III	Credits: 2	ESE : 50 Marks

**Course Objectives:**

Able to prepare compost in a limited space and describe the decomposing process. The interested students will get the knowledge of composting. They can generate employments. They will also turn towards organic farming. Will help to maintain the environment pollution free and will get the knowledge of biodiversity of local earthworms.

**Course Outcomes (CO):**

On successful completion of this course the students will be able to

CO1	Understand importance of vermitechnology.
CO2	Acquire knowledge on role of earthworms.
CO3	Gain information on vermicompost processing.
CO4	Know how to feed and monitor to prepare vermicompost.
CO5	Know harvest and packaging technology of vermicompost.

Offered by : Microbiology

**Course Content**

Instructional hours /week: 2

Unit	Description	Text Book	Chapter
I	<b>Vermiculture and Vermicomposting:</b> Green Revolution, Chemical Fertilizers, Composting, Vermicomposting, difference between vermiculture and vermicomposting, Advantages of vermicomposting, Vermitechnology and its importance	1	1 (a-h)
<b>Instructional Hours</b>			<b>03</b>
II	<b>Earth worm and vermicomposting:</b> Earthworms description, Geographical distribution of earthworms, Classification of earthworms, Biology of Earthworms - Anatomy and Physiology Basics, Amazing Earthworm Facts, Ecological Groups and Species, Earthworm Reproduction, Earthworm Needs for Vermicomposting	1, 2	1 (i-q), 3
<b>Instructional Hours</b>			<b>04</b>
III	<b>Vermicomposting Process:</b> Parameters for Choosing a System, Space Requirements, Types of Vermi-Systems, Covering the Bed, Accessing the Worm Bed, Bedding Options and Preparation, Adding Earthworms to Your Vermi-System, Utility Needs, Safety.	2	5, 6
<b>Instructional Hours</b>			<b>09</b>
IV	<b>Feeding and monitoring:</b> Feedstock Options, Developing a Feedstock Recipe, Processing Feedstocks, Testing New Feedstocks, Worm Feed Characteristics, Pre-Composting Feedstocks, Feeding Schedule, Applying Feedstocks to the Bed, The Daily Inspection, Moisture Control, Temperature Control, Lighting, Earthworm Predators or Annoyances, Troubleshooting	2	7-8

	Worm Bed Condition, Recording Observations.		
<b>Instructional Hours</b>			<b>10</b>
V	<b>Harvesting and Packaging:</b> Manual Earthworm Removal, Vermicast Harvesting, Packaging and Shipping Earthworms, Vermicast: Quality, Stability, and Maturity of Product, Product Labeling, Tea or Aqueous Extracts.	2	9
<b>Instructional Hours</b>			<b>04</b>
<b>Total Hours</b>			<b>30</b>

**Text Book(s):**

1. Avnish Chauhan, **Vermitechnology, Vermiculture, Vermicompost and Earthworms**. Lap Lambert Academic publishing, 2012.
2. Rhonda Sherman, **The Worm Farmer's Handbook**. Chelsea Green Publishing, 2018.

Unit I: Text book 1: Chapter 2 (a-h) - 11-18

Unit II: Text book 1, 2: Chapter 1(i-q), 3 - 22-34, 32-39


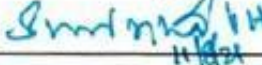


Unit III: Text book, Chapter 5, 6: 52-72

Unit IV: Text book 3, Chapter 7,8: 73-97

Unit V: Text book 3, Chapter 4: 25-27

**Reference Book(s):**

1. Sreenivasan E., **Handbook of Vermicomposting Technology**. The Western India Plywoods Ltd., 2015.
2. Glenn Munroe, **Manual of On-Farm Vermicomposting and Vermiculture**, Organic Agriculture Centre of Canada, 2005.
3. <https://www.onlinebiologynotes.com/vermicomposting/>
4. <https://www.vedantu.com/biology/vermiculture>

Course Designed by	Verified by HOD	Checked by	Approved by
			
Dr. B. David Jeyaraj	Dr. P. H. SURIKURU	Convener	

Course Code	Title	
20UMBSS01	Self-Study Paper I – Solid Waste Management	
Semester – II to V	Credit : 1	ESE : 50 Marks

**Course Objective:**

To impart knowledge and skills in the collection, storage, transport, treatment, disposal and recycling options for solid wastes.

**Course Outcomes (CO):**

**On the successful completion of the course, students will be able to demonstrate**

On successful completion of this course the students will be able to

<b>CO1</b>	Learn basic concepts of solid waste management
<b>CO2</b>	Achieve an overview understanding of the main aspects of waste policy and systems.
<b>CO3</b>	Emphasis their types, amounts of solid waste, regulatory aspects, the handling of wastes and byproducts.
<b>CO4</b>	Implement the technology for waste treatment, and political instruments and consequences of solid waste handling.
<b>CO 5</b>	Implement of solid waste treatment and methods.

