



# 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.



## M. Sc. MICROBIOLOGY SCHEME OF EXAMINATION

(Applicable to the students admitted during the academic year 2021– 2022 onwards)

Semester	Course Code	Name of the Course	Ins. Hrs/week	Examinations				Credit
				Dur. / Hrs	CI A	ES E	Total Marks	
I	21PGMBC101	Paper I – Basics of Microbiology and General Bacteriology	5	3	50	50	100	4
	21PGMBC102	Paper II – Microbial Physiology and Biochemistry	5	3	50	50	100	4
	21PGMBC103	Paper III – Analytical Methods in Microbiology	5	3	50	50	100	4
	21PGMBC104	Paper IV – Virology and Mycology	5	3	50	50	100	4
	21PGMBE 101 21PGMBE 102 21PGMBE 103	Elective Paper – I	5	3	50	50	100	4
	21PGMBQ101	Practical I – Lab in General and Analytical Microbiology	5	9	50	50	100	4
<b>Sub Total</b>			<b>30</b>				<b>600</b>	<b>24</b>
II	21PGMBC205	Paper V – Microbial Genetics and Molecular Biology	5	3	50	50	100	4
	21PGMBC206	Paper VI – Immunology	5	3	50	50	100	4
	21PGMBC207	Paper VII – Computational Biology, Microbial Genomics and Proteomics	5	3	50	50	100	4
	21PGMBC208	Paper VIII – Bioprocess Technology	5	3	50	50	100	4
	21PGMBE201 21PGMBE202 21PGMBE203	Elective Paper – II	5	3	50	50	100	4
	21PGMBQ202	Practical II – Lab in Molecular Biology and Immunology	5	9	50	50	100	4
<b>Sub Total</b>			<b>30</b>				<b>600</b>	<b>24</b>
III	21PGMBC309	Paper IX – Environmental and Agricultural Microbiology	5	3	50	50	100	4
	21PGMBC310	Paper X – Microbial Biotechnology and IPR	5	3	50	50	100	4
	21PGMBC311	Paper XI – Biostatistics and Research Methodology	5	3	50	50	100	4
	21PGMBC312	Paper XII – Microbial Food Technology	5	3	50	50	100	4
	21PGMBE301 21PGMBE302 21PGMBE303	Elective Paper – III	5	3	50	50	100	4
	21PGMBONL C	Online Course through SWAYAM**	-	-	-	-	100	4

	21PGMBQ303	Practical III – Lab in Environment, Agriculture and Food Microbiology	5	9	50	50	100	4
	21PGMBT301	*Internship Training	-	-	-	-	50	2
<b>Sub Total</b>			<b>30</b>				<b>750</b>	<b>30</b>
IV	21PGMBC413	Paper XIII – Medical Microbiology	5	3	50	50	100	4
	21PGMBV401	**Project and viva voce*	20	-	100	100	200	8
	21PGMBQ404	Practical IV – Lab in Medical Microbiology	5	9	50	50	100	4
			<b>30</b>				<b>400</b>	<b>16</b>
<b>Total</b>							<b>2350</b>	<b>94</b>

#### LIST OF ELECTIVE PAPERS:

Elective Papers	Course code	Group	Name of the Course
Elective Paper I/ Sem. I	21PGMBE101	A	Principles of Quality Assurance in Food
	21PGMBE102	B	Diagnostic Mycology
	21PGMBE103	C	Fundamentals of Plant tissue Culture
Elective Paper II/Sem. II	21PGMBE201	A	Principles of Quality Assurance in Pharmaceuticals
	21PGMBE202	B	Techniques in Parasitology
	21PGMBE203	C	Fundamentals of Animal tissue Culture
Elective Paper III/Sem. III	21PGMBE301	A	Total Quality Management (TQM)
	21PGMBE302	B	Clinical Data Base Management
	21PGMBE303	C	Techniques in Plant and Animal Tissue Culture

Part	Courses	Semesters	Credit/Points	Marks/Grade
III	Components Core / Elective Papers/ Online course	I to IV	86	2050
III	Research Project	IV	8	200
<b>Total</b>			<b>94</b>	<b>2250</b>
Optional	i) Advanced Learners Course (ALC) – self study	I – IV	Extra credit – 8 (2 / Paper / Sem.)	@ 400

@- NOT INCLUDED IN TOTAL MARKS & CGPA CALCULATION

#### List of Advanced Learners Course (Self Study)

S. No.	Course Code	Name of the Course
1	21PMBSS01	Cellular Organization
2	21PMBSS02	Cell Communication and Cell Signalling
3	21PMBSS03	Developmental Biology
4	21PMBSS04	Inheritance Biology
5	21PMBSS05	Evolution and Behaviour

#### Question Paper Pattern - Advanced Learners Course

Time:3 Hours

Max Marks:100

Knowledge Level	Section	Marks	Description
K2,K3	1-5	A(Either or Pattern)	5×8=40
K3/K4	6-15	B(Answer 5 Out of 10)	5×12=60

#### \* Internship Training:

Industrial Training has to be undergone during II semester vacation period (15 days).

Mark shall be given based on training report and presentation.

**\*Research Project and Viva-Voce Guidelines**

- 1) Project is pertain to the field of Microbiology
- 2) Two review meetings should be conducted at regular intervals in the presence of HoD and respective guide. The review should evaluate for a maximum of 50 marks.

<b>Review</b>	<b>Maximum Marks</b>
I	50
II	50

Dissertation evaluation	60 Marks
Viva-Voce	40 Marks

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

# SYLLABUS

# SEMESTER – I

Course Code	Title		
21PGMBC101	Paper I – Basics of Microbiology and General Bacteriology		
Semester : I	Credits : 4	CIA : 50 Marks	ESE : 50Marks

**Course Objective:**

To provide the student with basic knowledge of microorganisms and describe the general properties & characteristics of bacteria.

**Course Outcomes:**

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

<b>CO1</b>	Understand the development of microbiology.
<b>CO2</b>	Acquaintance on study of microbial diversity using different methods and systematics of bacteria.
<b>CO3</b>	Identify unique structures, capabilities and functions of microorganisms.
<b>CO4</b>	Discuss reproduction and life cycle of Bacteria.
<b>CO5</b>	Familiarize how to control microorganisms.

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

Unit	Description	Text Book	Chapter
<b>I</b>	<b>Historical Development:</b> Contributions of Leeuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Joseph Lister, Winogradsky, John Tyndal. History and Scope of Microbiology. Spontaneous generation conflict – Germ Theory of disease.	1	1
<b>Instructional Hours</b>			<b>10</b>
<b>II</b>	<b>Microbial Taxonomy:</b> Domains and Kingdom of life – Bacterial Nomenclature – Various criteria used in bacterial classification: Morphological, physiological, metabolic, serological, ecological and genetic analysis. Outline of Bergey's Manual of systematic bacteriology – Numerical taxonomy – 16S rRNA based classification.	2	2
<b>Instructional Hours</b>			<b>15</b>
<b>III</b>	<b>Morphology and Fine Structures:</b> Overview of bacterial cell structure (size, shape, arrangement of membrane and cellwall), cytoplasmic inclusions, mesosomes, flagella and motility, slime, capsule, pili, chemotaxis and endospore. Bacterial chromosome, nucleoid, plasmid (types and function). Staining -Gram, Negative, Capsule, Spore, Flagellar, Nuclear, Acid fast.	2	4
<b>Instructional Hours</b>			<b>18</b>
<b>IV</b>	<b>Reproduction and Growth:</b> Binary fission, Budding, Fragmentation, Microbial growth and life cycle of bacteria. Population growth and its measurement, effect of environmental conditions on growth (pH, temperature, aeration). Continuous and batch culture, diauxic synchronous growth cultures and anaerobic cultures.	1	5, 6
<b>Instructional Hours</b>			<b>17</b>

V	<b>Control of growth of Microbes:</b> Sterilization, disinfection, antiseptic, sanitizer, germicide, antimicrobial agent, physical methods of sterilization- dry-heat, moist-heat, filtration, radiation, chemical controls- dye alcohols, alkali, halogen, heavy metals, formaldehyde, phenols its derivatives, ethylene oxide, detergents.	3	7
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book(s):**

1. Prescott, Harley, and Klein’s, **Microbiology**, 7<sup>th</sup> Edition, McGraw Hill Education, 2008.
2. Dubey R.C., **A Text Book of Microbiology**, S. Chand & Company Ltd., 2013.
3. Jeffrey C. Pommerville, **Fundamentals of Microbiology**, 10<sup>th</sup> Edition, Jones&Barlett, 2014.

- Unit I : Text Book 1, Chapter 1: 1-16.
- Unit II : Text Book 2, Chapter 2: 26-58.
- Unit III : Text Book 2, Chapter 4: 79-125.
- Unit IV : Text Book 1, Chapter 5, 6: 101-142.
- Unit V : Text Book 3, Chapter 7: 195-221.

**Reference Book(s):**

1. Alcamo, E. **Fundamentals of Microbiology**, 6<sup>th</sup> Edition. Jones and Bartlett Publishers, New Delhi. 2001
2. Brooks, G.F., E. Jawetz, J.L. Melnick and E.A. Adelberg. **Medical Microbiology**. 26<sup>th</sup> Edition, New York: McGraw Hill Medical. 2013.
3. Patricia, M.T. Bailey and Scott’s **Diagnostic Microbiology**, 13<sup>th</sup> Edition, Mosby, Inc. Publishers, China. 2014.
4. <https://microbiologyinfo.com/>





**Tools for Assessment (50 Marks)**

CIA I	CIA II	CIA III	Assignment	Seminar	Quiz	Total
8	8	10	8	8	8	50

**Mapping**

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	M	H	H	H	H	H	M	H	M
CO2	H	H	M	H	M	H	M	H	H	M	M	M	H
CO3	H	H	M	H	H	M	M	H	M	H	H	M	H
CO4	H	H	M	L	M	M	M	H	H	H	H	M	H
CO5	H	H	L	M	H	H	M	H	H	H	M	M	M

H-High; M-Medium; L-Low

<b>Course Designed by</b> 	<b>Verified by HOD</b>  Dr. M. Manoj Kumar	<b>Checked by</b>  Dr. A. Srinivas Reddy Convenor CDC	<b>Approved by</b>  30 MAR 2022
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Course Code	Title		
21PGMBC102	Paper II - Microbial Physiology and Biochemistry		
Semester : I	Credits : 4	CIA : 50 Marks	ESE : 50 Marks

**Course Objective:**

This course provide the students with basics aspects of microbial physiology, important metabolic process and survival mechanisms.

**Course Outcomes:**

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

CO1	Understand the concept of nutrition metabolism, transport mechanism across bacterial cells.
CO2	Describe the properties of amino acids, proteins and enzymes.
CO3	Know various types of bacteria involved in photosynthesis and its mechanisms.
CO4	Explain the mechanisms of lipid and its connected metabolism.
CO5	Develop knowledge on bacterial reserve food material and its role.

**Offered by : Department of Microbiology**

**Course Content**

**Instructional Hours/ Week : 5**

Unit	Description	Text Book	Chapter
I	<b>Nutrition and Metabolism:</b> Concepts and nutritional categories. Transport of nutrients(diffusion, active transport, group translocation). Introduction to oxidative and substrate level phosphorylations, brief account of metabolism of carbohydrates, EMP,ED, TCA and glyoxylate cycles.	1	3-5
<b>Instructional Hours</b>			<b>15</b>
II	<b>Amino acids and Enzymes:</b> C, chemical reaction, physical properties, primary, secondary, tertiary and quaternary structure of enzyme, inhibition, mechanism of action. Enzyme kinetics, allosteric enzymes and its kinetic analysis and regulation.	3	9, 16-18
<b>Instructional Hours</b>			<b>15</b>
III	<b>Bacterial photosynthesis:</b> Type of photosynthesizing bacteria and their characteristic features, photosynthetic pigments, metabolism in photosynthetic bacteria, photosynthetic electron transport system; Dark reaction (Calvin Benson cycle), chemolithotrophy (energy from oxidation of inorganic electron donors), Hydrogen oxidizing bacteria, sulfur bacteria, Iron oxidizing bacteria, Ammonium and Nitrate oxidizing bacteria	2	12
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Fat and phospholipid hydrolysis:</b> Hydrocarbon transformation (Aliphatic/ Aromatic) Nitrogen fixation; Nitrogenase physiology and genetics, physiological difference in nitrogen fixing cells, free living, symbiotic and associative symbiotic organisms.	3	13, 14
<b>Instructional Hours</b>			<b>15</b>



V	<b>Energy, environment and microbial survival:</b> Survival and Energy, Reserve Material in Bacteria – glycogen and trehalose, lipid, PHA, TAG, Wax ester and Hydrocarbons, polypeptides, Polyphosphate, Resting cells – sporulation, cysts, viable and non-culturable cells, Nanobacteria, Programmed cell death.	1	13
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book(s):**

1. Byung Hong Kim, Geoffrey Michael Gadd, **Bacterial Physiology and Metabolism**, Cambridge University Press, 2008.
2. Alber G. Moat, John W. Foster, Michael P. Spector, **Microbial Physiology**, Wiley & Sons, 2002.
3. Jain J.L., **Fundamentals of Biochemistry**, S. Chand and Company, 2004.

- Unit – I : Textbook 1, Chapter 3-5: 35-85.
- Unit – II : Textbook 3, Chapter 9, 16-18: 164-250, 399-476.
- Unit –III : Textbook2, Chapter 12: 434-446.
- Unit – IV : Textbook 3, Chapter 13, 14: 450-502.
- Unit – V : Textbook 1, Chapter13: 482-493.

**Reference Book(s):**

1. Caldwell. D.R. **Microbial Physiology and Metabolism**, Wm C. Brown Publisher.1995.
2. Stainier R. Y. Ingraham, J.L. Wheolis, H.H. and Painter. P.R. **Microbiology**.1986.
3. <https://www.easybiologyclass.com/carbohvdrates-simple-lecture-notes>


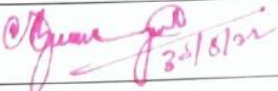
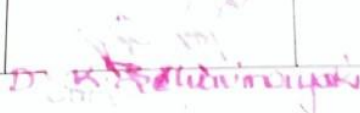
**Tools for Assessment (50 Marks)**

CIA I	CIA II	CIA III	Assignment	Seminar	Quiz	Total
8	8	10	8	8	8	50

**Mapping**

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	L	H	M	M	L	H	H	M	M	L	L
CO2	H	H	L	M	L	M	L	H	H	M	H	L	H
CO3	H	M	L	H	M	M	L	H	L	M	L	L	M
CO4	M	H	M	M	M	L	L	H	M	H	L	L	M
CO5	H	H	M	M	H	H	H	H	H	M	L	L	M

H – High; M- Medium; L – Low

<b>Course Designed by</b>	<b>Verified by HOD</b>	<b>Checked by</b>	<b>Approved by</b>
	 25/8/21 Dr. M. V. Venkatesh		

Course Code	Title		
21PGMBC103	Paper III – Analytical Methods in Microbiology		
Semester : I	Credits : 4	CIA : 50 Marks	ESE : 50 Marks

**Course Objective:**

To make the students to gain knowledge on techniques commonly performed in a microbiology laboratory.

**Course Outcomes:**

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

CO1	Gain knowledge about microscopy history and principles.
CO2	Understand the principles and application of chromatography.
CO3	Develop knowledge on centrifugation basic principles and applications.
CO4	Explain the electrophoresis principle, types and applications.
CO5	Describe the colorimetric principles by specific methods.

Offered by: Department of Microbiology

**Course Content**

Instructional Hours / Week : 5

Unit	Description	Text Book	Chapter
I	<b>Historical Development:</b> Microscopy: history and principles of microscopy, properties of light, magnification power, resolution, limit, resolving. Bright field - Dark Field - Phase contrast and Fluorescence microscope confocal microscopy, atomic force microscope Electron Microscope - Specimen preparation -TEM and SEM.	2	4
<b>Instructional Hours</b>			<b>15</b>
II	<b>Chromatography:</b> Principles, Instrumentation, Types and Detection methods – Paper, TLC, HPLC, GC, Ion- exchange, Column, Gel permeation, Chiral, and Affinity Chromatography Applications.	1	3
<b>Instructional Hours</b>			<b>15</b>
III	<b>Centrifugation:</b> Basic principles of centrifugation, differential and density gradient: zonal and isopycnic centrifugation. Sedimentation coefficient, factors affecting sedimentation coefficient. Ultracentrifuges: analytical and preparative with application. Rotors: types and applications.	2	3
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Electrophoresis:</b> Principles, Instrumentation, Types. Staining and Detection methods – Isoelectrophoresis – isoelectric focusing – Applications MALDI-TOF, 2D gel electrophoresis Native PAGE and SDS-PAGE.	1	4
<b>Instructional Hours</b>			<b>15</b>
V	<b>Colorimetry:</b> Principles, Instrumentation and Applications–Basic principles of spectrophotometry - The laws of absorption, principles and instrumentation for UV-visible and IR spectroscopy. Principles, theory and applications of spectrofluorometry, and Flame photometry.	1	5
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book(s):**

1. Boyer. **Modern Experimental Biochemistry**, 3<sup>rd</sup> Edition, Pearson Education, 2007.
2. Keith Wilson and John Walker. **Principles and Techniques in Practical**

**Biochemistry**, 5th Edition, Cambridge University Press, 2000.

Unit I : Text Book 2, Chapter 4: 131-163.

Unit II : Text Book 1, Chapter 3: 77-127.

Unit III : Text Book 2, Chapter 3: 103-130.

Unit IV : Text Book 1, Chapter 4: 129-158.

Unit V : Text Book 1, Chapter 5: 159-188.

**Reference Book(s):**

1. Kathleen Talaro and Arthur Talaro. **Foundation in Microbiology**. WCB Publishers. 1993.
2. David Freifelder. **Physical Biochemistry**. (2nd Edition)
3. Prescott, L.M J.P. Harley and C.A. Klein. **Microbiology**, 2<sup>nd</sup> Edition Wm, C. Brown publishers. 1995
4. Marion G. Macey. **Flow Cytometry Principles and Applications**.
5. Wilson Keith and Walker John, **Principles and Techniques of Biochemistry and Molecular Biology**, 6<sup>th</sup> Edition. Cambridge University Press, New York, 2005.
6. <https://www.saylor.org/site/wp-content/uploads/2012/07/Chapter121.pdf>
7. <http://gnu.inflibnet.ac.in:8080/jspui/bitstream/123456789/1262/1/colorimetry.pdf>

**Tools for Assessment (50 Marks)**

CIA I	CIA II	CIA III	Assignment	Seminar	Quiz	Total
8	8	10	8	8	8	50

**Mapping**

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	L	L	H	H	M	H	H	M	L	L	H
CO2	H	H	M	L	H	H	M	H	L	M	L	L	H
CO3	H	H	M	M	H	L	M	H	L	L	H	M	H
CO4	H	H	M	M	H	H	L	H	H	M	H	M	M
CO5	H	H	M	M	H	H	L	H	M	M	H	H	M

H - High; M - Medium; L – Low

Course Designed by	Verified by HOD	Checked by	Approved by
<i>Dr. C. EATH NATHIA</i> 30/02/2021	<i>Cor. M. Thiruvalluvar</i>	<i>Convenor CDC</i>	<i>30 MAR 2021</i>

Course Code	Title		
21PGMBC104	Paper IV - Virology and Mycology		
Semester : I	Credits : 4	CIA : 50 Marks	ESE : 50 Marks

**Course Objective:**

Students can have knowledge about Classification and Structure of viruses and their cultivation methods. They can have knowledge about various diseases caused by viruses. They can know various diagnostic and therapeutic treatments for fungal infections.

