




**KADI SARVA VISHWAVIDYALAYA**  
**B.Sc Microbiology Semester 5 Syllabus (W.E.F. June 2019)**

	<b>KADI SARVA VISHWAVIDYALAYA</b>					
	<b>B.SC MICROBIOLOGY SEMESTER - 5 SCHEME</b>					
<b>Subject Code</b>	<b>Course</b>	<b>Instructions Hrs / week</b>	<b>Examination</b>			<b>Credit</b>
			<b>Internal</b>	<b>University Exam</b>	<b>Total</b>	
CMB -501	Environmental Microbiology	3	30	70	100	3
CMB -502	Bioprocess and Fermentation Technology	3	30	70	100	3
CMB -503	Analytical Techniques in Microbiology	3	30	70	100	3
CMB -504	Molecular Genetics of Prokaryotes	3	30	70	100	3
FCG-501	( University Elective ) Basic English – V	2	15	35	50	2
EGC-501	(Generic Elective - Institute elective) Good Laboratory Practices and Good Manufacturing Practices	2	50	00	50	2
SE MB-501 A	(Discipline Specific Specialization) Food Microbiology-III	2	50	00	50	2
SE MB-501 A	(Discipline Specific Specialization) Pathology-III					
PMB-501	Microbiology Practical-V	12	0	200	200	6
<b>Total</b>		<b>30</b>	<b>235</b>	<b>515</b>	<b>750</b>	<b>24</b>



**KADI SARVA VISHWAVIDYALAYA**  
**B.ScMicrobiology Semester 5 Syllabus (W.E.F. June 2019)**

**CMB-501 Environmental Microbiology**

**RATIONALE:** To introduce the students with importance of environmental education system as well as the multidisciplinary nature of environmental studies. Along with it, students get to know origins of earth, components of earth and their environment.

**LEARNING OUTCOMES:**

- Development of awareness of Environmental friendly microorganisms.
- Gain knowledge on the soil, food, dairy and water related microorganisms.
- Enables the student to pursue further studies on environmental microbiology related sciences.

**TEACHING AND EVALUATION SCHEME:** The objective of evaluation is not only to measure the performance of students, but also to motivate them for better performance. Students are evaluated on the basis of Mid Term examinations for 30 marks and End Term Examination conducted by University examination for 70 marks.

Subject Code	Subject Title	Teaching Scheme	Credits	Examination Scheme			Total Marks
		Theory Per Week		Hrs.	Max Marks		
					Mid Term	End Term	
CMB 501	Environmental Microbiology	3	3	3	30	70	100

**COURSE CONTENT**

<b>Unit 1</b>	<b>Number of lectures: 12</b>
<b>Environment</b>	<b>Weightage: 25%</b>
<ul style="list-style-type: none"><li>• Introduction to Environment :Structure of earth Environment: Lithosphere, Hydrosphere and Atmosphere(3h)</li><li>• Abiotic and Biotic Factors of Environment(3h)</li><li>• Deterioration of Environment(1h)</li><li>• Conservation strategies of Environment(2h)</li><li>• Concept of various microbial Interactions among microflora (3h)</li></ul>	



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<b>Unit 2</b> <b>Ecosystem and Ecology</b> <ul style="list-style-type: none"><li>• Microbial ecology and Ecosystem: Introduction and Characteristics, Concept of ecology, Structure, function and types of ecosystem (3h)</li><li>• Concept of Biomes: The Terrestrial and Aquatic. (2h)</li><li>• Ecological pyramids- pyramid of numbers, pyramid of biomass, pyramid of energy (2h)</li><li>• Ecological succession(2h)</li><li>• Sustainability(1h)</li><li>• Microbiology of Rumen ecosystem (2h)</li></ul>	<b>Number of lectures: 12</b> <b>Weightage: 25%</b>
<b>Unit 3</b> <b>Air Microbiology</b> <ul style="list-style-type: none"><li>• Composition of air. Aerosol and its types, Airflora (2h)</li><li>• Importance of air borne pathogens and toxins(2h)</li><li>• Sampling Devices for collection of bioaerosol (2h)</li><li>• Microbial Survival in air (2 h)</li><li>• Air Sanitation(2h)</li><li>• Concept of Astromicrobiology(2h)</li></ul>	<b>Number of lectures: 12</b> <b>Weightage: 25%</b>
<b>Unit 4</b> <b>Soil Microbiology</b> <ul style="list-style-type: none"><li>• Physicochemical characteristics of soil (1hr)</li><li>• Soil microflora: Bacteria, Fungi, Algae, Protozoa, Viruses and Rhizosphere (1h)</li><li>• Use of Winogradsky column in studying microbial diversity in soil(2h)</li><li>• Interaction of microbes and their associations with plants<ul style="list-style-type: none"><li>i. Rhizosphere and its significance(2h)</li><li>ii. Mycorrhizae and root nodule formation(2h)</li></ul></li><li>• Various Biogeochemical cycles- N,O,P,C,S,H Cycles, (4h)</li></ul>	<b>Number of lectures: 12</b> <b>Weightage: 25%</b>