**Offered By: Microbiology**

Unit	Description	Text Book	Chapter
<b>I</b>	<b>Waste generation and management:</b> Issues in solid waste management, Integrated waste management, Implementing integrated waste management strategies, Typical costs for major waste management options	1	1
<b>II</b>	<b>Planning for municipal solid waste management programs:</b> State solid waste management planning, Local and regional solid waste management planning	1	4
<b>III</b>	<b>Solid waste stream characteristics:</b> Municipal solid waste, Methods of characterizing municipal solid waste, Municipal solid waste management, Discards of municipal solid waste by volume, The variability of municipal solid waste generation.	1	5
<b>IV</b>	<b>Source Reduction, Waste Minimization and Environmental Laws:</b> Hierarchy of Waste Management, Principles of Life Cycle, Costs of Environmental Management, Waste Minimization at Work, NEPA, RCRA, Clean Air Act, Clean Water Act, CERCLA, Emergency Planning and Community Right-To-Know Act, Oil Pollution Act, Pollution Prevention Act, Safe Drinking Water Act, Toxic Substances Control Act.	2	1, 2
<b>V</b>	<b>Collection of solid waste:</b> Types of waste collection services, Types of collection systems, equipment, and personnel requirements, Collection routes, Management of collection systems, Collection	1	7

	system economics, Recycling - Development and implementation of materials recovery facilities.		
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**Text Book(s):**

1. George Tchobanoglous, Frank Kreith. **Handbook of Solid Waste Management**, 2<sup>nd</sup> edition, The McGraw –Hill, 2002.
2. Cheremisinoff, Nicholas P. **Handbook of Solid Waste Management and Waste Minimization Technologies**. Elsevier Science (USA), 2003.

Unit I : Text Book 1, Chapter 1: 19- 43  
 Unit II : Text Book 1, Chapter 4: 117-130  
 Unit III: Text Book 1, Chapter 5: 131-160  
 Unit IV: Text Book 2, Chapter 1, 2: 1 - 32  
 Unit V : Text Book 1, Chapter 7: 203 – 230

**Reference Book(s):**

1. A. Nag, K. Vizayakumar, **Environmental Education and Solid Waste Management**, New Age International Ltd., Publishers, 2005.
2. Samuel Stucki, Christian Ludwig (auth.), Dr. Christian Ludwig, Dr. Stefanie Hellweg, Dr. Samuel Stucki. **Municipal Solid Waste Management: Strategies and Technologies for Sustainable Solutions**, 1<sup>st</sup> edition, Springer-Verlag Berlin Heidelberg, 2003.
3. <https://courses.lumenlearning.com/suny-monroe-environmentalbiology/>
4. [https://www.epa.gov/sites/production/files/2020-10/documents/master\\_swmg\\_10-20-20\\_0.pdf](https://www.epa.gov/sites/production/files/2020-10/documents/master_swmg_10-20-20_0.pdf)

Course designed by	Verified by	Checked by	Approved by
D. Jean R. Nash 11/21/21 Dr. K. FRANKLIN NOAH	Dr. J. H. SURIYATHA 11/21/21	 Convenor CDC	



Course Code	Title
20UMBSS02	Self Study Paper II- Human Anatomy and Physiology
Semester – II to V	Credit : 1

**Course Objective:**

Fundamentals of Anatomy & Physiology gives students in-depth instruction in the organization, structures, and functions of the human body. Students will learn the terminology, anatomy and physiology, and pathology of each body system and how they interrelate to maintain homeostasis.

**Course outcomes (CO):**

On successful completion of this course the students will be able to

CO1	Use correct terminology to discuss the chemistry, cell structure, and tissues of the human body.
CO2	Use correct terminology to discuss the components and functions of blood, as well as the formation and anatomy of blood cells.
CO3	Identify and explain the structure and functions of each body communication system.
CO4	Identify and explain the structure and functions of digestive system.
CO5	Explain the role of each body system in maintaining homeostasis.

**Offered by Microbiology**

Unit	Description	Text Book	Chapter
I	<b>Introduction to the human body, chemical and tissue level of organization:</b> The body and its constituents, Introduction to the human body, Introduction to the chemistry of life, The cells, tissues and organization of the body.	2	1-4
II	<b>Circulatory and cardiac system:</b> The blood, The cardiovascular system.	1	7, 8
III	<b>Body communication and respiration:</b> The nervous system, endocrine system, and respiratory system.	2	12-18, 23
IV	<b>Digestive system:</b> Activity, organization, organs, mouth, pharynx, esophagus, structure of digestive system, process of digestion.	1	9
V	<b>Protection and survival:</b> The tissue, skin, skeleton, muscular, renal and reproductive systems.	1	4-6, 10, 17

**Text Book(s):**

1. Ian Peate, Muralitharan Nair, **Fundamentals of Anatomy and Physiology for Nursing and Healthcare Students**, 2<sup>nd</sup> edition, Wiley Balckwell, 2017.
2. Gerard J. Tortora, Bryan H. Derrickson, **Principles of Anatomy and Physiology**, 14<sup>th</sup> Edition, Wiley, 2014.

Unit I: Text Book 2, Chapter 1-4, 2: 1- 141

Unit II: Text Book 1, Chapter 7, 8: 185-251


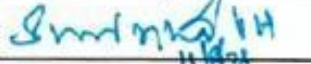


Unit III: Text Book 2, Chapter 12-18, 23: 379-650, 840-878

Unit IV: Text Book 1, Chapter 2: 258-292

Unit V: Text Book 1, Chapter 4-6, 10, 17: 95-179, 300-326, 551-569

**Reference Book(S):**

1. Anne Waugh, Allison Grant, **Ross & Wilson Anatomy and Physiology in Health and Illness**, 13<sup>th</sup> edition, Elsevier, 2018.
2. Frederic H. Martini, Judi L. Nath, Edwin F. Bartholomew. **Fundamentals of Anatomy & Physiology**, 9<sup>th</sup> edition, Benjamin Cummings, 2012.
3. [https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture\\_notes/nursing\\_students/LN\\_human\\_anat\\_final.pdf](https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/nursing_students/LN_human_anat_final.pdf)
4. <https://www.dr.naitiktrivedi.com/index.php/notes/anatomy-physiology-notes/>

Course Designed by	Verified by HOD	Checked by	Approved by
			
Dr. B. David Jeyaraj	Dr. P.H. SUKIRYA	Convener	