**Course Outcomes:**

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

CO1	Know about structure and characteristics of viruses.
CO2	Understand the disease caused by DNA viruses.
CO3	Analyse and determine infection caused by RNA viruses.
CO4	Know about fungal diagnostic procedures and treatment.
CO5	Explain Etiologies, epidemiology and basic mechanisms of pathogenesis in mycosis.

Offered by : Department of Microbiology

**Course Content**

Instructional Hours/ Week : 5

Unit	Description	Text Book	Chapter
I	<b>Viral classification and properties:</b> Historical perspective of virology - Scope of virology -Viral classification and properties of viruses – Replication of viruses, cultivation of viruses (animal inoculation, Embryonated egg and tissue culture) - properties of viroids and Prions.	1	29
<b>Instructional Hours</b>			<b>15</b>
II	<b>Animal DNA viruses:</b> Animal viruses- DNA viruses - morphology, replication, pathogenesis and laboratory diagnosis of Pox virus, Adeno virus, Hepatitis viruses – type A,B and D. Herpes simplex viruses, Oncogenic viruses- Papova virus,- oncogenes and Oncogenesis.	1	32-35
<b>Instructional Hours</b>			<b>15</b>
III	<b>Animal RNA viruses:</b> Animal viruses - RNA viruses - morphology, replication, pathogenesis and laboratory diagnosis of Poliovirus. Rabies virus, Influenza virus, Mumps virus, Measles virus and Rubella virus, Retro virus - HIV virus. Dengue, Japanese Encephalitis, SARS, Swine Flu and Corona Virus.	1	38-44
<b>Instructional Hours</b>			<b>15</b>
IV	<b>General Properties of Fungi:</b> Isolation and identification of medically important fungi – diagnosis of fungal disease - routine mycological techniques - antifungal agents.	2	5
<b>Instructional Hours</b>			<b>15</b>
V	<b>Fungal Infections:</b> Superficial mycosis –Pityriasisversicolor, Tineanigra, piedra. Cutaneous mycosis – Dermatophytes. Systemic mycosis –Opportunistic mycosis – Candidosis, Cryptococcosis, aspergillosis. Subcutaneous mycosis - Sporotrichosis, Chromoblastomycosis, Mycetoma.	1, 3	45, 40
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book(s):**

1. Jawetz, E., Melnic, J.L., and Adelberg, E.A. **Review of Medical Microbiology**. 22<sup>nd</sup> edition, Lange Medical Publishers, New York, 2001.
2. Fritz H. Kayser, K. A. Bienz, J. Eckert, **Medical Microbiology**. Thieme publishers, 2005.
3. Prescott, M., Harley, J.P., and Klein, D.A., **Microbiology**, 10<sup>th</sup> edition, McGraw-Hill Inc, NY, 2016.

- Unit I : Text Book 1, Chapter 29 (407-427)
- Unit II : Text Book 1, Chapter 32-35 (457-512)
- Unit III : Text Book 1, Chapter 38 -44 (553-657)
- Unit IV : Text Book 2, Chapter 5 (348-357)
- Unit V : Text Book 3, Chapter 40 (942-950), T.B 1 Chapter 45- (671-710)

**Reference Book(s):**

1. Knipe D.M., Howley P.M., and Griffin D.E., **Fields Virology**. 5<sup>th</sup> edition, Vol - I, II. Lippincott, Williams & Wilkins, 2006.
2. Cann, A.J. **Principles of Molecular Virology**, Academic Press, 2005.
3. Dimmock, N.J., Easton, A.J., and Leppard, K.N., **Introduction to Modern Virology**, 6<sup>th</sup> edition, Blackwell Scientific Publications, Oxford, UK, 2007.
4. Flint, S.J., Racaniello, V.R., Enquist, L.W., Rancaniello, V. R., and Skalka, A. M., **Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Viruses**. American Society Microbiology, 2003.
5. <https://paramedicsworld.com/microbiology-notes/virology-notes/medical-paramedical-studynotes>





**Tools for Assessment (50 Marks)**

CIA I	CIA II	CIA III	Assignment	Seminar	Quiz	Total
8	8	10	8	8	8	50

**Mapping**

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H	M	H	H	H	H	L	H	M
CO2	H	H	M	H	M	H	M	M	H	M	L	H	H
CO3	H	H	L	M	H	H	M	H	H	H	M	H	L
CO4	H	H	L	H	H	H	M	H	H	M	M	H	M
CO5	H	H	M	M	H	H	H	M	M	M	M	H	H

H – High; M- Medium; L – Low

Course Designed by	Verified by HOD	Checked by	Approved by
	 30/01/22 Dr. M. Rajasekhar	 Dr. J. S. Srinivasan Convenor CDC	 30 MAR 2022

Course Code	Title		
21PGMBQ101	Practical I – Lab in General and Analytical Microbiology		
Semester : 1	Credits : 4	CIA : 50 Marks	ESE : 50 Marks

**Course Objective:**

To make the students to gain knowledge on the distribution, morphology and physiology of various microorganisms and to understand the laboratory skills, techniques, control of infectious microbes from various sources. Students can know microbiology related techniques like staining cultural characteristics and other techniques.

**Course Outcomes:**

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

CO1	Develop knowledge on laboratory guideline, and various staining techniques and sterilization methods.
CO2	Understand the media preparation, culture techniques, preservation of microorganisms
CO3	Acquire knowledge about measurement of microbial cell.
CO4	Comprehend knowledge on basic lab instrumentation.
CO5	Understand working principles of advanced instrumentation.

**Offered by: Department of Microbiology**

**Course Content**

**Instructional Hours / Week : 5**

S. No.	Experiment
1	Laboratory precautions, basic Lab glass wares.
2	Methods of Sterilization – Principles and Methods – Physical Methods – Dry heat- Hot air Oven, Moist heat – Autoclave, Chemical methods – Alcohols, Aldehydes
3	Bacterial Staining – Simple, Grams, Acid fast, Spore, Capsule
4	Isolation of bacteria and fungi from various samples
5	Culture media Preparation, Liquid and Solid Media, Types of Media –Simple, Defined, Complex, Enriched, Enrichment, Differential, Selective, transport and Anaerobic Media
6	Pure Culture Techniques –Pour plate, Spread Plate and Streak plate
7	Enumeration of Bacteria, fungi and Actinomycetes from Soil
8	Cultural Characteristics of Microorganisms
9	Maintenance and preservation of Microbes
10	Measurement of microbial cell load
11	Isolation of bacteria from samples by Standard Plate Count
12	Cultivation of Anaerobic Bacteria
13	Micrometry- Size and Shape of an Organism
14	Basic Lab instrumentation – Autoclave, Hot air oven, pH meter, Centrifuge, laminar air flow.
15	Advanced Lab Instrumentation – Thermal cycler, Spectrophotometer, SDS Page, Blotting, HPLC, GC MS
<b>Instructional Hours : 75</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**. Pearson Education Limited, 2017

**Reference Book(s):**

1. Dubey RC and Maheshwari DK., **Practical Microbiology**. S Chand and Co. Ltd., New Delhi, 2002.
2. P. Gunasegaram, **Laboratory Manual in Microbiology**. New Age International. 2007.
3. <https://microbenotes.com/fields-of-microbiology/>
4. [https://bio.libretexts.org/Bookshelves/Microbiology/Book%3AMicrobiology\\_\(Boundless\)/1%3A\\_Introduction\\_to\\_Microbiology/1.3%3A\\_The\\_Science\\_of\\_Microbiology/1.3B\\_Applied\\_Microbiology](https://bio.libretexts.org/Bookshelves/Microbiology/Book%3AMicrobiology_(Boundless)/1%3A_Introduction_to_Microbiology/1.3%3A_The_Science_of_Microbiology/1.3B_Applied_Microbiology)

**Tools for Assessment (50 Marks)**

Laboratory Performance			Test I	Test II	Observation Note Book	Total
Level of Engagement in Lab	Preparation	Result				
8	8	8	10	10	6	50

**Mapping**

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H	M	M	H	M	M	L	H	H
CO2	H	H	H	H	H	H	M	H	H	L	M	M	H
CO3	H	H	L	L	M	H	M	H	H	L	L	M	H
CO4	H	H	L	M	H	H	L	H	H	H	M	M	M
CO5	H	H	M	L	H	H	L	H	H	M	L	M	L

H-H igh; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
<i>S. Sathya</i> (Dr. S. SATHYANATHAN) 20/03/2022	<i>S. Sathya</i> 30/3/22 (Dr. M. SATHYANATHAN)	<i>S. Sathya</i> 30/3/22 Convenor CDC	<i>S. Sathya</i> 30 MAR 2022

# SEMESTER – II



Course Code	Title		
21PGMBC205	Paper V – Microbial Genetics and Molecular Biology		
Semester : II	Credits : 4	CIA : 50 Marks	ESE : 50 Marks

**Course Objective:**

Make students understand about the structure and function of biologically important molecules. Students will learn about DNA, RNA and the molecular events that govern cell functions.

**Course Outcomes:**

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

CO1	Describe the structure and function of DNA and RNA in a cell.
CO2	Elucidate central cell biological processes and how they are regulated.
CO3	Explain RNA synthesis and its control mechanisms.
CO4	Understand how molecular transformation process.
CO5	Comprehend DNA repair and recombination.

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

Unit	Description	Text Book	Chapter
I	<b>DNA:</b> Structure, Salient features of double helix, Types of DNA, denaturation and renaturation, topoisomerases; Organization of DNA Prokaryotes, Viruses, Eukaryotes. RNA Structure	1	10
<b>Instructional Hours</b>			<b>15</b>
II	<b>Replication:</b> Bidirectional and unidirectional replication, semi-conservative, semi- discontinuous replication. Mechanism of DNA replication: Enzymes and proteins involved in DNA replication –DNA polymerases, DNA ligase, primase, telomerase – for replication of linear ends.	3	3
<b>Instructional Hours</b>			<b>15</b>
III	<b>Transcription:</b> Definition, promoter - concept and strength of promoter. Transcriptional Machinery and Mechanism of transcription. Principles of transcriptional regulation, regulation at initiation with examples from <i>lac</i> and <i>trp</i> operons.	1	13
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Transformation:</b> Discovery, mechanism of natural competence Conjugation - Discovery, mechanism, Hfr and F' strains Transduction - Generalized transduction, specialized transduction. Property and function of plasmids, Types of plasmids	2	15
<b>Instructional Hours</b>			<b>15</b>
V	<b>DNA repair and recombination:</b> DNA Mismatch Repair, Double Strand Break Repair, Recombination as a molecular biology tool Mutations and mutagenesis: Definition and types of Mutations; Physical and chemical mutagens; Uses of mutations.	1	18
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book(s):**

1. Benjamin A. Pierce, **Genetics – A Conceptual Approach**, W. H. Freeman and Company, Fourth Edition, 2012.
2. Peter J. Russel, **Genetics – A Molecular Approach**. Pearson Education Inc., Third Edition, 2010.
3. Primrose, S.B. and R.M. Twyman, **Principles of Gene Manipulation and Genomics**, Black well Publishing, Seventh Edition, 2006.

Unit I : Text Book 1, Chapter 10:271-285.

Unit II : Text Book 3, Chapter 3: 36-50.

Unit III: Text Book 1, Chapter 13: 351-367.

Unit IV: Text Book 2, Chapter 15: 429-460.

Unit V : Text Book 1, Chapter 18:481-505.

**Reference Book(s):**


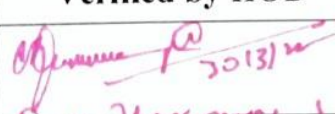


1. James D. Watson, Alexander Gann, Tania A.Baker, Michael Levine, Stephen P.Bell, Rishard Losick, **Molecular Biology of the Gene**, Cold Spring Harbor Laboratory Press. New York. Seventh Edition, 2014.
2. Primrose, S.B., R. M. Twyman and R. W. Old, **Principles of Gene Manipulation**, Sixth Edition, Blackwell Science Publishing, 2008.
3. Brown TA. **Gene Cloning and DNA Analysis – An Introduction**, Wiley Blackwell Publishing, Sixth Edition, 2010.
4. <https://ocw.mit.edu/courses/health-sciences-and-technology/hst-161-molecular-biology-and-genetics-in-modern-medicine-fall-2007/lecture-notes/>

**Tools for Assessment (50 Marks)**

CIA I	CIA II	CIA III	Assignment	Seminar	Quiz	Total
8	8	10	8	8	8	50

**Mapping**

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	L	H	H	H	H	H	H	H	H	H	H
CO2	L	H	M	H	H	H	H	M	H	M	H	H	H
CO3	L	L	L	M	H	H	H	H	H	H	H	M	H
CO4	H	M	L	L	H	H	H	H	H	H	H	H	H
CO5	H	M	L	M	H	H	H	H	H	M	H	H	M

Course Designed by	Verified by HOD	Checked by	Approved by
	 2013	 Convenor CDC	

30 MAR 2022

Course Code	Title		
21PGMBC206	Paper VI - Immunology		
Semester : II	Credits : 4	CIA : 50 Marks	ESE: 50 Marks

**Course Objective:**

Imparting advanced technological knowledge through a detailed study of topics such as immunodiagnosis, assessment of cell mediated immunity and current trends in immunology of diseases.

**Course Outcomes:**

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

CO1	Gain knowledge on cells and organs of immune system.
CO2	Learn antigen and antibody reaction and determination.
CO3	Acquire knowledge on antigen and immunoglobulin's.
CO4	Understand different types of hypersensitive reactions.
CO5	Know about autoimmune diseases and treatment.

Offered by: Microbiology

**Course Content**

Instructional Hours/ Week : 5

Unit	Description	Text Book	Chapter
I	<b>Cells and Organs of immune system:</b> Cells of the immune system - lymphoid cells, mononuclear cells, granulocytic cells and mast cells. T & B – cell maturation, activation and differentiation. Organs of the immune system - primary and secondary lymphoid organs – cutaneous / mucosal - associated lymphoid tissues.	2, 3	3, 2
<b>Instructional Hours</b>			<b>15</b>
II	<b>Antigen - Antibody reactions:</b> Agglutination and precipitation. Immunelectrophoresis, Complement fixation test, Immunofluorescence, ELISA, RIA, Immuno electron microscopy. Forensic serology, Immunohaematology – ABO, RH incompatibility.	1, 3	13, 6
<b>Instructional Hours</b>			<b>15</b>
III	<b>Antigens and Immunoglobulin's:</b> factor influence immunogenicity - Epitopes - Haptens - study of antigenicity. Immunoglobulin's – structure – types and biological activities. Antigenic determinants. Monoclonal antibodies.	1, 3	11, 14
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Hypersensitive reactions:</b> Type. Complement system - classical, lectin pathways and lectin pathways, biological consequences. T - cell receptor. Cytokines – Structure, functions and receptors. Major Histocompatibility complex, classes, structure and its functions.	3	7, 13
<b>Instructional Hours</b>			<b>15</b>
V	<b>Autoimmune diseases:</b> Antigen processing and presentation - Transplantation immunology - Transplantation antigens, HLA typing. Tumor immunology - treatment of tumors. Immune response to infectious disease.	1, 3	19, 20
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book(s):**

1. Ananthanarayanan, R., and Panicker, C.K.J., **Text Book of Microbiology**. Orient Longman. New Delhi, 2004.
2. Coleman, R.M., Lombard, M.F., and Sicard, R.E., **Fundamental Immunology, 4<sup>th</sup> edition**, Wm. C. Publishers. London. 2000.
3. Goldsby, R.A., Barbara, T.J.K., and Osborne, A., **Kuby Immunology, 6<sup>th</sup> edition**, W.H. Freeman and Company, New York, 2006.

Unit I: Text Book 2, Chapter 3 (47-66), Text Book 3, Chapter 2 (24-55)

Unit II: Text Book 1, Chapter 13 (92-109), Text Book 3, Chapter 6 (137-158)

Unit III: Text Book 1 Chapter 11 (80-91), Text Book 3, Chapter 4 (76-100)

Unit IV: Text Book 3, Chapter 7 (161-182); Chapter 13 (299-317)

Unit V: Text Book 1 Chapter (169-176), Text Book 3, Chapter 20 (462-478)

**Reference Book(s):**

1. Coleman, R.M., Lombard, M.F., and Sicard, R.E., **Fundamentals of Immunology, 4<sup>th</sup> edition**, WMC Publications. London, 2000.
2. Hyde, R.M. **NMS - Immunology**. 4<sup>th</sup> edition, Lippincott Williams and Wilkins, Baltimore, 2000.
3. Janeway, Jr. C.A., Walport, P.T.M., and Shlomchick, M.J., **Immunobiology - The Immune System in Health and Disease**, 5<sup>th</sup> edition, Churchill Livingstone - Garland Publishing Company, New York, 2001.
4. <https://www.roitt.com/>

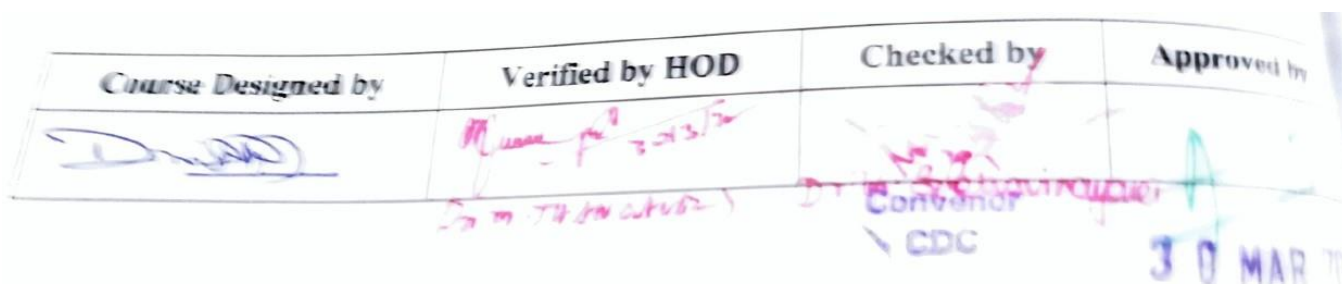
**Tools for Assessment (50 Marks)**

CIA I	CIA II	CIA III	Assignment	Seminar	Quiz	Total
8	8	10	8	8	8	50

**Mapping**

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	H	H	L	M	M	M	L	H	H	H	M	H
CO2	H	H	L	L	H	L	L	M	H	M	H	H	M
CO3	M	M	M	M	M	L	H	H	H	H	H	M	H
CO4	M	L	M	M	M	H	L	M	H	H	H	H	H
CO5	H	M	H	M	H	H	H	H	H	M	H	H	M

H – High; M- Medium; L – Low



Course Code	Title		
21PGMBC207	Paper VII – Computational Biology, Microbial Genomics and Proteomics		
Semester : II	Credits : 4	CIA : 50 Marks	ESE: 50 Marks

**Course Objective:**

To know the computational analysis of genes and genomes, protein sequences, analyzing proteins in lab and protein and gene sequence modification methods.