**REFERENCES:**

1. Cell Biology, Genetics, Molecular biology, Evolution and Ecology Author- Verma and Agrawal
2. Microbial Ecology Author- Atlas and Bartha
3. Microbiology Authors- M. Pelczar, E.C.S. Chain and N. Krieg
4. Environmental Biotechnology Author- InduSekhar Thakur
5. Environmental Microbiology Author- Pepper and Gerba

**SUGGESTED REFERENCES:**



**KADI SARVA VISHWAVIDYALAYA**  
**B.ScMicrobiology Semester 5 Syllabus (W.E.F. June 2019)**

1. Experiments in Biotechnology, Authors- Nigohjkar and Nigohjkar,
2. Environmental Microbiology, Author- P.D. Sharma.
3. Environmental Microbiology, Author- K.G. Vijaya.
4. The nature and properties of soil, Authors- Harry buckman and Nyle C. brady.
5. Introduction to soil Microbiology Internationals, Authors- Martin Alexander.

**INSTRUCTION STRATEGIES**

1. Interactions with the students to understand the level of students
2. Explaining & discussing the major terminologies related to genetics and immunology.
3. Teaching the topics included in the syllabus with the help of teaching aids like OHP, LCD (Power point presentation), Notes, Question Banks, References and Reprints / Copy of Articles, Models, Diagrams
4. Assistance in solving of questions from our question bank .
5. Assistance in solving of questions asked in national entrance exams like CSIR –NET / other Universities.

**TEACHING AND EXAMINATION**

<b>UNIT</b>	<b>Examination Scheme %Weightage</b>	<b>Teaching Scheme No. of Lecture</b>
Unit 1	25	12
Unit 2	25	12
Unit 3	25	12
Unit 4	25	12
Total	100	48



**KADI SARVA VISHWAVIDYALAYA**  
**B.ScMicrobiology Semester 5 Syllabus (W.E.F. June 2019)**

**CMB-502- Bioprocess and Fermentation Technology**

**RATIONALE:** This course is designed to enable students to acquire the basic understanding of industrially important microorganisms and their advantages and disadvantages in the industries and uses of microbes for production of various microbial products.

**LEARNING OUTCOMES:**

- Gain the knowledge regarding the industrially important microorganisms and their application in the production of various products.

**TEACHING AND EVALUATION SCHEME:** The objective of evaluation is not only to measure the performance of students, but also to motivate them for better performance. Students are evaluated on the basis of Mid Term examinations for 30 marks and End Term Examination conducted by University examination for 70 marks.

Subject Code	Subject Title	Teaching Scheme	Credits	Examination Scheme			Total Marks
		Theory Per Week		Hrs.	Max Marks		
					Mid Term	End Term	
CMB 502	Bioprocess and Fermentation Technology	3	3	3	30	70	100

**COURSE CONTENT**

<b>Unit 1</b>	<b>Number of lectures: 12 Weightage: 25%</b>
<b>Fundamentals of Industrial Microbiology</b>	
<ul style="list-style-type: none"><li>• General concepts (1h) and History of Fermentation technology (2h)</li><li>• Introduction and Definitions of fermentation. Range of Fermentations(2h)</li><li>• Components of Fermentation technology(1h)</li><li>• Primary and secondary screening. (3h)</li><li>• Inoculum development. Bacteria, Mycelial and Yeast(3h)</li></ul>	

<b>Unit 2</b>	<b>Number of lectures: 12 Weightage: 25%</b>
<b>Strain Improvement and Fermentation Media</b>	
<ul style="list-style-type: none"><li>• Strategies of strain improvement: Feed Back Inhibition and Regulation, Recombination, Mutagenesis, Mutant – Auxotrophic, Analogue, Revertant (7h)</li><li>• Strain improvement by modifying properties other than the yield of product(1h)</li><li>• Fermentation media (4h) Characteristics of an ideal fermentation media,<ul style="list-style-type: none"><li>• Raw materials for media preparation.</li></ul></li></ul>	



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**Unit 3** **Number of lectures: 12 Weightage: 25%**  
**Sterilization, Design of Fermenter and Types of Fermentation process**