**Course Outcomes:**

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

CO1	List the importance of bioinformatics in systems biology.
CO2	Explain computational analysis the sequences for gene prediction.
CO3	Identify the use of genes and metabolic pathways in systems biology.
CO4	Infer the appropriate tools in systems biology for modeling.
CO5	Know about Concepts of OMICS.

Offered by: Biotechnology

**Course Content**

Instructional Hours / Week: 5

Unit	Description	Text Book	Chapter
I	<b>Biological Databases:</b> Introduction to bioinformatics - classification of biological databases, Biological data formats, Application of bioinformatics in various fields. <b>Systems Biology-</b> Understanding Biology at system level, requirement of system level understanding, computing and system biology.	1	1
<b>Instructional Hours</b>			<b>15</b>
II	<b>Introduction to Sequence alignment:</b> Substitution matrices – PAM and BLOSUM. Pairwise alignment methods; Multiple sequence alignment methods. Evolutionary analysis: distances - clustering methods – rooted and unrooted tree representation – Bootstrapping strategies.	1	4
<b>Instructional Hours</b>			<b>15</b>
III	<b>Genes and Genomes:</b> Interpreting expression data using Gene Ontology; Evolution of modularity and transcriptional networks, metabolite sensing and translational control; Microarrays-types and applications.	3	5
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Metabolic pathway database:</b> KEGG pathway database, Concept of metabolome and metabolomics. Gene networks - Integration of Networks.	4	24
<b>Instructional Hours</b>			<b>15</b>
V	<b>OMICS Concepts:</b> Genomics, Proteomics, transcriptomics, interactomics, Phenomics, localizomics; Combination of omics approaches: data integration, modeling; Synthetic biology	3	7
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book(s):**

1. Rastogi, C. S., Namita Mendiratta, **Bioinformatics-Methods and Applications**, PHI Learning Pvt. Ltd., 4<sup>th</sup> Edition, 2013.
2. Harisha, S., **Fundamentals of Bioinformatics**, I. K. International Publishing House, 1<sup>st</sup> Edition, 2007.
3. Sandy Primrose and Richard Twyman., **Principles of Gene Manipulation and Genomics**, Blackwell Publishing, 2010.

Unit – I: Text Book 1, Chapter 1, Page No. 1-26.

Unit – II: Text Book 1, Chapter 4, Page No. 57 -70

Unit – III: Text Book 3, Chapter 5, Page No. 106-126.

Unit – IV: Text Book 4, Chapter 24, Page No. 472-479.

Unit – V: Text Book 3, Chapter 7, Page No. 153-168.

**Reference Book(s):**

1. Teresa Attwood., **Introduction to Bioinformatics**, Pearson Publications, 1<sup>st</sup> Edition, 2007.
2. Andreas D. Baxevanis, B.F. Francis Ouellette., **Bioinformatics**, Wiley Publishers, 3<sup>rd</sup> Edition, 2011.
3. Dov Stekel., **Microarray Bioinformatics**, Cambridge University Press, 1<sup>st</sup> Edition, January 2010.
4. David Mount., **Bioinformatics: Sequence and Genome Analysis**, Cold Spring Harbor Lab Press, 2<sup>nd</sup> Edition, 2004.
5. <https://www.ncbi.nlm.nih.gov/books/NBK143764/>
6. <https://www.expasy.org/links>
7. [https://ww2.chemistry.gatech.edu/~lw26/course\\_Information/4581/labs/tbp/rasmol/rasmol\\_tbp\\_fset.html](https://ww2.chemistry.gatech.edu/~lw26/course_Information/4581/labs/tbp/rasmol/rasmol_tbp_fset.html)


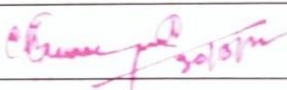
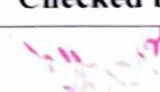

**Tools for Assessment (50 Marks)**

CIA I	CIA II	CIA III	Assignment	Seminar	Quiz	Total
8	8	10	8	8	8	50

**Mapping**

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	M	M	L	M	M	H	H	H	H	M	H
CO2	H	H	H	H	M	H	M	H	H	M	H	H	H
CO3	M	H	M	M	M	M	M	M	H	H	M	H	H
CO4	M	H	M	L	H	H	H	M	H	H	H	M	H
CO5	H	H	L	L	H	H	H	H	H	M	H	H	H

High; M-Medium; L-Low.

Course Designed by	Verified by HoD	Checked by	Approved by
			
			30 MAR 2022



Course Code	Title		
21PGMBC208	Paper VIII – Bioprocess Technology		
Semester : II	Credits: 4	CIA : 50 Marks	ESE: 50 Marks

**Course objective:**

Develop skills of the students in the area of Bioprocess Technology with emphasis on screening, strain improvement methods and microbial production of various metabolites.

**Course outcomes:**

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

CO1	Operate fermenter in the fermentation process.
CO2	Get knowledge about the sterilization of the medium and upstream process of bioreactors.
CO3	Attain technical knowledge on bacterial growth kinetics.
CO4	Analyse the types of microbial products and downstream processing.
CO5	Demonstrate the screening and strain improvement of industrially important organisms.

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

Unit	Description	Text Book	Chapter
I	<b>Basic Design of Fermenter:</b> Design of a basic fermenter, bioreactor configuration, design features, computer control of fermentation process, measurement and control of process. Types of Bioreactors and its functions.	1	15
<b>Instructional Hours</b>			<b>15</b>
II	<b>Physical factors and scale-up:</b> Transport phenomena in fermentation: Gas- liquid exchange and mass transfer, oxygen transfer, critical oxygen concentration, heat transfer, aeration/agitation, its importance. Sterilization of Bioreactors, nutrients, air supply, products and effluents, process variables and control, scale-up of bioreactors.	3	6
<b>Instructional Hours</b>			<b>15</b>
III	<b>Cultures in the fermenter:</b> Growth of cultures in the fermenter. Importance of media in fermentation, media formulation and modification. Kinetics of growth in batch culture, continuous culture with respect to substrate utilization, specific growth rate, steady state in a chemostat, fed-batch fermentation, yield of biomass, product, calculation for productivity.	4	2
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Microbial Products and Downstream process:</b> Enzymes- Introduction, Immobilized Enzyme system, large scale production, medical and industrial application. Down streaming process of microbial products (Peptides, Biopolymers, surfactants, Enzymes) - separation, extraction and purification, drying, crystallization centrifugation, filtration, freeze-drying, spraydrying.	3	7
<b>Instructional Hours</b>			<b>15</b>

V	<b>Strain improvement &amp; Preservation:</b> Isolation, selection and improvement of microbial cultures. Strain improvement for the selected organism: Use of recombinant DNA technology, protoplast fusion techniques for strain improvement. Improvement of characters other than products and its application in the industry. Preservation of cultures after strain improvement programme.	2	6
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book(s):**

1. Mansi, E.M.T., and Bryce, C.F.A., **Fermentation Microbiology and Biotechnology**. 3<sup>rd</sup> edition, Taylor and Francis, New York, 2012.
2. McNeil. B and Harvey, L.M. **Practical Fermentation Technology**, John Wiley & Sons, Ltd., 2008.
3. Waites, M., Morgan, N.L., Rockey, J. S., Higton, G. **Industrial Microbiology: An Introduction**, Wiley, 2001.
4. Stanbury, P.T., and Whitaker, A. **Principles of Fermentation Technology**, Pergamon Press. NY, 2005.

Unit I: Text Book 1, Chapter 15 (415-430)

Unit II: Text Book 3, Chapter 6 (94-108)

Unit III: Text Book 4, Chapter 2 (21-68)

Unit IV: Text Book 3, Chapter 7 (109-123) Chapter 9 - 11 (113-165)

Unit V: Text Book 2, Chapter 6 (125-160), T. Book 3, Chapter 4 (75-85).

**Reference Book(s):**

1. Patel, A.H. **Industrial Microbiology**. Macmillan India Ltd. New Delhi, 2003.
2. Reed, G. **Presscott and Dunn's Industrial Microbiology**. 5<sup>th</sup> edition, CBS Publishers, New Delhi, 2002.
3. [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)


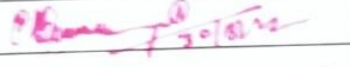
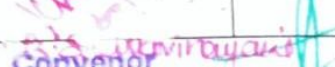

**Tools for Assessment (50 Marks)**

CIA I	CIA II (Online)	CIA III	Assignment	Seminar	Quiz	Total
8	8	10	8	8	8	50

**Mapping**

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	L	H	L	L	H	M	H	H	H	H	M	H	H
CO2	M	H	H	H	H	H	H	H	H	H	H	M	H
CO3	M	M	L	M	H	H	H	H	H	M	H	H	H
CO4	H	M	L	M	H	H	H	H	H	H	H	H	M
CO5	H	H	M	M	H	H	H	H	H	M	M	H	M

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
		 Convenor CDC	 3-0 MAR 2022



Course Code	Title		
21PGMBQ202	Practical II – Lab in Molecular Biology and Immunology		
Semester : II	Credits : 4	CIA : 50 Marks	ESE : 50Marks

**Course Objective:**

Students get hands on experience on the experiments related to molecular biology and immunology.

**Course Outcomes:**

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

<b>CO1</b>	Examine the isolation and characterization of plasmid and chromosomal DNA.
<b>CO2</b>	Demonstrate the principle and characterization of SDS PAGE.
<b>CO3</b>	Analyse the amplification of DNA by PCR.
<b>CO4</b>	Perform various serological techniques.
<b>CO5</b>	Perform various immunotechniques.

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

S. No.	Title
1	Isolation of mutants: Auxotrophic and Antibiotic resistant.
2	Isolation and characterization of chromosomal DNA from bacteria.
3	Isolation and characterization of plasmid DNA from bacteria.
4	Restriction digestion of DNA by agarose gel electrophoresis.
5	Separation of protein by SDS PAGE.
6	Isolation of protoplast and spheroplast.
7	DNA amplification by PCR.
8	Agglutination reaction: Blood grouping.
9	Serological tests: WIDAL, ASO, CPR, RPR
10	Precipitation reaction: ODD, RID
11	Immunoelectrophoresis: Counter current and Rocket electrophoresis
12	ELISA
<b>Total Hours: 75</b>	

**Text Book(s):**

1. James G. Cappuccino and Chad Welsh. **Microbiology A Laboratory Manual**. Pearson Education Limited. 11<sup>th</sup> edition. 2017.
2. Aneja, K. R. **Experiment sin Microbiology, Plant Pathology and Biotechnology**. New Age International (P) Limited Publisher. 2014.

**Reference Book(s):**

1. Dixit, R., K. Bisen, A. Kumar, A. Borah and C. Keswani. **Lab Manual in Molecular Biology**. 1<sup>st</sup> edition. 2016.
2. Goldsby, R. A., T. J. Kindt, B. A. Osborne and J. Kuby. **Immunology**, 5<sup>th</sup> edition. W.H. Freeman and Company, 2003.





**Tools for Assessment (50 Marks)**

Laboratory Performance			Test I (Mid sem.)	Test II (Model)	Observation notebook	Total
Level of engagement in lab	Preparation	Result				
8	8	8	10	10	6	50

**Mapping**

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	H	H	H	H	H	H	M	H	H
CO2	M	H	H	H	H	H	H	H	H	H	H	M	H
CO3	H	H	H	H	H	H	H	H	H	M	H	H	H
CO4	H	H	H	M	H	H	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	H	H	H	H	M	H	M

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

Course Designed by	Verified by HOD	Checked by	Approved by
	 Dr. M. B. S. N. Chatterjee	 Coordinator CDC	 30 MAR 2022

# SEMESTER – III

Course Code	Title		
21PGMBC309	Paper IX -Environmental and Agricultural Microbiology		
Semester: III	Credits: 4	CIA - 50 Marks	ESE - 50 Marks

**Course Objective:**

To gain understanding of the role of microbes in soil physiology, as well as air pollution and its sources and causes, as well as environmental contamination and toxicology, environmental health, monitoring, technology, geology, and management.

**Course Outcomes:**

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

CO1	Acquire the knowledge of different microbes from air, air sanitization and air sampling using various techniques.
CO2	Understand the factors influencing presence of and activities of microorganisms in different soils.
CO3	Know the Microorganisms responsible for water pollution especially Water-borne pathogenic microorganisms and their transmission.
CO4	Understand various biogeochemical cycles – Carbon, Nitrogen, Phosphorus cycles etc. and microbes involved.
CO5	Understanding the use of Biofertilizers is being emphasized along with chemical fertilizers and organic manures.

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

Unit	Description	Text Book	Chapter
I	<b>Aerobiology</b> -Microbial contamination of air-Biological indicators of air pollution. Air sampling Devices. Significance of air Microflora, Air sanitation- methods and applications. Room sanitation in Hospitals, Industries and Pharmaceuticals etc. Outline of Airborne diseases and preventive measures. Effect of Air pollution on plants and Humans.	2	15
<b>Instructional Hours</b>			<b>15</b>
II	<b>Soil Microbiology</b> -Structure, Types, Physical and Chemical properties-Soil microbes (Types and Enumeration). Soil as a source of industrial strains. Biogeochemical cycling-Nitrogen, Carbon, Phosphorous, Sulphur, Iron cycles and its importance.	1	2
<b>Instructional Hours</b>			<b>15</b>
III	<b>Water Microbiology</b> - Water Pollution and Waterborne Pathogens- Assessment of water quality (Microbial) Bacteriological examination of water-Indicator organisms. Bacteriological analysis of drinking water and other quantitation techniques; drinking water purification. Waste water- Sources, types, composition and characteristics (DO, BOD, COD). Microbiology of waste water. Sewage treatment.	1	9-11
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Microbial interactions:</b> Positive and Negative interactions. Microbial flora of soil. Plant – Microbe interactions:-Nitrogen fixation- Symbiotic and non-symbiotic, physiology and genetics of nitrogen fixation. Mycorrhizae, Rhizosphere and Phylloplane microorganisms. Animal-Microbe Interactions - Rumen microflora, Nematophagous fungi, Bioluminescent bacteria, Termite nutrition	2	48
<b>Instructional Hours</b>			<b>15</b>
V	<b>Applications of microbes in agriculture:</b> Biofertilizers. Mass production of biofertilizers. Bio pesticides- bacterial, fungal and		14,15, 37

viral. Advantages and disadvantages of biopesticides over the chemical counterparts. GM crops and its significance.	2	& 45
<b>Instructional Hours</b>	<b>15</b>	
<b>Total Hours</b>	<b>75</b>	

**Text Book(s):**

1. Subba Rao N.S. **Soil microbiology**, 4<sup>th</sup> Edition Oxford and PHB publishers. 2020.
2. Vijay Ramesh.K. **Environmental Microbiology**. 2019.

Unit I: Text Book 2 Chapter 15: 56  
 Unit II:Text Book 1 Chapter 2: 11-46  
 Unit III: Text Book 1 Chapter 9-11: 317-337  
 Unit IV: Text Book 2 Chapter 48: 141  
 Unit V: Text Book 2 Chapter 14, 15, 37 &45: 302-342

**Reference book(s):**

1. Gupta P.K. **Biotechnology and genomics**, Rastogi Publications. 2013.
2. Larry. L. Barton, **Microbial Ecology**, Atlas and Bartha. 1<sup>st</sup> Edition. 2011.
3. Singh DP & SK Dwivedi. **Environmental Microbiology and Biotechnology**. 1<sup>st</sup> Edition, New Age International (P) Ltd., Publishers, New Delhi. 2005.
4. Joseph C Daniel. **Environment Aspects of Microbiology**. 1<sup>st</sup> Edition, Bright sun Publications, Chennai. 1999.
5. <https://drive.google.com/file/d/1R7kCrPX14ejScvHuEAxIs3a1N9NC1EdO/view?usp=sharing>
6. <https://drive.google.com/file/d/1kz/Q4K6Ta8pHneJxzdRcuqFG7UOhWq9y/view?usp=sharing>

**Tools for Assessment (50 Marks)**

CIA I	CIA II	CIA III	Assignment	Quiz	Model	Total
8	8	10	8	8	8	50

**Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	L	H	L	L	M	H	H	H	L	L	M
CO2	M	H	L	H	M	L	H	H	H	H	L	L	M
CO3	H	H	M	H	M	H	M	H	H	H	L	L	M
CO4	L	L	M	H	H	M	H	H	L	H	L	L	L
CO5	M	H	L	H	M	M	H	M	M	H	L	L	H

H - High; M - Medium; L – Low

Course Designed by	Verified by HOD	Checked by	Approved by
<i>Dr. S. Esath Nazeer</i> 30/03/2022 (Dr. S. Esath Nazeer)	<i>Chinnthara</i> 30/03/2022 (Chinnthara)	<i>Dr. S. Esath Nazeer</i> 30/03/2022 Coordinator CDC	<i>Dr. S. Esath Nazeer</i> 30/03/2022 30 MAR 2022

Course Code	Title		
21PGMBC310	Paper X – Microbial Biotechnology and IPR		
Semester: III	Credits: 4	CIA : 50 Marks	ESE: 50 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	Outline Scope and Application of Microbial products.
CO2	Interpret the use of microorganisms in Industrial Scale.
CO3	Applications of microbes in biotransformation, therapeutic and industrial biotechnology
CO4	Explain Intellectual Property Rights and protection
CO5	Explicate patent agreements

Offered by: Microbiology

**Course Content**

Instructional Hours / Week: 5

Unit	Description	Text Book	Chapter
I	<b>Microbial biotechnology:</b> Scope and its applications in human therapeutics, agriculture (Biofertilizers, PGPR, Mycorrhizae), environmental, and food technology. Use of prokaryotic and eukaryotic microorganisms in biotechnological applications. Genetically engineered microbes for industrial application: Bacteria and yeast.	1	2
<b>Instructional Hours</b>			<b>15</b>
II	<b>Therapeutic and Industrial Biotechnology</b> Recombinant microbial production processes in pharmaceutical industries - Streptokinase, recombinant vaccines (Hepatitis B vaccine). Microbial polysaccharides and polyesters, Microbial production of bio-pesticides, bioplastics, Microbial biosensors.	2	11,12
<b>Instructional Hours</b>			<b>15</b>
III	<b>Applications of Microbes in Biotransformations</b> Microbial based transformation of steroids and sterols, Bio-catalytic processes and their industrial applications: Production of high fructose syrup and production of cocoa butter substitute.	3	1
<b>Instructional Hours</b>			<b>15</b>
IV	<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).	4	1
<b>Instructional Hours</b>			<b>15</b>
V	<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.	4	4,5
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book(s):**

- Alexander N. Glazer and Hiroshi Nikaido **Microbial Biotechnology Fundamentals of applied Microbiology**, Cambridge University Press 2<sup>nd</sup> edition 2007.
- Bernard R. Glick, Jack J. Pasternak and Cheryl L. Patten, **Molecular Biotechnology Principles and applications of recombinant DNA**. ASM Press 4<sup>th</sup> edition, 2010.
- Colin Ratledge and Bjorn Kristiansen, **Basic Biotechnology**, Cambridge University Press, 2<sup>nd</sup> Edition 2013.
- Deepa Goel and Shomini Parashar, **IPR, Biosafety and Bioethics**, Pearson Publication 2013.  
 Unit I : Text Book 1, Chapter 2: 45 - 85. Text Book 2, Chapter 13: 501-545  
 Unit II : Text Book 2, Chapter 5: 169 - 199. Chapter 8: 267-295.  
 Unit III: Text Book 3, Chapter 24: 549 - 578.  
 Unit IV: Text Book 4, Chapter 1: 1 - 20, Chapter 3: 47 – 57.  
 Unit V : Text Book 4, Chapter 4: 62 - 72, Chapter 5: 84 – 99.

**Reference Book(s):**

- Prescott, Harley and Klein’s **Microbiology** by Willey JM, Sherwood LM, Woolverton CJ 9<sup>th</sup> edition, Mc Graw Hill Publishers. 2014.
- Peter F. Stanbury, Allan Whitaker, Stephen J. Hall. **Principles of Fermentation Technology**, Butterworth-Heinemann – Elsevier. 3<sup>rd</sup> Edition 2017.
- Kankanala C, **Genetic Patent Law & Strategy**, 1<sup>st</sup> Edition, Manupatra Information Solution Pvt. Ltd. New Delhi. 2007.
- Singh K K. **Biotechnology and Intellectual Property Rights: Legal and Social Implications**, Springer India. 2015.
- Senthil Kumar Sadhasivam and Mohammed Jaabir, M. S. **IPR, Biosafety and biotechnology Management**. Jasen Publications, Tiruchirappalli, India. 2008.
- [Intellectual Property Rights and Biological Resources \(wupperinst.org\)](http://wupperinst.org)
- [9.4 Intellectual Property Rights.pdf \(icsi.edu\)](http://icsi.edu)

**Tools for Assessment (50 Marks)**

CIA I	CIA II	CIA III	Assignment	Quiz	Seminar	Total
8	8	10	8	8	8	50

**Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	M	H	M	H	H	H	L	L	H
CO2	H	H	H	L	M	H	H	M	H	H	H	L	H
CO3	H	H	L	H	H	H	M	H	H	H	H	H	H
CO4	H	H	H	M	M	H	M	H	L	M	M	L	H
CO5	H	H	H	M	M	H	M	H	H	M	L	H	H

H-H igh; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
		 Dr. K. S. ... Convenor CDC	 30 MAR 2022



Course Code	Title		
21PGMBC311	Paper XI – Biostatistics and Research Methodology		
Semester: III	Credits: 4	CIA : 50 Marks	ESE: 50 Marks

**Course Objective:**

Students can have knowledge about designing the research project and various statistical applications in Research

**Course Outcome:**

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

CO 1	Know about various statistical applications in research.
CO 2	Get the knowledge of Plagiarism and research ethics
CO 3	Understand the knowledge of project design, processing and presentation of research data
CO 4	Understand the basic ideas of significant test and its hypothesis
CO 5	Analyze the types and significance of research

Offered by: Microbiology

**Course Content**

Instructional Hours/ Week: 5

Unit	Description	Text Book	Chapter
I	<b>Definition</b> – Scope of Biostatistics, Probability analysis, Variables in Biology-Collection, Classification and Tabulation of data. Graphical and diagrammatical representation –Scale diagram - Histogram- frequency curve	2	1-3, 5-6
Instructional Hours			<b>15</b>
II	<b>Measures of central tendency</b> - Arithmetic mean, Median, Mode. Calculation of Mean, median, Mode in series of individual observations, discrete series, continuous, open end classes, measure of dispersion, standard deviation, standard error.	2	7-8
Instructional Hours			<b>15</b>
III	<b>Simple correlation coefficient</b> , correlation regression- simple and linear	2	10,11
Instructional Hours			<b>15</b>
IV	<b>Basic ideas of significant test</b> -Hypothesis testing, Level of significant test, test based on studies-t-test- chi square, Goodness of fit.	2	3-5
Instructional Hours			<b>15</b>
V	<b>Research Methodology</b> – Types of Research- Significance of Research. Research Problem - Selection of research problem – Formulation of research objectives - project design - review of literature writing	1	1-3
Instructional Hours			<b>15</b>
Total Hours			<b>75</b>

**Text Book(s):**

1. Gupta.S.P. **Statistical Methods**. Sulthan Chand and Sons. 2012.
2. Kothari. **Research Methodology: Methods and Techniques**. New Age International Publishers. New Delhi. 2004.

Unit I: Text Book 2 Chapter 1-3,5-6:27-39

Unit II:Text Book 2 Chapter 7-8: 79-118

Unit III: Text Book 2 Chapter 10-11: 175-199



Unit IV: Text Book 2 Chapter 3-5: 201-262

Unit V: Text Book 1 Chapter 1-3: 289-386

**Reference Book(s):**

1. S.C. Gupta and V. K. Kapoor. **Fundamentals of Mathematical Statistics.** Sulthan Chand and Sons. 11<sup>th</sup> Edition. 2002.
2. Sokal, R.R. and Rohlf, F.J. **An Introduction to Biostatistics.** W.H. Freeman and Company. 1987.
3. [Research Methodology \(cusb.ac.in\)](http://cusb.ac.in)
4. [Biostatistics & Research Methodology--PharmD Notes ~ Revolution PharmD](#)

**Tools for Assessment (50 Marks)**

CIA I	CIA II	CIA III	Assignment	Seminar	Quiz	Total
8	8	10	8	8	8	50

**Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	L	M	M	M	L	H	L	M	L	L	H
CO2	M	H	M	L	H	H	M	H	L	L	L	L	H
CO3	M	H	H	L	H	H	M	H	L	L	L	L	H
CO4	H	L	H	M	M	M	M	M	L	L	L	L	H
CO5	H	H	M	L	H	H	L	H	L	H	L	L	H

H – High; M- Medium; L - Low

Course Designed by	Verified by HOD	Checked by	Approved by
M. DHANALAKSHMI 30/3/22	P. CHANDRASEKHAR 30/3/22	Convenor CDC	30 MAR 2022

Course Code	Title		
21PGMBC312	Core Paper XII- Microbial Food Technology		
Semester III	Credits: 4	CIA: 50 Marks	ESE: 50 Marks

**Course Objective:**

Students will gain the knowledge of various types of food spoilage and an understanding the principles of food processing and to improve the food quality for the general public. They will come to know the role of ISO and FAO etc.

**Course Outcome:**

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

CO 1	To learn about the food and spoilage mechanism
CO 2	Gain knowledge about the food borne diseases and dairy products
CO 3	Understand the collection and processing of food items
CO 4	Know about the use of microorganisms in food industries for public health benefits.
CO 5	Gain knowledge on various control agencies for food products

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

Unit	Description	Text Book	Chapter
I	<b>The Scope of Food Microbiology:</b> Microorganism and food, Food preservation, Food safety.	1	1, 3
	<b>Microbial growth-</b> Intrinsic factors, Nutrient content, P <sup>H</sup> , anti-microbial barrier and constituents, Extrinsic factors: relative humidity, temperature, Gaseous atmosphere.		
	<b>Microbiology of primary food commodities:</b> Spoilage, Spoilage of meat, Structure and composition, Spoilage of fresh meat, Spoilage of fish, structure and composition, spoilage of fresh fish.	1	4, 5
<b>Instructional Hours</b>			<b>15</b>
II	<b>Food borne diseases-</b> Introduction to Foodborne Pathogens, Host invasion, Pathogenesis. Staphylococcal Gastro enteritis, Habitat, distribution, nutritional requirement and growth, Prevention.	2	22, 7
	<b>Fermented milk products</b> –Dairy products, Milk biota, Cheese, Butter. Health benefits of fermented milk, Anti-cancer effect, probiotics. Botulism, Salmonellosis, Gastro entero enteritis, Shigellosis and Yersiniosis.	2	26
<b>Instructional Hours</b>			<b>15</b>
III	<b>Microbiology of food preservation:</b> Preservation by use of High temperature, Low temperature, Canning, Drying, Radiation and Food additives.	1	3, 4
	<b>Food preservation-</b> Heat processing – Pasteurization, Appertization, Quantifying Thermal Death of microorganism D values, Aseptic packaging methods.		
	<b>Methods for the Microbiological Examination of Foods:</b> Indicator organism, Direct examination, Rapid Methods for the Detection of Specific Organisms and Toxins, Laboratory Accreditation	1	10
<b>Instructional Hours</b>			<b>15</b>

<p><b>IV</b></p>	<p><b>Food Microbiology and Public Health:</b> Food Hazards, Significance of Foodborne Disease, Risk Factors Associated with Foodborne Illness, <b>The Alimentary Tract:</b> Its Function and Microflora.</p>	<p>3</p>	<p>6</p>
	<p><b>Chemical Preservatives:</b> Nitrite, Sulfur Dioxide, ‘Natural’ Food Preservatives, Control of Water Activity.</p>	<p>3</p>	<p>4</p>

<b>Instructional Hours</b>			<b>15</b>
<b>V</b>	<b>Controlling the Microbiological Quality of Foods:</b> The Hazard Analysis and Critical Control Point (HACCP) Protocols for CCP Deviations, Record keeping, Risk analysis. Quality, Codes of Good Manufacturing Practice.	3	11
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book(s):**

1. M.R. Adams and M.O. Moss, **Food Microbiology**. 2<sup>nd</sup> Edition. Royal society of chemistry. Thomas Graham House, science park, Cambridge. 2005.
2. James M Jay. **Modern food microbiology**. 6<sup>th</sup> Edition. Aspen publishers, Maryland. 2000.
3. Martin R. Adams and Maurice O. Moss. **Food Microbiology**, 3<sup>rd</sup> edition, Royal society of chemistry. Thomas Graham House, Science Park, Cambridge. 2008.

Unit: 1: Text book: 1- Chapter:1 pp 1-4

Chapter:3 pp 21-51

Chapter:4 pp 93-109

Chapter:5 pp 133-138

Unit: 2: Text book: 2- Chapter:22 pp 423-427

Chapter:7 pp 123-128

Chapter:26 pp 511-528

Unit: 3: Text book: 1- Chapter:3 pp 63 - 80

Chapter:4 pp 93 109

Chapter:10 pp 370-388,394

Unit: 4: Text book: 3-Chapter:4 pp 90-112

Chapter:6 pp 158-172

Unit: 5: Text book: 3- Chapter:11 pp 396,425-434

**Reference Book(s):**

1. Jay, J.M . **Modern Food Microbiology**., Van Nostra and Rainhokdd Co. 4<sup>th</sup> Edition. 1991.
2. Roday. S. **Food Hygeine and Sanitation**. Tata Mcgraw Hill Publications, 1998.


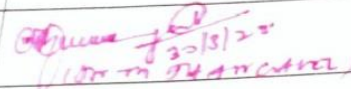


**Tools for Assessment (50 Marks)**

CIA I	CIA II	CIA III	Assignment	Quiz	Seminar	Total
8	8	10	8	8	8	50

**Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	L	M	M	H	H	M	H	M	L	L	M
CO2	M	M	L	H	L	H	M	H	H	H	L	H	M
CO3	M	H	M	H	M	H	H	H	H	M	L	H	L
CO4	L	L	H	H	M	H	H	M	M	H	L	L	L
CO5	H	H	L	M	H	H	H	M	L	H	L	L	L

H-High; M-Medium; L-Low

<b>Course Designed by</b>	<b>Verified by HOD</b>	<b>Checked by</b>	<b>Approved by</b>
	 30/3/2022	 Convener CDC	 30 MAR 2022

Course Code	Title		
21PGMBQ303	Practical III -Lab in Environment, Agriculture and Food Microbiology		
Semester: III	Credits: 4	CIA - 50 Marks	ESE - 50 Marks

**Course Objective:**

Students get hands on experience on the basic techniques on area Environment, Agriculture and Food Microbiology

**Course Outcomes:**

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

CO1	Students will learn sampling of microbes from air and get to study new organisms apart from standard preserved cultures
CO2	The knowledge of isolation of various physiological groups of bacteria from soil will help them in screening bacteria for future research activities.
CO3	They will learn to carry out routine analysis of potable water and rapid detection of <i>E coli</i> by MPN technique.
CO4	The students will have a fair knowledge of food spoilage and preservation techniques used in the food industry.
CO5	They will be competent to take up the role of microbiologists in the Food and Dairy Industry.

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

S. No.	Experiment
1.	Bioassay of Bti and Bt
2.	Comparison of microflora in Bt-treated and chemical pesticide-treated Soils
3.	Isolation and Enumeration of soil microbes by plate culture methods.
4.	Isolation of free-living nitrogen fixing bacteria
5.	Isolation of Rhizobium from root nodules of leguminous plants
6.	Isolation of phosphate solubilizing microorganisms
7.	Bacteriological examination of air
8.	Bacteriological examination of water
9.	BOD and COD determination
10.	Enumeration of microorganisms in foods
11.	Collection, sampling and microbiological analysis of food materials from local vendors.
12.	Study of microflora in fermented foods - Isolation of microbes from yoghurt, curd.
13.	Dairy Microbiology - Direct microscopic count and standard plate count
14.	Methylene blue reductase test
15.	Methylene blue reductase test
16.	Production of wine
17.	Demonstration of microbial succession
18.	Demonstration of microbial antagonism
19.	Total Hours : 75

**Text Book(s):**

1. Rajan, **Text book of Experimental Procedures in Life Sciences**. 2019.
2. Shalini Sehgal. **A Laboratory Manual of Food Analysis**. 2020.
3. Subba Rao N. S. **Agricultural Microbiology**. Medtech. 3<sup>rd</sup> Edition, 2020.
4. Rumpa Saha and Shukla Das. **Microbiology Practical manual**. Kindle edition.2022.
5. Richard. K. Robinson. **Dairy Microbiology Handbook**. 3<sup>rd</sup> Edition. A John Wiley & Sons, Inc., Publication. 2002.

**Reference Book(s):**

1. Dubey RC and Maheshwari DK., **Practical Microbiology**. S Chand and Co. Ltd., New Delhi, 2002.
2. Gunasegaram.P, **Laboratory Manual in Microbiology**. New Age International. 2007.
3. <https://microbenotes.com/fields-of-microbiology/>
4. [https://bio.libretexts.org/Bookshelves/Microbiology/Book%3AMicrobiology\\_\(Boundless\)/1%3A\\_Introduction\\_to\\_Microbiology/1.3%3A\\_The\\_Science\\_of\\_Microbiology/1.3B\\_Applied\\_Microbiology](https://bio.libretexts.org/Bookshelves/Microbiology/Book%3AMicrobiology_(Boundless)/1%3A_Introduction_to_Microbiology/1.3%3A_The_Science_of_Microbiology/1.3B_Applied_Microbiology)

**Tools for Assessment (50 Marks)**

Laboratory Performance			Test I	Test II	Observation notebook	Total
Level of engagement in lab	Preparation	Result				
8	8	8	10	10	6	50

**Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	L	L	M	H	H	M	H	H	H	L	L	M
CO2	H	M	L	H	M	M	L	M	H	H	L	L	L
CO3	L	L	L	H	M	M	M	L	H	M	L	L	L
CO4	H	M	M	H	M	H	H	H	H	L	L	L	L
CO5	H	H	H	H	H	H	H	H	M	M	L	L	M

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by

(Dr. M. Phaniendra)

Dr. M. Phaniendra  
Convenor  
CDC

30 MAR 2022

# SEMESTER IV

Course Code	Title		
21PGMBC413	Paper XIII – Medical Microbiology		
Semester: IV	Credits: 4	CIA :50 Marks	ESE:50 Marks

**Course Objective:**

This course is intended to provide the student with a foundation in medical microbiology. Concepts in bacteriology, mycology and parasitology will be explored.

**Course Outcomes:**

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

CO1	Understand the Infection, types of infection, Host-parasite relationship and Micro flora of human body.
CO2	Gain knowledge on nature of Antimicrobial agents.
CO3	Understand the different concepts of control agents for microorganisms.
CO4	Acquire knowledge on parasitology morphology and life cycle.
CO5	Learn the techniques to control the pathogenicity and laboratory diagnosis of fungi.