- Sterilization of media: Batch and Continuous(3h)
- Sterilization of air and Fermenter (1h)
- Types fermentations processes- Batch, Continuous and Fed batch(2h)
- Design of typical batch fermenter. (2h)
- Types of fermenters. Airlift, Tower, Cyllindroconical, Cyclone column, Packed bed reactor, Stirrer Tank, Fluidised Bed reactor. (4h)

**Unit 4** **Number of lectures: 12 Weightage: 25%**  
**Downstream processes**

- Separation of microbial cells and suspended solids: Filtration, Centrifugation, Floatation and Flocculation (3h)
- Intracellular product recovery: Cell disruption (2h)
- Concentration of products : Solubilization, solvent extraction, precipitation and distillation (2h)
- Purification of products : Crystallization, Chromatography, ultrafiltration, evaporation and drying (3h)
- Introduction to Fermentation economics. (2h)

**REFERENCES:**

- |  |
|--|
| 1. Fermentation technology (Volumes), Authors- H.A. Modi                         |
| 2. Textbook of Industrial Microbiology, Author- A. H. Patel.                     |
| 3. Principles of Fermentation Technology, Authors- Standbary, Whitaker and Hall. |
| 4. Industrial Microbiology, Author- L. E. Cassida                                |

**SUGGESTED REFERENCES:**

- |   |
|---|
| 1. Industrial Microbiology, Author- G. Reed.            |
| 2. Industrial Microbiology, Author- Agarwal AndParihar. |
| 3. Biology of Industrial Microorganisms. A.L. Demain.   |
| 4. Bioprocess Engineering Author- Cruger and Cruger     |

**INSTRUCTION STRATEGIES**

1. Interactions with the students to understand the level of students
2. Explaining & discussing the major terminologies related to genetics and immunology.
3. Teaching the topics included in the syllabus with the help of teaching aids like OHP, LCD (Power point presentation), Notes, Question Banks, References and Reprints / Copy of Articles, Models, Diagrams
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<b>UNIT</b>	<b>Examination Scheme %Weightage</b>	<b>Teaching Scheme No. of Lecture</b>
Unit 1	25	12
Unit 2	25	12
Unit 3	25	12
Unit 4	25	12
Total	100	48



**KADI SARVA VISHWAVIDYALAYA**  
**B.ScMicrobiology Semester 5 Syllabus (W.E.F. June 2019)**

**CMB-503 Analytical Techniques in Microbiology**

**RATIONALE:** This course is designed to enable students to acquire the basic understanding of various instrumental techniques used in the microbiology their advancements in the microbiology.

**LEARNING OUTCOMES:**

- Gain the knowledge regarding the various techniques applied in the microbiology.
- Development of the various advance instrumental skills in the microbiology.
- **TEACHING AND EVALUATION SCHEME:** The objective of evaluation is not only to measure the performance of students, but also to motivate them for better performance. Students are evaluated on the basis of Mid Term examinations for 30 marks and End Term Examination conducted by University examination for 70 marks.

Subject Code	Subject Title	Teaching Scheme	Credits	Examination Scheme			Total Marks
		Theory Per Week		Hrs.	Max Marks		
					Mid Term	End Term	
CMB 503	Analytical Techniques in Microbiology	3	3	3	30	70	100

**COURSE CONTENT**

<b>Unit 1</b>	<b>Number of lectures: 12 Weightage: 25%</b>
<b>Spectrophotometry</b>	
Principle, Instrumentation Method and Application	
<ul style="list-style-type: none"><li>• UV-Visible Spectroscopy (6h)</li><li>• Atomic Absorbtion Spectroscopy (3h)</li><li>• Flame Photometry (3h)</li></ul>	
<b>Unit 2</b>	<b>Number of lectures: 12 Weightage: 25%</b>
<b>Electrophoresis</b>	
<ul style="list-style-type: none"><li>• Introduction and Principle (1h), Various Support Media (Gel) (2h)</li><li>• Factors affecting Electrophoretic Mobility(1h)</li><li>• Separation of protein and nucleic acids (Native PAGE, SDS-PAGE, (3h) Agarose gel(2h) 2D Electrophoresis (1h)</li><li>• Applications of electrophoresis(2h)</li></ul>	
<b>Unit 3</b>	<b>Number of lectures: 12 Weightage: 25%</b>
<b>Centrifugation :</b>	
<ul style="list-style-type: none"><li>• Basic Principles of Sedimentation (2h)</li></ul>	





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- Methods and Applications of Density Gradient Centrifugation (Rate Zonal (2h) and Isopycnic) (2h)
- Types of Centrifuges : Benchtop, Clinical and Analytical, High speed (2 h)
- Ultracentrifugation (Introduction, (2h) Instrumentation(2h) and Applications(1h))