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

Unit	Description	Text Book	Chapter
I	<b>Infection:</b> types of infection, sources of infection, reservoirs and vehicles of infection, predisposing factors. <b>Host-parasite relationship:</b> governing the infection and establishment of disease, factors affecting virulence. <b>Normal Micro flora of human body:</b> normal flora of skin, respiratory, gastrointestinal, genital tract, role of resident flora, concept of probiotics. Mode of spread of infection; Respiratory, skin, wound & burn infection, venereal infections, alimentary tract infection, blood born infection and nosocomial infection.	1	9,10
<b>Instructional Hours</b>			<b>15</b>
II	<b>Antimicrobial agents:</b> History, Antibiotics, Antifungal and Antivirals (common drugs, their spectrum and mode of action). Methodologies for testing of antibacterial, antifungal, and antiviral drugs (in vivo and in vitro infectivity models), mechanism drug resistance. Clinical studies: Phase I, phase II, phase III and phase IV of clinical trials –Objectives, Conduct of trials, Outcome of trials.	1	28
<b>Instructional Hours</b>			<b>15</b>
III	<b>Bacteriology:</b> Gram positive organisms - Morphology, cultural characteristics, pathogenicity and laboratory diagnosis of <i>Staphylococcus aureus</i> , <i>Streptococcus pyogenes</i> , <i>Bacillus anthracis</i> , <i>Mycobacterium tuberculosis</i> . Gram negative organisms -. <i>E. coli</i> , <i>Salmonella typhi</i> , <i>Vibrio cholerae</i> , <i>Pseudomonas aeruginosa</i> , <i>Neisseria gonorrhoeae</i>	2	22-41
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Parasitology:</b> Morphology, Life cycle, Pathogenicity and laboratory diagnosis of <i>Entamoeba histolytica</i> , <i>Trichomonas vaginalis</i> , <i>Plasmodium malariae</i> , <i>Taenia solium</i> , <i>Enterobius vermiculari</i> , <i>Ascaris lumbricoides</i> .	3	3-18
<b>Instructional Hours</b>			<b>15</b>
V	<b>Mycology:</b> Morphology, Pathogenicity and laboratory diagnosis of <i>Candida albicans</i> , <i>Cryptococcus neoformans</i> , <i>Aspergillus</i> , <i>Histoplasma capsulatum</i> .	4	8-15



<b>Instructional Hours</b>	<b>15</b>
<b>Total Hours</b>	<b>75</b>

**Text Book(s):**

- Brooks, G. F., Jawetz, Melnick and Adelbergs **Medical Microbiology**. New York.: McGraw-Hill Medical.2007.
- Paniker, C. K., and Ananthanarayan, R. Ananthanarayan and Panikers, **Textbook of Microbiology**. Himayatnagar, Hyderabad: Orient Longman.2005.
- Paniker, C. K., **Textbook of Medical Parasitology**. New Delhi: Jaypee Brothers Medical (P).2007.
- Anaissie, E. J., **Clinical Mycology**. Churchill Livingstone: Elsevier.2009.

- Unit I : Text Book 1, Chapter 9, 10 :149-173  
 Unit II : Text Book 1, Chapter 28: 371-379  
 Unit III : Text Book 2, Chapter 22-41:192- 395  
 Unit IV : Text Book 3, Chapter 3-18 :14-189  
 Unit V : Text Book4, Chapter 8-15 :199-369

**Reference Book(s):**

- Patricia, M.T. Bailey and Scott’s **Diagnostic Microbiology**, 13<sup>th</sup> Edition, Mosby, Inc. Publishers, China. 2014.
- Patrick R.Murray, Ken.S.Rosenthal, George.S.Kobayashi, Michael A.Ptaller **Medical Microbiology**., 3<sup>rd</sup> Edition, C.V. Mosby Co. 1998.
- <https://microbiologyinfo.com/>

**Tools for Assessment (50 Marks)**

CIA I	CIA II (Online)	CIA III	Assignment	Seminar	Quiz	Total
8	8	10	8	8	8	50

**Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	L	M	H	H	H	H	H	H	H	H	H
CO2	M	H	M	L	H	H	M	H	L	M	H	H	M
CO3	H	H	M	L	H	H	H	H	H	H	H	H	M
CO4	M	M	M	L	H	M	M	H	H	H	L	H	H
CO5	H	H	M	M	H	H	H	H	H	H	M	L	M

H - High; M - Medium; L – Low

<b>Course Designed by</b> <i>[Signature]</i> 20/13/12	<b>Verified by HOD</b> <i>[Signature]</i> 20/13/12	<b>Checked by</b> <i>[Signature]</i> Dr. H. S. Sathya Narayana Convenor CDC	<b>Approved by</b> <i>[Signature]</i> 30 MAR 2022
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DR. M. THANGAVEL      DR. M. THANGAVEL



# 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.



## OFFICE OF CONTROLLER OF EXAMINATIONS

### GUIDELINES FOR PREPARATION OF PROJECT REPORT

#### 1. ARRANGEMENT OF CONTENTS:

The sequence in which the project report material should be arranged and bound is as follows:

1. Cover Page & Title Page
2. Bonafide Certificate
3. Abstract
4. Table of Contents
5. List of Tables
6. List of Figures
7. List of Symbols, Abbreviations
8. Chapters
9. Appendices
10. References

The table and figures shall be introduced in the appropriate places.

#### 2. PAGE DIMENSION AND SIZE OF THE PROJECT REPORT:

(a) The size of the project report for undergraduate and post graduate degree should contain a minimum of 40 and 60 pages of content respectively. The pages will be counted from the first page of Chapter I. The dimension of the project report should be in A4 size.

(b) The project report should be bound using flexible cover of thick art paper. The cover should be **printed in black letters** and the text for printing should be identical.

**(c) Page Numbering**

All page numbers (**whether it is in Roman or Arabic numbers**) should be typed without punctuation on the central bottom of each page. The preliminary pages of the reports (such as Title page, Acknowledgement, Table of Contents, etc.) should be numbered in lower case Roman numerals. The title page will be numbered as (i) but this should not be typed. The page immediately following the title page shall be numbered as (ii) and it should appear at the top right hand corner as already specified. Pages of main text, starting with Chapter 1 should be consecutively numbered using Arabic numerals.

**3. PREPARATION FORMAT:**

**Cover Page & Title Page** – A specimen copy of the Cover page & Title page of the project report are given in **Appendix 1**.

**Bonafide Certificate** – The Bonafide Certificate shall be in **double line spacing using Font Style Times New Roman and Font Size 14**, as per the format in **Appendix 2**.

The certificate shall carry the supervisor's signature and shall be followed by the supervisor's name, academic designation (not any other responsibilities of administrative nature) and Department where the supervisor has guided the student. The term „**SUPERVISOR**“ must be typed in capital letters between the supervisor's name and academic designation.

**Abstract** – Abstract should be one page synopsis of the project report typed **double line spacing, Font Style Times New Roman and Font Size 13.**

**Table of Contents** – The table of contents should list all material following it as well as the Abstract which precedes it. The Title page and Bonafide Certificate will not find a place among the items listed in the Table of Contents. **One and a half** spacing should be adopted for typing the matter under this head.

**List of Tables** – The list should use exactly the same captions as they appear above the tables in the text. **One and a half** spacing should be adopted for typing the matter under this head.

**List of Figures** – The list should use exactly the same captions as they appear below the figures in the text. **One and a half** spacing should be adopted for typing the matter under this head.

**3.7. Table and figures** - By the word Table, is meant tabulated numerical data in the body of the project report as well as in the appendices. All other non- verbal materials used in the body of the project work and appendices such as charts, graphs, maps, photographs and diagrams may be designated as figures.

**List of Symbols, Abbreviations**– One and a half spacing should be adopted for typing the matter under this head. Standard symbols, abbreviations etc. should be used.

**Chapters** – The chapters may be broadly divided into 3 parts

- (i) Introductory chapter,
- (ii) Chapters developing the main theme of the project work
- (iii) Conclusions and scope

The introductory chapter will have sections covering a general introduction and importance of the research project.

The main text will be divided into several chapters and each chapter may be further divided into several divisions and sub-divisions.

- ❖ Each chapter should be given an appropriate title.
- ❖ Tables and figures in a chapter should be placed in the immediate vicinity of the reference where they are cited.

**Appendices** – Appendices are provided to give supplementary information, which if included in the main text may serve as a distraction.

- Appendices should be numbered using Arabic numerals, e.g. Appendix 1, Appendix 2, etc.
- Appendices, Tables and References appearing in appendices should be numbered and referred at appropriate places just as in the case of Chapters.
- Appendices shall carry the title of the work reported and the same title shall be made in the contents page also.

**List of References** –The listing of references should be typed 4 spaces below the heading “REFERENCES” in alphabetical order in single spacing left – justified. The reference material should be listed in the alphabetical order of the first author. The name of the author / authors should be immediately followed by the year and other details.

- (i) If more than one paper by the same first author and same year of publications, the year of citation will be followed by a, b etc to differentiate them.

- (ii) While citing the paper in the text, the name of the first author and year alone must be cited. e.g Samson (2004) or Jeyaraj (2007a). The reference numbers should not be used in the text of the paper
- (iii) A paper, a monograph or a book may be designated by the name of the first author followed by the year of publication, placed inside brackets at the appropriate places in the Thesis.

#### **4. TYPING INSTRUCTIONS:**

The impression on the typed copies should be black in colour.

**One and a half** spacing should be used for typing the general text. The general text shall be typed in the **Font style „Times New Roman“ and Font size 13.**

## APPENDIX 1

**TITLE** <Font Size 18> <1.5 line spacing>

*a project report submitted by*

<Font Size 14> <Italic>

**NAME OF THE STUDENT (REGISTER NUMBER)**<Font Size 16>

*in partial fulfillment for the award of the degree*

<Font Size 14> <Italic> <1.5 line spacing>

*in*

**NAME OF THE PROGRAMME** <Font Size 16>

*under the supervision of* <Font Size 14> <Italic>

**NAME OF THE SUPERVISOR** <Font Size 16>



**NAME OF THE DEPARTMENT**<Font Size 14>

**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.

**MONTH & YEAR** <Font Size 14>

**BONAFIDE CERTIFICATE**

<Font Style Times New Roman – size -16>

<Font Style Times New Roman – size -14>

This is to certify that the project report entitled “.....**TITLE OF THE PROJECT.....**” is the bonafide work of “.....**NAME OF THE CANDIDATE(S) WITH REGISTER NUMBER.....**” who carried out the project work under my supervision.

<<Signature of the Head of the Department>>

**SIGNATURE**

<<Name>> <<size -16>

**HEAD OF THE DEPARTMENT**

<<Academic Designation>>

<<Department>>

<<Signature of the Supervisor>>

**SIGNATURE**

<<Name>> <<size -16>

**SUPERVISOR**

<<Academic Designation>>

<<Department>>

<Font Style Times New Roman – size -14>

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Submitted for the Viva Voce held on .....

**Internal Examiner**

**External Examiner**



## **EVALUATION PROCESS**

Review – I has to be conducted during the Last week of December

Review – II has to be conducted during the Last week of January

Review – III has to be conducted during the Last week of February

Document, Preparation and Implementation has to be done during the First week of March

Viva-Voce examination will be conducted at the end of the semester by both Internal (Respective Guides) and External Examiners, after duly verifying the Project Report available in the College.

Course Code	Title		
21PGMBQ404	Practical IV – Lab in Medical Microbiology		
Semester: IV	Credits: 4	CIA :50 Marks	ESE:50 Marks

**Course Objective:**

The general characteristics of bacteria, protozoa, yeasts, molds, and viruses are used to understand the role of microorganisms in human health and disease. The interactions between the host and the microorganisms are emphasized as well as the physical and chemical methods of control.

**Course Outcomes:**

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

CO1	Acquire knowledge on basic principles of medical microbiology and infectious disease.
CO2	Understand infectious disease transmission, and the role of the human body's normal microflora.
CO3	Understand the different conceptual basis for pathogenic microorganisms and the mechanisms by which they cause disease in the human body.
CO4	Gain knowledge on relationship of this infection and symptoms and the accompanying pathology.
CO5	Learn the techniques for pathogenic mycology and the mechanisms

**Offered by: Microbiology**

**Course Content**

**Instructional Hours / Week: 5**

S.No	Experiments
1.	Demonstration normal microbial flora of skin, mouth and throat
2.	Isolation and identification of Staphylococcal species using suitable media, staining techniques and biochemical tests
3.	Identification of bacterial species belonging to Enterobacteriaceae family using suitable biochemical tests (E. coli, Proteus, Pseudomonas, , Klebsiella)
4.	Microbiological analysis of urine specimens
5.	To determine antibiotic sensitivity for Gram negative and Gram positive bacteria by disc diffusion method
6.	To determine Minimal Inhibitory Concentration (MIC) and Minimal Bactericidal concentration of an antibiotic for test bacteria.
7.	Rapid Screening test for HIV – Tridot ELISA
8.	Serodiagnosis of HBV
9.	Serodiagnosis of HIV
10.	Cultivation of Viruses by Embryonated Egg Inoculation Method - Demo
11.	RAPD analysis
12.	Observation of parasites – Entamoeba , Plasmodium, Ascaris, Taenia
	<b>Total hours : 75</b>



# ELECTIVES

Course Code	Title		
21PGMBE101	Elective Paper I – Group A – Principles of Quality Assurance in Food		
Semester : I	Credits : 4	CIA : 50 Marks	ESE: 50 Marks

**Course Objective:**

To make the students to gain knowledge on techniques commonly performed in a food industry.

**Course Outcomes:**

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

CO1	Develop knowledge on food hazards.
CO2	Improve management of quality assurance in food industry.
CO3	Create step by step operating procedures and work on instructions.
CO4	Understand food safety and good manufacturing practices.
CO5	Gain knowledge on food safety microbial standards and applications.

**Offered by: Department of Microbiology**

**Course Content**

**Instructional Hours / Week : 5**

Unit	Description	Text Book	Chapter
I	<b>Food Safety and Hazards in Food:</b> Definition, Biological hazards in foods - Pathogenic bacteria, viruses, parasites. Chemical hazards in foods - Permitted food additives, Naturally occurring harmful compounds, Unavoidable contaminants, Agricultural residues, Industrial contaminants, Chemical residues, Prohibited chemicals, Food allergens. Physical hazards in foods - Broken glass, Plastic, Metal pieces, Wood pieces, Stones, Personal articles.	1	2
<b>Instructional Hours</b>			<b>15</b>
II	<b>Quality Assurance:</b> Theories and Applications, Functions of a Quality Assurance Program, Careers in Quality Assurance, QA Responsibilities and Operational Interactions, Need for and Roles of QA, Organization of a QA Program, QA Personnel, QA Audits, Product Quality Audits, HACCP Audits, QA Documentation System, Work Instructions, Records, HACCP Program Documents.	2	3
<b>Instructional Hours</b>			<b>15</b>
III	<b>Manufacturing Audits - Control of Processing Operations:</b> Objectives, elements, education, training, Process control documentation, Unit Operations in the Food Industry - Materials Handling, cleaning, separation, disintegration, pumping, mixing, heating, cooling, evaporating, drying, packaging. Product manufacturing audit and HACCP analysis.	2	6
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Good Manufacturing Practice Audits:</b> Food Plant Sanitary Practices, Value of a Planned Sanitation Program, Quality Assurance and Sanitation, Food Plant Sanitation Management, Employee Hygiene and Sanitary Handling of Food, Sanitation and Housekeeping, Pest Control in Food Processing Plants, Sanitation Laws and Regulations, The Sanitation/GMP Audit.	2	7
<b>Instructional Hours</b>			<b>15</b>

V	<b>HACCP:</b> Concept, importance, advantages, guidelines, training, program development, principles, Implementation and maintenance of HACCP program, regulatory aspects of HACCP, sanitation and the HACCP concept.	2	9
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book(s):**

1. InteazAlli. **Food Quality Assurance: Principles and Practices**, CRC Press, 2003.
2. Andres Vasconcellos J., **Quality Assurance for the Food Industry: A Practical Approach**. CRC Press, 2003.

- Unit I : Text Book 1 Chapter 2: 27-39
- Unit II : Text Book 2 Chapter 3: 79-118
- Unit III : Text Book 2 Chapter 6: 175-199
- Unit IV : Text Book 2 Chapter 7: 201-262
- Unit V : Text Book 2 Chapter 9: 289-386

**Reference Book(s):**

1. JayJM, Loessner MJ, Golden DA. **Modern Food Microbiology**, 7<sup>th</sup> Edition. Springer, 2005.
2. Rosamund M. Baird, Norman A. Hodges and Sephen P. Denyer. **Handbook of Microbiological Quality Control**, CRC Press, 2000.
3. [https://www.academia.edu/41208822/Food\\_Quality\\_Management\\_Notes](https://www.academia.edu/41208822/Food_Quality_Management_Notes).
4. <http://foodtechnotes.com/category/quality-control-and-quality-assurance-and-tqm/>.


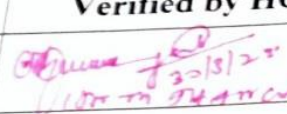

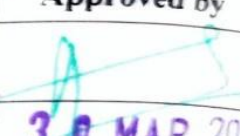
**Tools for Assessment (50 Marks)**

CIA I	CIA II	CIA III	Assignment	Seminar	Quiz	Total
8	8	10	8	8	8	50

**Mapping**

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H	H	H	M	H	H	L	L	H
CO2	H	H	M	M	H	H	H	H	H	H	L	L	H
CO3	H	H	H	H	H	H	M	M	M	M	M	L	H
CO4	H	H	M	H	H	H	H	H	M	M	H	M	H
CO5	H	H	M	M	H	H	M	H	M	M	H	M	H

H - High; M - Medium; L – Low

<b>Course Designed by</b>	<b>Verified by HOD</b>	<b>Checked by</b>	<b>Approved by</b>
	 20/3/22 HOD in Microbiology	 Convener CDC	 30 MAR 2022

Course Code	Title		
21PGMBE102	Elective Paper I – Group B – Diagnostic Mycology		
Semester : I	Credits : 4	CIA : 50 Marks	ESE: 50 Marks

**Course Objective:**

To assimilate knowledge across diagnostic procedures in mycology discipline.

**Course Outcomes:**

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

CO1	Develop knowledge and awareness of the basic principles and concepts of fungal diseases.
CO2	Interpret the pathogenesis and lab diagnosis of yeast and mould infections.
CO3	Use research-based knowledge on fungal skin infections
CO4	Understand the fungi, fungal toxins and antifungal agents
CO5	Apply the knowledge of diagnosis of mycotic infections

Offered by: Department of Microbiology

**Course Content**

Instructional Hours / Week : 5

Unit	Description	Text Book	Chapter
I	<b>Laboratory aspects of diagnostic mycology:</b> Epidemiology of systemic fungal diseases, Medically important fungi, Opportunistic Fungi, Fungal Diseases, Superficial mycoses Subcutaneous mycoses Cutaneous mycoses, Systemic Antifungal drugs.	1	1,2
<b>Instructional Hours</b>			<b>15</b>
II	<b>Pathogenesis and Laboratory Diagnosis of Mycotic Infections:</b> Yeasts and Moulds: Candidiasis, Cryptococcosis, Trichosporon and Other yeast like infections, Aspergillosis, Zygomycoses, Histoplasmosis, Blastomycosis, Coccidioidomycosis, paracoccidioido mycoses, Sporotrichosis, Penicilliosis	1	3, 4, 5
<b>Instructional Hours</b>			<b>15</b>
III	<b>Pathogenesis and Laboratory Diagnosis of Mycotic Infections:</b> Skin and subcutaneous tissues: Superficial cutaneous fungal infections, Eumycetoma, Chromoblastomycosis, Pneumocytosis	1	6,7
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Fungal Toxins and Drugs:</b> Morphology, taxonomy, classification of fungi, recovery of fungi from clinical specimens. Dermatophytes and agents of superficial mycoses, Mycotoxins, Antifungal agents testing and quality control. Newer methods in diagnostic Mycology, Immunity to fungal infections.	2, 3	1, 3,4,5,6
<b>Instructional Hours</b>			<b>15</b>
V	<b>Isolation and Identification of Fungi (Laboratory Diagnosis):</b> Selection, collection and transportation of specimens Skin, Hair, Nail, Mucous membranes, Ear, eye, Corneal ulcer, Pus, Blood, Biopsy, Sputum, Urine, Vaginal and Cervical swab, Stool samples, Plural and peritoneal fluid, Superficial, sub-cutaneous and cutaneous samples. Smear Preparation: KOH Preparation, 20% KOH with 20% Glycerol, KOH – DMSO (Dimethylsulphoxide) 100% Lactophenol Cotton Blue, India ink preparation.	3	3
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book(s):**

1. William, E Dismukes, Peter G Pappas, Jack D Sobel. **Clinical Mycology**, Oxford University Press, 2003.
2. Errol Reiss, H Jean Shadomy, G Marshall Lyon III. **Fundamental Medical Mycology**, Wiley- Blackwell Publications, 2012.
3. Michael R. McGinnis, **Laboratory Handbook of Medical Mycology**, Academic Press, London Ltd. 2012.

- Unit I : Text Book 1, Chapter 1, 2.1-140
- Unit II : Text Book 1, Chapter 3, 4, 5: 141-364
- Unit III : Text Book 1, Chapter 6, 7: 365- 424
- Unit IV : Text Book 2, Chapter 1: 3-30. Text Book 3, Chapter 3, 4, 5, 6: 73-446
- Unit V : Text Book 3, Chapter 3: 73-99

**Reference Book(s):**

1. Jawetz E Melnick J L., Adelberg. **Medical Microbiology**, McGraw-Hill Companies, Inc. 26<sup>th</sup> edition, 2010.
2. Bailey and Scotts **Diagnostic Microbiology**, Mosby, Inc., an affiliate of Elsevier Inc.13<sup>th</sup> edition 2014.
3. <https://paramedicsworld.com/mycology-notes/laboratory-diagnosis-of-fungi/medical-paramedical-studynotes>
4. <https://microbeonline.com>

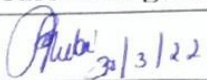



**Tools for Assessment (50 Marks)**

CIA I	CIA II	CIA III	Assignment	Seminar	Quiz	Total
8	8	10	8	8	8	50

**Mapping**

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H	H	H	H	H	H	L	H	H
CO2	H	H	M	H	H	H	M	H	H	H	L	H	H
CO3	H	H	M	M	H	H	M	H	H	H	L	H	L
CO4	H	H	M	H	H	H	M	M	H	H	M	H	L
CO5	H	H	M	L	H	H	M	H	H	H	M	H	L

H-H igh; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
 30/3/22	 Dr. M. TANGAVEL.	 GDC	 3-0 MAR 2022



Course Code	Title		
21PGMBE103	Elective Paper I – Group C – Fundamentals of Plant Tissue Culture		
Semester : I	Credits : 4	CIA : 50 Marks	ESE : 50 Marks

**Course Objective:**

To learn the basics of plant tissue culture for rapid clonal propagation *in vitro*.

**Course Outcomes:**

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

CO1	Understand on basic development of plant tissue culture.
CO2	Gain knowledge on the setup of laboratory and sterilization techniques.
CO3	Acquire knowledge on media used for culture techniques and their preparation.
CO4	Understand the different concepts of tissue culture.
CO5	Learn the techniques for production of plants through <i>in vitro</i> condition.

Offered by : Department of Microbiology

**Course Content**

Instructional Hours / Week : 5

Unit	Description	Text Book	Chapter
I	<b>Introduction to Plant tissue culture:</b> Origin and development, history, scope and applications, culture room and vessels, medium constitution and functions of each element, growth regulators, sterilization techniques; Setting up of primary culture.	1	1
<b>Instructional Hours</b>			<b>15</b>
II	<b>Laboratory design and sterilization techniques:</b> Washing and storage facilities, Media preparation room, Transfer area, Culture room, Data collection area and specialised facilities and Transplantation area. Sterilization techniques – Dry heat, flame, moist heat, filter, surface sterilization.	2	2
<b>Instructional Hours</b>			<b>15</b>
III	<b>Tissue Culture Media and Preparation:</b> Media composition, Types of media, Media preparation, Selection of new media, sterilizing the culture vessels and media, Aseptic culture technique	2	3 & 4
		1	3
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Concepts of tissue culture:</b> Totipotency, differentiation, dedifferentiation and redifferentiation. Micropropagation; Raising of virus free and pest resistant plants, methods. Somatic embryogenesis: Factors and molecular aspects.	3	5
<b>Instructional Hours</b>			<b>15</b>
V	<b>Initiation of plant tissue culture:</b> Induction and growth parameters; Culture initiation, Callus culture, Formation, cloning, suspension culture, regeneration. Micropropagation through various explants (Leaf, Stem, Axillary bud, Tuber, Corms and Bulbills).	2	6
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book(s):**

1. Smith, R.H. **Plant Tissue culture techniques and experiments**, Academic Press. 2013.
2. Razdan, M.K. **Introduction to plant tissue culture**. Science publishers, inc, USA, 2<sup>nd</sup> edition. 2002.
3. Bhojwani, S.S. and M.K. Razdan. **Plant tissue culture: Theory and Practice**, Elsevier Science, 1<sup>st</sup> Edition, New York. 1996.

- Unit I : Text Book 1, Chapter 1: 1-22  
 Unit II : Text Book 2, Chapter 2: 14-21  
 Unit III : Text Book 2, Chapter 3: 22- 34; Chapter 4: 35-42  
 Text Book 1, Chapter 3: 31-43  
 Unit IV : Text Book 3, Chapter 5: 125-166  
 Unit V : Text Book 2, Chapter 6:59-70

**Reference Book(s):**

1. Guptha, P.K. **Elements of Biotechnology**. Rastogi Publications, 2016
2. Slater, A., Scott, N. and Fowler, M. **Plant Biotechnology: The Genetic Manipulation of Plants**, Oxford, 2008.
3. <https://nptel.ac.in/courses/102/103/102103016/>
4. <https://www.mooc-list.com/tags/biotechnology>
5. <https://www.coursera.org/courses?query=biotechnology>

**Tools for Assessment (50 Marks)**

CIA I	CIA II	CIA III	Assignment	Seminar	Quiz	Total
8	8	10	8	8	8	50

**Mapping**

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H	H	M	H	L	L	L	L	H
CO2	H	H	M	H	H	H	L	H	L	L	L	L	H
CO3	M	H	L	H	H	H	L	H	H	L	L	L	H
CO4	H	H	L	H	H	L	L	H	L	L	L	L	H
CO5	H	H	L	L	H	H	L	H	L	M	L	L	H

H-H igh; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
<i>Shatiralla</i> 30/03/2022 (Dr. S. ESATH NATHAR)	<i>[Signature]</i> 30/03/2022 (Dr. S. Esath Nathar)	<i>[Signature]</i> 30/03/2022 Coordinator CDC	<i>[Signature]</i> 30 MAR 2022

Course Code	Title		
21PGMBE201	Elective Paper II – Group A Principles of Quality Assurance in Pharmaceuticals		
Semester : II	Credits : 4	CIA : 50 Marks	ESE : 50 Marks

**Course Objective:**

To understand and implement quality assurance and quality control measures effectively for the particular operation during drug development in the Pharma Industry.

**Course Outcomes:**

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

CO1	Understand the strategy of regulation to control microorganisms.
CO2	Identify things, situations, processes, etc. that may cause harm, particularly to people.
CO3	Describe the qualifications, training and experience required.
CO4	Implement their role within GMP with confidence and knowledge of the principle requirements.
CO5	Explain the principles of good laboratory practices (GLP) and its importance within a regulated laboratory environment.

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

Unit	Description	Text Book	Chapter
I	<b>Microbiological Control Strategy:</b> Overview, Main factors to be controlled, Controlled facilities, Controlled procedures, Controlled product ingredients, Controlled utilities, Controlled equipment's, Controlled formulation.	1	1
<b>Instructional Hours</b>			<b>15</b>
II	<b>Microbial Contamination Risk Assessment in Non-sterile Drug Product Manufacturing and Risk Mitigation:</b> Regulatory, Compendia, and Industry Guidance, Regulatory, Compendia, and Industry Guidance, Putting into Perspective the Microbiological Risk Associated with Non-sterile Products, Risk Assessment Tools, Organizational Risk Management Maturity, Hierarchy of Risks, Effect of Product Attributes, Emerging Manufacturing Technologies.	1	2
<b>Instructional Hours</b>			<b>15</b>
III	<b>Qualification of Microbiological Laboratory Personnel and Equipment:</b> Introduction, Reasons, Requirements, and Strategies for Qualification, Critical Aspects of Microbiological Methods, Practical Examples for Qualification of Laboratory Personnel.	1	3
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Good Manufacturing Practices:</b> Concept and philosophy of GMP, Organization and Personal, Premises, Equipment's, Raw Material, Manufacturing Documents, In Process Quality Control (IQPC), Standard Operating Procedure, Packaging and Labelling Control, Good Ware House Practices, Materials and Management, Finished Product Release, Distribution of Records.	2	2
<b>Instructional Hours</b>			<b>15</b>

V	<b>Good Laboratory Practices:</b> Concept and philosophy of GLP, GLP Guidelines for Manufacturing Unit, GLP Guidelines for Non-Clinical Testing, Quality Audit.	2	3
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Books:**

- David Roesti and Marcel Goverde, **Pharmaceutical Microbiological Quality Assurance and Control**, John Wiley & Sons Inc., 2020.
- Nagori B.P., Ajay Gaur, Renu Solanki and Vipin Mathur. **Pharmaceutical Quality Assurance**, Seventh Edition, 2018.

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

Unit II : Text Book 1, Chapter 2: 23-53.

Unit III: Text Book 1, Chapter 3: 57-76.

Unit IV: Text Book 2, Chapter 2: 21-168

Unit V : Text Book 2, Chapter 3: 169-229

**Reference Book(s):**

- Rosamund M. Baird, Norman A. Hodges, Stephen P. Denver, **Handbook of Microbiological Quality Control – Pharmaceuticals and Medical Devices**, Taylor and Francis, First Edition, 2005.
- Shayne Cox Gad, **Pharmaceutical Manufacturing Handbook: Regulations and Quality**. John Wiley & Sons Inc., 2008.
- [https://www.who.int/medicines/areas/quality\\_safety/quality\\_assurance/QualityAssurancePharmVol2.pdf](https://www.who.int/medicines/areas/quality_safety/quality_assurance/QualityAssurancePharmVol2.pdf).
- <https://www.pharmaguideline.com/p/quality-assurance.html>.


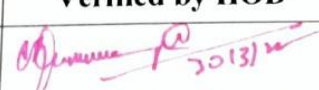


**Tools for Assessment (50 Marks)**

CIA I	CIA II	CIA III	Assignment	Seminar	Quiz	Total
8	8	10	8	8	8	50

**Mapping**

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	H	L	M	H	M	H	H	H	M	H	H
CO2	H	H	L	L	M	H	M	H	H	H	H	M	H
CO3	H	M	L	M	H	M	H	M	H	M	H	M	H
CO4	L	L	L	L	H	H	H	M	H	H	M	H	M
CO5	M	L	M	M	M	L	M	H	H	H	H	H	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
	 Do. M. H. Gaur	 Conventor CDC	 30 MAR 2022

Course Code	Title		
21PGMBE202	Elective Paper II – Group B Techniques in Parasitology		
Semester : II	Credits : 4	CIA: 50 Marks	ESE: 50 Marks

**Course Objective:**

To enable students to understand the pathogenesis, clinical presentations and complications of parasitic diseases

**Course Outcome (CO):**

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

CO1	Provide students with adequate knowledge about endemic parasites, national parasitic problems
CO2	Provide with biological, epidemiological and ecological aspects of parasites that causing diseases to human beings.
CO3	Examine and identify the microscopic morphology of parasites and their larval stages in stained smears.
CO4	Analyze the results obtained from history, clinical examination and investigational data into meaningful diagnostic formulation.
CO5	Recognize sample collection, preservation and examination.

Offered by: Microbiology

**Course Content**

Instructional Hours/ Week : 5

Unit	Description	Text Book	Chapter
I	<b>General Introduction:</b> Protozoa: General features, amoebae, Flagellates, Examination of feces- Microscopy, Wet mount, Thick smear, Permanent stained smear- Iron Haematoxylin stain. Wheatley Trichrome stain. Concentration method, Flootation method, Zinc sulphate Centrifugal Flootation, Sedimentation- Egg count, Fecal culture.	1	2, 3
<b>Instructional Hours</b>			<b>15</b>
II	<b>Symbiosis and parasitism:</b> Commensalism, Phoresis, Parasitism, Mutualism, Parasite-Host interactions- Effect of Parasite on host: Tissue damage, Parenchymatous, Fatty degeneration, Necrosis, Tissue changes, Hyperplasia, Neoplasia, Metaplasia. <b>Intestinal nematodes:</b> <i>Ascaris lumbricoides</i> , <i>Enterobius vermicularius</i> , <i>Strongylus stercoralis</i> , <i>Trichuris trichiura</i> .	2	1,2&16
<b>Instructional Hours</b>			<b>15</b>
III	<b>Malarial parasites:</b> Examination of Blood, Examination for malarial Parasite. Thin smear, Thick smear, Wright stain, Examination for Micro filarial-wet mount, Concentration method, DEC Provocation method, <b>Laboratory methods for the diagnosis of parasitic Infection overview:</b> Intestinal protozoa, Blood and tissue protozoa. Parasitic infection in compromised host- <i>Entamoeba histolytica</i> , <i>Cryptosporidium sp</i> , <i>Leishmania sp</i> , <i>Toxoplasma gondii</i> .	1	6
<b>Instructional Hours</b>			<b>15</b>

<b>IV</b>	<b>Human Hook worm diseases:</b> <i>Necator americanus</i> , <i>Ancylostoma duodenale</i> , <i>Ascaris lumbricoides</i> , Life cycle, Epidemiology, Diagnosis. Nematodes-Filarial Nematodes, <i>Wuchereria bancrofti</i> , <i>Brugia malayi</i> , Tropical pulmonary	1	18
<b>Instructional Hours</b>			<b>15</b>
<b>V</b>	<b>Collection Preservation, Shipment of Specimen:</b> Preservation of Specimen: Safety, Fresh specimen Collection times, Processing of Specimen Macroscopic and Microscopic examination of fecal specimens- ova and parasite identification, Direct wet smear, Concentration sedimentation and Flotation methods, Permanent stained smear.	4	26, 27
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book(s):**

1. Paniker CJK, **Text Book of Medical Parasitology**, 7<sup>th</sup> edition, Jaypee brothers Medical publishers (p) Ltd, New Delhi, 2013.
2. Burton.J.Bogitsh, Clint Carter.E, Thomas Oeltmann.N, **Human Parasitology**, 4<sup>th</sup> edition, Elsevier, Academic Press. UK, 2013.
3. Braily & Scott, **Diagnostic Microbiology**, 13<sup>th</sup> edition, Patricia.M Tille Elsevier, 2014.
4. Lynne Shore Garcia, **Diagnostic Medical parasitology**, 5<sup>th</sup> edition, ASM Press, Washington, 2007.

Unit – I: Textbook 1, Chapter 2,3 & 23: 09-29 & 229-234

Unit – II: Textbook 2, Chapter 1, 2 & 16: 1-34 & 291-326

Unit – III: Textbook 1, Chapter 6: 63-86

Unit – IV: Textbook 1, Chapter 18: 182-189

Unit – V: Textbook 4, Chapter 26, 27: 759-830

**Reference Book(s):**

1. David Greenwood, Mike Barer, Richard Slack, Will Irving, **Medical Microbiology- Guide to Microbial Infection, Pathogenesis, Immunity, lab diagnosis and control**, 18<sup>th</sup> Ed., British library, Elsevier, 2012.
2. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3109637/-2/phylum-protzoa/study-notes-on-entamoeba-histolytica>

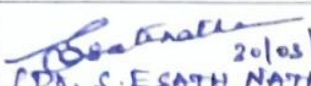



**Tools for Assessment (50 Marks)**

CIA I	CIA II	CIA III	Assignment	Seminar	Quiz	Total
8	8	10	8	8	8	50

Mapping

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	H	H	H	H	H	H	M	H	H
CO2	M	H	H	H	H	H	H	H	H	H	H	M	H
CO3	H	H	H	H	H	H	H	H	H	M	H	H	H
CO4	H	H	H	M	H	H	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	H	H	H	H	M	H	M

H – High; M- Medium; L – Low

Course Designed by	Verified by HOD	Checked by	Approved by
 20/03/2022 (Dr. S. ESATH NATHAR)	 30/3/22 (Dr. M. Manoj Kumar)	 Convenor CDC	 30 MAR 2022



Course Code	Title		
21PGMBE203	Elective Paper II – Group C Fundamentals of Animal Tissue Culture		
Semester : II	Credits: 4	CIA: 50 Marks	ESE: 50 Marks

**Course Objective:**

This course aims to provide a comprehensive overview of fundamentals of animal tissue culture in terms of the development, characterization, and applications.

**Course Outcomes:**

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

CO1	Know and understanding the principles of cell culture techniques.
CO2	Describe the equipment's used in animal cell culture.
CO3	Manage to manipulate with cell cultures.
CO4	Know and understanding the cell culture problems and possibilities.
CO5	Demonstrate knowledge on design and use the cell culture facilities.

**Offered by: Microbiology**

**Course Content**

**Instructional Hours/ Week : 5**

Unit	Description	Text Book	Chapter
I	<b>Introduction of Animal Cell and Tissue Culture:</b> Introduction of Animal Cell and Tissue Culture, History of development of Animal cell culture techniques, Significance and Applications of tissue culture techniques.	1	1
<b>Instructional Hours</b>			<b>15</b>
II	<b>Requirements in Animal Cell Culture Laboratory:</b> Requirements in Animal Cell Culture, Equipments used in Cell culture, Culture vessels, Aseptic techniques, Culture media, designing of culture media, Serum free media development.	1	5, 8-10
<b>Instructional Hours</b>			<b>15</b>
III	<b>Primary culture and cell line Development:</b> Primary culture, secondary culture, cell line, cryopreservation, contaminations, organotypic culture, Insect Cell Culture: An Overview, In vitro transformation of animal cells, Types of cell culture.	2	7
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Characterization of cell line:</b> Characterization, Cell cycle analysis, FBS, Temperature, authentication, species identification, lineage or tissue markers, immunocytochemistry, karyotyping, chromosome banding, molecular identification by isoenzyme.	2	9
<b>Instructional Hours</b>			<b>15</b>



V	<b>Applications of cell Line:</b> Cell culture in virus isolation, vaccine production, drug/therapeutics development, cancer studies using cell culture, production of hybridoma and monoclonal antibody production, therapeutic cloning, tissue engineering and CRISPR-Cas in gene function studies.	1	27
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hour</b>			<b>75</b>

**Text Book(s):**

1. Ian Freshney, R. **Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications**, 6<sup>th</sup> Edition, John Wiley & Sons, Inc., 2010.
2. John M. Davis. **Animal Cell Culture Essential Methods**, John Wiley & Sons, Inc., 2011.

Unit I: Text Book 1, Chapter 1 (1-12)

Unit II: Text Book 1, Chapter 5 (55-72), Chapter 8-10 (105-129)

Unit III: Text Book 2, Chapter 7 (205-299)

Unit IV: Text Book 2, Chapter 9 (255-292)

Unit V: Text Book 1, Chapter 27 (467-480)

**Reference Book(s):**

1. Michael Butler. **Animal Cell Culture and Technology**, 2<sup>nd</sup> edition Bios Scientific Publishers Taylor & Francis Group London and New York, 2004.
2. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7325846/>





**Tools for Assessment (50 Marks)**

CIA I	CIA II	CIA III	Assignment	Seminar	Quiz	Total
8	8	10	8	8	8	50

**Mapping**

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	L	M	H	L	H	L	L	H	L	H
CO2	M	H	L	L	H	M	L	M	L	L	H	L	H
CO3	H	H	M	L	M	H	L	M	L	L	H	L	H
CO4	H	H	H	L	H	H	L	L	H	L	H	H	H
CO5	M	H	H	H	H	L	H	H	L	H	L	H	H

H – High; M- Medium; L – Low

Course Designed by	Verified by HOD	Checked by	Approved by
	 30/3/22	 DR. K. S. ... Convenor CDC	

30 MAR 2022

Course Code	Title		
21PGMBE301	Elective Paper III-Group A - Total Quality Management		
Semester: III	Credits: 4	CIA :50 Marks	ESE:50 Marks

**Course Objective:**

To provide the student with basic knowledge on total quality management and ISO Registration

**Course Outcomes (CO)**

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

CO1	Understand the Need for quality Evolution.
CO2	Familiarize with seven traditional tools of quality.
CO3	Familiarize with Quality Statements, Strategic quality planning.
CO4	Discuss Cost of Quality and Quality Function Deployment.
CO5	Familiarize with Benefits of ISO Registration and Audits.

Offered by: Microbiology

**Course Content**

Instructional Hours / Week: 5

Unit	Description	Text Book	Chapter
I	Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - orientation, satisfaction, complaints, retention.	1	1,2
<b>Instructional Hours</b>			15
II	The seven traditional tools of quality – New management tools – Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, FMEA – Stages, Types.	1	3
<b>Instructional Hours</b>			15
III	Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.	1	16
<b>Instructional Hours</b>			15
IV	Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.	2	14
<b>Instructional Hours</b>			15
V	Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific, Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation— Documentation—Internal Audits—Registration- Environmental Management System: Introduction—ISO 14000 Series Standards— Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.	2	8
<b>Instructional Hours</b>			15
<b>Total Hours</b>			75

**Text Book(s):**

1. Jens J.Dahlgard, Kai Kristensen, Gopal K.Kanji: Taylor & Franci, **Fundamentals of TotalQuality Management Process analysis and improvement**, Routledge, London.2005.
2. Dale H. Besterfiled, Carol B.Michna, Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, **Total Quality Management**, Pearson Education Asia, Revised 3<sup>rd</sup> Edition, Indian Reprint, 6<sup>th</sup> Impression, 2013.

Unit I : Text Book 1, Chapter 1,2: 1-4,4-8

Unit II: Text Book 1, Chapter 3:9-13

Unit III: Text Book 1, Chapter 16: 203-217

Unit IV: Text Book 2, Chapter 14:315-329

Unit V: Text Book 2, Chapter 8: 167-198

**Reference Book(s):**

1. James R. Evans and William M. Lindsay, "**The Management and Control of Quality**", 8<sup>th</sup> Edition, First Indian Edition, Cengage Learning, 2012.
2. Janakiraman. B and Gopal .R.K., "**Total Quality Management - Text and Cases**", Prentice Hall (India) Pvt. Ltd., 2006.
3. Suganthi.L and Anand Samuel, "**Total Quality Management**", Prentice Hall (India) Pvt. Ltd., 2006.
4. [GE-6757-TOTAL-QUALITY-MANAGEMENT-IV-YEAR-VII-SEM-NOTES.pdf](http://velhightech.com/GE-6757-TOTAL-QUALITY-MANAGEMENT-IV-YEAR-VII-SEM-NOTES.pdf) (velhightech.com)
5. [totalqualitymanagement.pdf \(rmkec.ac.in\)](http://totalqualitymanagement.pdf(rmkec.ac.in))





**Tools for Assessment (50 Marks)**

CIA I	CIA II	CIA III	Assignment	Seminar	Quiz	Total
8	8	10	8	8	8	50

**Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	L	L	H	M	M	M	L	L	L	L	M
CO2	M	H	M	H	M	H	M	H	L	L	L	L	M
CO3	H	M	H	M	H	H	H	H	L	L	L	L	L
CO4	H	M	H	M	M	M	H	M	L	L	L	L	L
CO5	H	M	H	M	H	H	M	H	L	L	L	H	H

H - High; M - Medium; L – Low

Course Designed by	Verified by HOD	Checked by	Approved by
	 30/3/22		

(Dr. M. Thiruvakara)

Dr. M. S. Srinivasan  
Convener  
CDC

30 MAR 2022

Course Code	Title		
21PGMBE302	Elective Paper III-Group B - Clinical Data Base Management		
Semester III	Credits: 4	CIA: 50 Marks	ESE:50 Marks

**Course Objective:**

Students understand the knowledge about generation of high-quality, reliable, and statistically sound data from clinical trials. This helps to produce a drastic reduction in time from drug development to marketing.

**Course Outcome:**

CO 1	To understand the infra structure required in performing clinical research
CO 2	To become familiar with the basic biostatistical and epidemiologic methods.
CO 3	To understand the practice of collecting, organizing, protecting, and storing an organization's data
CO 4	To get knowledge on patient care and safety in relation to the use of medicines and paramedical interventions
CO 5	To analyze and understand the processing principles and guidelines of biomedical research

Offered by: Microbiology

**Course Content**

Instructional Hours/ Week: 5

Unit	Description	Text Book	Chapter
I	<b>Guidelines:</b> Start with the report, Keep it in the computer, plan. Prescription for successes, Develop the Data Entry Software.	1	2,3
	<b>Design Decisions:</b> Reason for performing, Study objectives, Secondary response, quality control, study population, Defense review, rewrite. <b>Documentation:</b> Treatment plan, Data management, monitoring, Quality control. Outcome Measures and Evaluation.	1	5,8
<b>Instructional Hours</b>			<b>15</b>
II	<b>Protocol development:</b> Internal and external reporting; Performance Measures: timesheet, clinical monitor, Clinical Trial Management. Implications of guidelines in the development of trial protocol, Key component, Trail summary, outcome measures ethics.	2	1 1,3
<b>Instructional Hours</b>			<b>15</b>
III	<b>Pharmacovigilance:</b> Hypothesis generating methods, Prescription event monitoring, hypothesis. Legal basic, United states, regulations, Food and drug administration Reporting Standards for Investigational drugs and biological product. Statistical Methods of Evaluating Pharmacovigilance data.	3	1
<b>Instructional Hours</b>			<b>15</b>

IV	<b>Guidelines of Medical Coding:</b> Introduction to medical coding of Data—MedDRA and other Medical Terminologies -Introduction, Why do we need to code clinical data, problems in coding, Standard medical technology. International Classification of Diseases, MedDRA, Scope and utility, structure, Data entry, Data Retrieval, Strength and weakness. Computer system, objectives, technical criteria, system analysis and testing, CRF Track, Remote data entry.	4	10,12
<b>Instructional Hours</b>			<b>15</b>
V	<b>Regulatory Affairs:</b> Ethical Issues, Conflict of interest, Selection Of Special Groups As Research, Drug trails, Vaccine trails. Pharmacodynamics: Phase I, II , III. ICMR guidelines for biomedical research, Epidemiological studies.	5	3,4,5
<b>Instructional Hours</b>			<b>15</b>
<b>Total Hours</b>			<b>75</b>

**Text Book(s):**

1. **A manager's guide to the design and conduct of clinical trials** by Phillip I. Good, 2<sup>nd</sup> Edition, John Wiley & Sons.2006.
2. **Clinical Trials: A Practical Guide to Design, Analysis, and Reporting** by Duolao Wang, Ameet Bakhai,Publisher: Andrew Ward.2006.
3. **Pharmacovigilance** 2<sup>nd</sup> Edition, Ron Mann, Elizabeth Andrew. John Wiley & Sons Ltd. 2007.
4. **Clinical Data Management**, 2<sup>nd</sup> Edition. Richard K. Rondel, Sheila A. Varley, Colin F. Webb John wiley & Sons Ltd. 2000.
5. **Ethical guidelines for biomedical research on human participants**, Indian council of medical Research. 2006.

Unit: 1: Text book: 1- Chapter:2 pp 1-13

Chapter:3 pp 17-21

Chapter:5 pp 34-36

Chapter:8 pp 84-93

Unit: 2: Text book: 2- Chapter:1 pp 1-11

Chapter:3 pp 23-35.

Unit: 3: Text book: 3- Chapter:3 pp 27-34

Chapter:1 pp 1-9

Unit: 4: Text book: 4-Chapter:10 pp 177-204.

Chapter:12 pp 229-249.

Unit: 5: Text book: 5- Chapter:3 pp 21-33

Chapter: 4 pp 34-40

Chapter: 5 pp 56- 40

**Reference Book(s):**

1. Principles and Practice of Clinical Research By John A Gallin. 2006
2. Clinical Data Management By Richard K. Rondel, Sheila A. 2002. Varley, Colin F. Webb
3. Understanding Oracle Clinical by Safari Books online

Tools for Assessment (50 Marks)

CIA I	CIA II	CIA III	Assignment	Seminar	Quiz	Total
8	8	10	8	8	8	50

Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	M	H	H	H	M	H	H	H	H	H	H
CO2	H	H	M	L	L	H	M	H	L	L	L	L	M
CO3	H	H	M	L	H	H	L	H	H	M	L	H	L
CO4	H	M	H	H	H	H	H	H	L	L	L	H	H
CO5	M	H	M	M	M	H	H	H	L	L	H	L	L

H – High; M- Medium; L – Low

Course Designed by	Verified by HOD	Checked by	Approved by
Dr. Janki N. Patil 30/3/22 (Dr. K. Franklin N. Patil)	Dr. Janki N. Patil 30/3/22 (Dr. K. Franklin N. Patil)	Dr. Janki N. Patil 30/3/22 (Dr. K. Franklin N. Patil) Coordinator CDC	30 MAR 2022

Course Code	Title		
21PGMBE303	Elective Paper III – Group C Techniques in Plant and Animal Tissue Culture		
Semester: III	Credits: 4	CIA: 50 Marks	ESE: 50 Marks

**Course Objective:**

To learn the technical advancements in the field of animal and plant tissue culture.

**Course Outcomes:**

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

CO1	Understanding the basic development of plant and animal tissue culture.
CO2	Gain knowledge about setup of animal and plant tissue culture laboratory and sterilization techniques.
CO3	Acquire knowledge on media preparation and usage for animal and plant tissue culture.
CO4	Understand the different concepts of animal and plant tissue culture.
CO5	Learn the different techniques of animal and plant tissue culture and their applications.

**Offered by: Microbiology****Course Content**

Instructional Hours / Week: 5

Unit	Description	Text Book	Chapter
I	<b>Cell culture and characterization:</b> Primary Culture- Isolation of Tissue, Steps involved in primary cell culture and Establishment of Cell culture. Cell Lines- Nomenclature, Subculture and Propagation, Immortalization of cell lines. Cell counting, Cell Proliferation, Plating Efficiency, Labeling Index	1	11, 12,15
<b>Instructional Hours</b>			<b>15</b>
II	<b>Contamination and assay:</b> Source of contamination, Type of microbial contamination, Monitoring, Eradication of Contamination, Cross-Contamination. Cytotoxicity: measurement of cell death; Apoptosis and its determination; Cytotoxicity assays. <b>Cryopreservation &amp; Stem cell culture:</b> Need of Cryopreservation, Preservation, Cell banks, Transporting Cells.	1	18, 19, 21
<b>Instructional Hours</b>			<b>15</b>
III	<b>Media:</b> Physicochemical Properties, Balanced Salt Solutions, Complete Media, Serum, Disadvantages of Serum supplemented media, Serum-Free Media, Advantages of Serum-Free media.	1	8,9
	Composition of MS media, Gamborgs media, Nitch's media, Whites media and their preparation. Plant growth regulators. Sterilization techniques.	2	1, 2,3
<b>Instructional Hours</b>			<b>15</b>
IV	<b>Invitro culture for plants:</b> Micropropagation, Callus culture, somatic embryogenesis, suspension culture, embryo culture, haploid culture, protoplast culture and fusion; Soma clonal variation; Artificial seeds; Greenhouse conditions, hardening.	2	8,9
<b>Instructional Hours</b>			<b>15</b>
V	<b>Gene Transfer Methods:</b> <i>Agrobacterium</i> mediated gene transfer, <i>Agrobacterium</i> based vectors (Ti plasmids and Ri plasmids), viral vectors and their applications. Direct gene transfer methods - electroporation, microinjection and particle bombardment. Characterization of transgenics, screenable and selectable markers. Marker free methodologies and gene targeting.	3	16, 23
<b>Instructional Hours</b>			<b>15</b>



Total Hours	75
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**Text Book(s):**

1. Ian Freshney. R., **Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications**, John Wiley & Sons, Inc., Hoboken, New Jersey, 6<sup>th</sup> Edition. 2010.
2. Razdan, M. K., **Introduction to Plant Tissue Culture**, Science Publisher Inc., UK.2003.
3. Chawla, H. S., **Introduction to Plant Biotechnology**, Science Publisher Inc., UK. 2002.  
 Unit I: Text Book 1, Chapter 11, 12, 15: 65, 78-90, 137  
 Unit II: Text Book 1, Chapter 18, 19, 21: 212, 242, 311-327  
 Unit III: Text Book 1, Chapter 8, 9:42, 52  
 Text Book 2, Chapter 1, 2 & 3: 3-13, 22-35  
 Unit IV: Text Book 2, Chapter 8 & 9: 87-199.  
 Unit V: Text Book 3, Chapter 2: 359-394

**Reference Book(s):**

1. Mantel. S.H, Mathews. J.A. and Mickee, R.A., **An Introduction to Genetic Engineering in Plants**, Black well Scientific Publishers, London, 1985.
2. Pierik, R.L.M., **Invitro Culture of Plants**, Martinus Nijhoff Publishers, Dordrecht, 1987.
3. Dixon, R.A. and R.A. Gonzales. **Plant Cell Culture, A Practical Approach**, Oxford University Press, Oxford, 2<sup>nd</sup> Edition, 1994.
4. Jennie P. Mather (Editor), David Barnes (Editor), **Animal Cell Culture Methods**, Volume 57 (Methods in Cell Biology), Academic Press, 1<sup>st</sup> Edition, 2001.
5. Butler, M., **Mammalian Cell Biotechnology: A Practical Approach**, Oxford University Press, New York, 2005.
6. <https://www.elsevier.com/books/animal-biotechnology/verma>
7. [web.nchu.edu.tw/pweb/users/taiwanfir/lesson/1146.pdf](http://web.nchu.edu.tw/pweb/users/taiwanfir/lesson/1146.pdf)

**Tools for Assessment (50 Marks)**

CIA I	CIA II	CIA III	Assignment	Seminar	Quiz	Total
8	8	10	8	8	8	50

**Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	L	L	M	M	M	H	L	L	H	L	H
CO2	H	H	L	L	H	H	H	H	L	L	H	L	H
CO3	H	H	L	L	H	H	M	H	L	L	H	L	H
CO4	M	L	L	M	M	H	M	H	L	L	H	L	H
CO5	M	H	H	L	H	H	H	H	L	L	H	L	H

H - High; M - Medium; L – Low

Course Designed by	Verified by HOD	Checked by	Approved by
Dr. Frank Noor (Dr. K. Franklin Noor)	Dr. Frank Noor (Dr. K. Franklin Noor)	Dr. Frank Noor (Dr. K. Franklin Noor)	Dr. Frank Noor (Dr. K. Franklin Noor)

30 MAR 2022



# SELF STUDY PAPERS

Course Code	Title
21PMBSS01	Advanced Learners Course – Cellular Organization
Semester: I - IV	Credit: 2

**Course Objective:**

The course aims at giving the student an overview of cellular organisation with the cellular microenvironment and the signalling events resulting from these interactions, cells response to physiological cues.

**Course Outcomes:**

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

CO1	Recognize the types of cell and understand the importance of cell in biology.
CO2	Know and be able to discuss the energy and central dogma of cell, be able to give examples of their functions.
CO3	Understand and discuss central cellular signal pathways and cellular adhesion in cells.
CO4	Demonstrate the background of cell with skeleton and their motility.
CO5	Interpret the cell division and their communication of the molecules.

Offered by: Microbiology

**Course Content**

Unit	Description	Text Book	Chapter
I	<b>Introduction to cell biology-</b> Introduction to cells, Evolution, prokaryotic and Eukaryotic cell, chemical and Physical background, micro and macro molecules of cells, Chromatin, chromosomes and nucleus of cell	1 2	1,2,3 1,2
II	<b>Energy, Catalysis and Biosynthesis</b> – use of energy by cells, free energy and catalysis, Activated carriers and biosynthesis, <b>Central Dogma</b> – from Gene to protein, Membrane Structure and function, Cellular Organelles and Membrane Trafficking	1 2	4 3
III	<b>Signaling mechanisms and Cellular adhesions:</b> general principles of cell signaling, plasma membrane receptors G protein coupled receptors, Enzyme coupled receptors. Hormones and their receptors, bacterial and plant two-component signalling systems, bacterial chemotaxis, and quorum sensing. Extracellular matrix, cellular adhesion, intracellular junction and connective tissues	1 2	7, 8 16
IV	<b>Cytoskeleton and Cellular motility:</b> Cytoskeleton – Intermediate filaments, Microtubules and centrosomes, Actin and actin binding Filaments, intermediate filaments, motor proteins, Intracellular Motility, Cellular Motility and muscle contraction	1 2	9 17
V	<b>Cell division cycle and Cellular communication:</b> overview of cell cycle, cell cycle control system, Phases of cell cycle, Mitosis and cytokinesis Regulation of hematopoiesis, general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation	1 2	10 18

**Text Book(s):**

1. Thomas D Pollard, Willam C Earnshaw, Jennifer Lippincott Schwartz, Graham T Johnson, **Cell Biology** –. 3<sup>rd</sup> edition, Elsevier Press, 2017.
2. Alberts, Bray, Hopkin, Johnson, Lewis, Raff, Roberts, Walter, 4<sup>th</sup> Edition, **Essential Cell Biology**, Garland Science, Taylor and Francis group, 2014.

- Unit I : Text Book 1 & 2 , Chapter 1-3 & 1-2
- Unit II : Text Book 1 & 2, Chapter 4 & 3
- Unit III: Text Book 1 & 2, Chapter 7,8,16
- Unit IV: Text Book 1 & 2, Chapter 9,17
- Unit V: Text Book 1 & 2, Chapter 10,18

**Reference Book(s):**

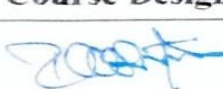
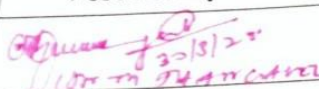
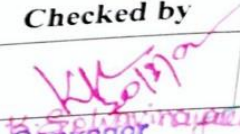
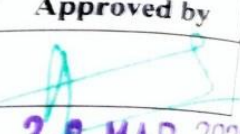
1. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter. **Molecular Biology of the Cell**. Garland Science, 2015.
2. Gerald C. Karp. **Cell and Molecular Biology, Concepts and Experiments**. John Wiley and Sons, Inc., 2003.
3. CELLS II CELLULAR ORGANIZATION

**Question Paper Pattern - Advanced Learners Course**

Time:3 Hours

Max Marks:100

Knowledge Level		Section	Marks	Description
K2,K3	1-5	A(Either or Pattern)	5×8=40	Short Answer/Define
K3/K4	6-15	B(Answer 5 Out of 10)	5×12=60	Descriptive Detailed

Course Designed by	Verified by HOD	Checked by	Approved by
	 30/3/22 Dr. M. S. Anand	 Convener CDC	 30 MAR 2022

Course Code	Title
21PMBSS02	Advanced Learners Course – Cell communication and Cell Signalling
Semester: I - IV	Credit: 2

**Course Objective:**

The course aims at giving the student an overview of cellular interactions with the cellular microenvironment and the signalling events resulting from these interactions, cells response to physiological cues.

**Course Outcomes:**

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

CO1	Recognize the principle mechanism of pathogen interaction with cell.
CO2	Know and be able to discuss the major groups of intracellular-and membrane-bound receptors, be able to give examples of such receptors.
CO3	Understand and discuss central cellular signal pathways in eukaryotic cells.
CO4	Demonstrate the connection between cellular signal pathways and medical phenomena, using examples.
CO5	Describe the principles of cells involved in immunity.

Offered by: Microbiology

**Course Content**

Unit	Description	Text Book	Chapter
I	<b>Host-parasite interaction:</b> Recognition and entry processes of different pathogens like bacteria, viruses into animal and plant host cells, alteration of host cell behaviour by pathogens, virus-induced cell transformation, pathogen-induced diseases in animals and plants, cell-cell fusion in both normal and abnormal cells	1	8
II	<b>Cell signalling:</b> Hormones and their receptors, cell surface receptor, signalling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signalling pathways, bacterial and plant two-component signalling systems, bacterial chemotaxis, and quorum sensing	1	11,12
III	<b>Cellular communication:</b> Regulation of haematopoiesis, general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation	1	1,2
IV	<b>Cancer:</b> Genetic rearrangements in progenitor cells, oncogenes, tumour suppressor genes, cancer and the cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis, therapeutic interventions of uncontrolled cell growth	2	4,5
V	<b>Innate and adaptive immune system:</b> Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity, and immunogenicity. B and T cell epitopes, structure and function of antibody molecules, generation of antibody diversity, monoclonal antibodies, antibody engineering, antigen-antibody interactions	1	1

**Text Book(s):**

1. Donald R. Demuth and Richard Lamont, **Bacterial Cell-to-Cell Communications – Role in Virulence and Pathogenesis**. Cambridge University Press, New York, 2006.
2. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter. **Molecular Biology of the Cell**. Garland Science, 2015.  
 Unit I: Text Book 1, Chapter 8  
 Unit II: Text Book 1, Chapter 11 & 12  
 Unit III: Text Book 1, Chapter 1,2  
 Unit IV: Text Book 2, Chapter 4,5  
 Unit V: Text Book 1, Chapter 1

**Reference Book(s):**

1. Gerald C. Karp. **Cell and Molecular Biology**, Concepts and experiments. John Wiley and Sons, Inc. 2003.
2. Lodish, Arnold Berk, Paul Matsudaira, Chris A. Kaiser, Monty Krieger, Matthew P. Scott, Lawrence Zipursky, James Darnell. **Molecular Cell Biology**, 5<sup>th</sup> edition. Macmillan Learning, 2003.
3. Jeremy M. Berg, John L. Tymoczko, Lubert Stryer. **Biochemistry**, WH Freeman and Company. 5<sup>th</sup> edition, 2002.
4. [Karp-Cell-and-Molecular-Biology-Concepts-and-Experiments-7ed-pdf-179-Mb.pdf \(colorado.edu\)](#)

**Question Paper Pattern - Advanced Learners Course**

Time:3 Hours

Max Marks:100

Knowledge Level		Section	Marks	Description
K2,K3	1-5	A(Either or Pattern)	5×8=40	Short Answer/Define
K3/K4	6-15	B(Answer 5 Out of 10)	5×12=60	Descriptive Detailed

Course Designed by	Verified by HOD	Checked by	Approved by
<i>Prabha</i> 31/3/22	<i>[Signature]</i> 30/3/22 Dr. M. TAANGAVEL.	<i>[Signature]</i> 20/3/22 GDC	<i>[Signature]</i> 30 MAR 2022

Course Code	Title
21PMBSS03	Advanced Learners Course – Developmental Biology
Semester: I - IV	Credit: 2

**Course Objective:**

The course aims at giving the student an overview of presents the basic concepts and facts relating to the developmental biology of animals.

**Course Outcomes:**

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

CO1	Recognize the basic concepts and development stages of animals in biology.
CO2	Know and discuss the model organisms with their anatomy and genetics.
CO3	Understand and discuss early and late development of cells.
CO4	Demonstrate the concept of stem cells.
CO5	Interpret the application of developmental biology in various fields with updated molecular methods.

Offered by: Microbiology

**Course Content**

Unit	Description	Text Book	Chapter
I	<b>History &amp; Basic concepts of development:</b> Overview of how the modern era of developmental biology emerged through multidisciplinary approaches, stages of development- zygote, blastula, gastrula, neurula cell fate & commitment – potency-concept of embryonic stem cells, differential gene expression, terminal differentiation, lineages of three germ layers, fate map Mechanisms of differentiation- cytoplasmic determinants, embryonic induction, concept of morphogen, mosaic and regulative development Pattern formation- axis specification, positional identification (regional specification) Morphogenetic movements	1	4,5
II	<b>Model organisms, Anatomy and Genetics:</b> <i>Xenopus</i> , Zebra fish, chick, mouse, <i>Drosophila</i> , <i>C. elegans</i> . Cycle of life – Frog's Life, Evolutionary embryology, Medical embryology and teratology, Evidence for genomic Equivalence, Differential Gene Transcription, DNA methylation and Control of transcription, Differential RNA processing, Control of gene expression at the level of translation	1 2	1,2,3 3, 6,7,8,9,10,11,12
III	<b>Early Development</b> in invertebrate /vertebrate models <i>Drosophila</i> , <i>C. elegans</i> , <i>Xenopus</i> , Mouse/ human Cleavage, gastrulation, Axis specification (Dorsoventral, anterior posterior), & body plan patterning, left right asymmetry in vertebrates, <b>Late Development</b> in invertebrate /vertebrate models. Organogenesis- development of central nervous system in vertebrates, vulval formation in <i>C. elegans</i>	1	4,5,6,7,8
IV	<b>The stem cell concept - Organogenesis:</b> stem cell concept, Mesenchymal stem cells, Emergence of the ectoderm, Neural crest cells and axonal specificity, paraxial and intermediate mesoderm, Lateral plate mesoderm and the endoderm, development of the tetra pod limb, Sex determination, post embryonic development, saga of the germ line	1 2	9-16 20-22

V	<b>Systems biology- developmental biology to medicine, ecology and Evolution: Medical aspects of Developmental</b>	1 2	1, 3, 5, 9, 10, 11,
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biology, Developmental Plasticity and Symbiosis, developmental mechanisms of evolutionary change and Molecular methods in developmental biology – Animal cap assay, ribonuclease protection analysis, WISH, Microinjection, DNA foot printing, Mapping	16, 17
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**Text Book(s):**

1. Scott F Gilbert Sinauer Associates, **Developmental Biology**. Publishers Sunderland, Massachusetts USA, 2010.
2. J M W Slack. **Essential Developmental Biology**, Blackwell Publishing Ltd, by John Wiley & Sons, Ltd. 3<sup>rd</sup> edition, 2013.

Unit I: Text Book 1, Chapter 4,5  
 Unit II: Text Book 1 & 2, Chapter 1-3 & 3,6-12  
 Unit III: Text Book 1, Chapter 4-8  
 Unit IV: Text Book 1&2, Chapter 9-16, 20-22  
 Unit V: Text Book 1 &2, Chapter 1,3,5,9-11 & 16, 17

**Reference Book(s):**

1. Matthew Guille, **Molecular Methods in Developmental Biology**, Volume 127, Humana Press Inc., Totowa, NJ, 1999.
2. Scott F Gilbert. **Developmental Biology**, 6<sup>th</sup> edition, Sunderland (MA): Sinauer Associates; 2000.
3. [Developmental Biology Notes - Microbe Notes](#)

**Question Paper Pattern - Advanced Learners Course**

Time:3 Hours

Max Marks:100

Knowledge Level		Section	Marks	Description
K2,K3	1-5	A(Either or Pattern)	5×8=40	Short Answer/Define
K3/K4	6-15	B(Answer 5 Out of 10)	5×12=60	Descriptive Detailed

<b>Course Designed by</b> D. Frank Nook 30/3/22 (D. K. Franklin Nook)	<b>Verified by HOD</b> [Signature] 30/3/22 COV. in [Signature]	<b>Checked by</b> [Signature] DT. [Signature] Convener CDC	<b>Approved by</b> [Signature] 30 MAR 2022
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Course Code	Title
21PMBSS04	Advanced Learners Course - Inheritance Biology
Semester: I-IV	Credit: 2

**Course Objective:**

To make students understand the principles of Genetics and inheritance biology, and to study gene functions for individual characteristics and also may contribute to susceptibility to certain diseases.

**Course Outcomes:**

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

CO1	Imparts knowledge on the different aspects of genetics and model organisms.
CO2	Understand the central dogma of molecular biology and the genome of prokaryotic and eukaryotic microorganisms.
CO3	Know the molecular linkage and recombination process.
CO4	Explain the mutations in familial inheritance.
CO5	Describe applications and techniques of modern genetic technology.

Offered by: Microbiology

**Course Content**

Unit	Description	Text Book	Chapter
I	<b>Introduction to inheritance biology:</b> General introduction to inheritance biology. Historical developments: Model organisms in genetic analyses and experimentation: <i>Escherichia coli</i> , <i>Saccharomyces cerevisiae</i> , <i>Neurospora crassa</i> , <i>Caenorhabditis elegans</i> , <i>Drosophila melanogaster</i> , <i>Arabidopsis thaliana</i> , <i>Danio rerio</i> .	1	2
II	<b>Mendel's Laws:</b> Mendel's Laws: Dominance, segregation, independent assortment, deviation from Mendelian inheritance, Rediscovery of Mendel's principles, Chromosome theory of inheritance: Allele, multiple alleles, pseudoallele, complementation tests, Extensions of Mendelian genetics: Allelic interactions, concept of dominance, recessiveness, Incomplete dominance and co-dominance, Multiple alleles, Epistasis, penetrance and expressivity.	1	3
III	<b>Linkage and recombination of genes:</b> Linkage and recombination of genes, Cytological basis of crossing over, Crossing over at four-strand stage, Molecular mechanism of crossing over, mapping Homologous and non-homologous recombination, including transposition, site-specific recombination.	2	7
IV	<b>Rules of extra nuclear inheritance:</b> Rules of extra nuclear inheritance, Organelle heredity - Chloroplast mutations in <i>Chlamydomonas</i> , mitochondrial, mutations in <i>Saccharomyces</i> , Maternal effects – Shell coiling in <i>Limnaea peregra</i> Infectious heredity - Kappa particles in <i>Paramecium</i> . Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders. Polygenic inheritance, heritability and its measurements, QTL mapping.	1	13

V	<b>Structural organization of chromosomes:</b> Structural organization of chromosomes - centromeres, telomeres and repetitive DNA, Packaging DNA molecules into chromosomes, Concept of euchromatin and heterochromatin, Normal and abnormal karyotypes of human chromosomes, Chromosome	2	11
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banding, Giant chromosomes: Polytene and lamp brush chromosomes, Variations in chromosome structure: Deletion, duplication, inversion and translocation, Variation in chromosomal number and structural abnormalities –Kline felter syndrome, Turner syndrome, Down syndrome.		
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**Text Book(s):**

1. Snustad DP, Simmons MJ. **Principles of Genetics**.6<sup>th</sup> edition, John Wiley and Sons Inc., 2011.
2. Russell PJ. **Introduction to Genetics - A Molecular Approach**. 3<sup>rd</sup> edition, Benjamin Cummings, 2009.

Unit I: Text Book 1, Chapter 2  
 Unit II: Text Book 1, Chapter 3  
 Unit III: Text Book 2, Chapter 7  
 Unit IV: Text Book 1, Chapter 13  
 Unit V: Text Book 2, Chapter 11

**Reference Book(s):**

1. Klug WS, Cummings MR, Spencer CA, Palladino M. **Concepts of Genetics**.10<sup>th</sup> edition, Benjamin Cummings, 2012.
2. Griffith AJF, Wessler SR, Lewontin RC, Carroll SB. **Introduction to Genetic Analysis**. 9<sup>th</sup> edition, W.H.Freeman and Co., New York, 2007.
3. Hartl DL, Jones EW. **Genetics: Analysis of Genes and Genomes**. 7<sup>th</sup> edition, Jones and Bartlett Publishers, 2009.
4. Gardner EJ, Simmons MJ, Snustad DP. **Principles of Genetics**.8<sup>th</sup> edition. Wiley-India, 2008.
5. [PowerPoint Presentation \(ddtwo.org\)](http://ddtwo.org).

**Question Paper Pattern - Advanced Learners Course**

Time:3 Hours

Max Marks:100

Knowledge Level		Section	Marks	Description
K2,K3	1-5	A(Either or Pattern)	5×8=40	Short Answer/Define
K3/K4	6-15	B(Answer 5 Out of 10)	5×12=60	Descriptive Detailed

<b>Course Designed by</b> D. Jank Nook 30/3/22 (D.K. Franklin Nook)	<b>Verified by HOD</b> D. Jank Nook 30/3/22 (D.K. Franklin Nook)	<b>Checked by</b> D. Jank Nook 30/3/22 DT. Convener CDC	<b>Approved by</b> D. Jank Nook 30 MAR 2022
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Course Code	Title
21PMBSS05	Advanced Learners Course - Evolution and Behaviour
Semester: I - IV	Credit: 2

**Course Objective:**

Students will understand the concepts in Evolution of living organisms and their behavioural patterns according to time.

**Course Outcomes:**

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

<b>CO1</b>	Know about the emergence of evolutionary thought and concepts of life.
<b>CO2</b>	Understand the origin of cells and other living organisms.
<b>CO3</b>	Analyse the evolution of cell organelles and genetic material.
<b>CO4</b>	Describe the mechanism of genetic drift over evolution.
<b>CO5</b>	Explain about the behavioural changes of living organisms.

**Offered by: Microbiology****Course Content**

Unit	Description	Text Book	Chapter
I	<b>Emergence of Evolutionary thoughts:</b> Lamarck, Darwin – concepts of variation, adaptation, struggle, fitness and natural selection, Mendelism, Spontaneity of mutations, The evolutionary synthesis.	2	2
II	<b>Origin of cells and unicellular evolution:</b> Origin of basic biological molecules, Abiotic synthesis of organic monomers and polymers, Concept of Oparin and Haldane, Experiment of Miller (1953), Evolution of prokaryotes, Origin of eukaryotic cells, Evolution of unicellular eukaryotes.	3	1
III	<b>Molecular Evolution:</b> Concepts of neutral evolution, molecular divergence and molecular clocks, Molecular tools in phylogeny, classification and identification, Protein and nucleotide sequence analysis, Origin of new genes and proteins, Gene duplication and divergence.	1	8
IV	<b>The Mechanisms:</b> Population genetics – populations, gene pool, gene frequency, Hardy-Weinberg law, Concepts and rate of change in gene frequency through - Natural selection, Migration, Random genetic drift.	4	9
V	<b>Behavior:</b> Approaches and methods in study of behavior, Proximate and ultimate causation, Neural basis of learning, memory, cognition, sleep and arousal. Development of behavior, Social communication, Social dominance, Use of space and territoriality. Parental care, Aggressive behavior, Habitat selection and optimality in foraging, Migration, orientation and navigation, Domestication and behavioral changes.	1	10

**Text Book(s):**

1. Bateson, P. **Behaviour, Development and Evolution**, Open Book Publishers. 2017.
2. Workman, L. and W. Reader. **Evolution and Behaviour**. CRC Press. 2016.
3. Barton, N.H., D.E.G. Briggs, J.A. Eisen, D.B. Goldstein and N.H. Patel. **Evolution**, Cold Spring Harbour Laboratory Press. 2007.
4. Douglas J. Futuyma, **Evolution**, 3<sup>rd</sup> Edition, Sinauer Associate Inc., 2013.

- Unit I : Text Book 2, Chapter 2
- Unit II : Text Book 3, Chapter 1
- Unit III: Text Book 1, Chapter 8
- Unit IV: Text Book 4, Chapter 9
- Unit V: Text Book 1, Chapter 10

**Reference Book(s):**

1. Wise, J. R. Roush and S. Flower. **Concepts of Biology**, Create Space Independent Publishing Platform. 2013.
2. Skinner, B.F. **Science and Human Behaviour**, The Free press. 2014.
3. [Evolution and behavior \(acetheraceonline.com\)](http://acetheraceonline.com)

**Question Paper Pattern - Advanced Learners Course**

Time:3 Hours

Max Marks:100

Knowledge Level		Section	Marks	Description
K2,K3	1-5	A(Either or Pattern)	5×8=40	Short Answer/Define
K3/K4	6-15	B(Answer 5 Out of 10)	5×12=60	Descriptive Detailed

Course Designed by	Verified by HOD	Checked by	Approved by
Dr. Janki N. N. 30/3/22 (Dr. K. Franklin N. N.)	Dr. Janki N. N. 30/3/22 (Dr. K. Franklin N. N.)	Dr. K. Franklin N. N. 30/3/22 Convener CDC	30 MAR 2022