**Unit 4** **Number of lectures: 12 Weightage: 25%**

**Chromatography**

- Definition and introduction of types of Chromatography (3h)
- General Principles Underlying Chromatographic techniques. (2h)
- Partition coefficient and adsorption (1h)
- Introduction, Instrumentation, Working and Applications of :Paper and Thin Layer, (3h)  
Ion Exchange Chromatography, (3h)

**REFERENCES:**

1. Biophysical chemistry - principles and techniques - Upadhyay, Upadhyay and Nath
2. Principles and techniques of Practical biochemistry - Wilson and Walker

**SUGGESTED REFERENCES:**

1. Instrumental methods of chemical analysis - Chatwal and Anand
2. Bioseparation: Principles and Techniques, Author- B. Sivasankar.
3. Protein Analysis and Purification, Authors- I.M. Rosenberg.
4. Principles of Instrumental Analysis. Author- D.A. Skoog

**INSTRUCTION STRATEGIES**

1. Interactions with the students to understand the level of students
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4. Assistance in solving of questions from our question bank .

<b>UNIT</b>	<b>Examination Scheme %Weightage</b>	<b>Teaching Scheme No. of Lecture</b>
Unit 1	25	12
Unit 2	25	12
Unit 3	25	12
Unit 4	25	12
Total	100	48



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**CMB-504- Molecular Genetics of Prokaryotes**

**RATIONALE:** This course is designed to enable students to acquire the basic understanding of microbial genetics and their genome organization

**LEARNING OUTCOMES:**

- Enabling the students to know and understand the basics of replication, transcription, translation and regulation of gene expression in prokaryotes and eukaryotes.
- Refurbishing knowledge on classical genetics and genetic disorders.
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**TEACHING AND EVALUATION SCHEME:** The objective of evaluation is not only to measure the performance of students, but also to motivate them for better performance. Students are evaluated on the basis of Mid Term examinations for 30 marks and End Term Examination conducted by University examination for 70 marks.

Subject Code	Subject Title	Teaching Scheme	Credits	Examination Scheme			Total Marks
		Theory Per Week		Hrs.	Max Marks		
					Mid Term	End Term	
<b>CMB 504</b>	<b>Molecular Genetics of Prokaryotes</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>30</b>	<b>70</b>	<b>100</b>

**COURSE CONTENT**

<p><b>Unit 1 Introduction of Genetics</b></p> <ul style="list-style-type: none"> <li>• Fundamentals of Genetics</li> <li>• Nature of Genetic material <ul style="list-style-type: none"> <li>A. Understanding of terms: Gene, allele, genotype, phenotype, intron, exon, cistron, recon, muton, plasmid, chromosome, genome, zygote, merozygote, crispr (3 h)</li> <li>B. Experimental proof for Nucleic acid as genetic material: Work of Griffith; Avery, McCarty and MacLeod; Hershey and Chase (2 h)</li> </ul> </li> <li>• Gene structure and function (2 h) <ul style="list-style-type: none"> <li>A. Chemistry of DNA, Watson and Cricks model of DNA structure</li> <li>B. Typical gene structure, functions of gene</li> </ul> </li> <li>• DNA replication (5 h) <ul style="list-style-type: none"> <li>A. Semi conservative nature, Meselson and Stahl's experiment</li> <li>B. Molecular mechanism: Strand separation, formation of leading and lagging strand, formation of Okazaki fragments and their removal, proof reading</li> <li>C. Post-replicative modifications and their significance</li> </ul> </li> </ul>	<p align="center"><b>Number of lectures: 12</b>  <b>Weightage: 25%</b></p>
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**Unit 2: Gene Expression in Prokaryotes**

**Number of lectures: 12**

**Weightage: 25%**

- **Transcription (2 h)**
  - I. Initiation, role of enzyme, sigma factor, promoter, operator
  - II. Elongation
  - III. Termination: Rho dependent and Rho independent
- **Genetic Code:** Characteristics -Triplet nature, polarity, degeneracy, near universality and Wobble phenomenon (2 h)
- **Translation : (5 h)**
  - I. Initiation, 70 S initiation complex,
  - II. Elongation: recognition, peptidyl transfer, translocation
  - III. Termination
  - IV. Fate of ribosomes, polysome system, polycistronic RNA
- **Regulation of Gene Expression: (3h)**
  - I. Negative inducible control - lac operon
  - II. Negative repressible control - trp operon

**Unit 3 Mutation**

**Number of lectures: 12**

**Weightage: 25%**

- **Introduction (3 h)**
  - A. Spontaneous and induced mutations, proof for spontaneity of mutation by replica plate method
  - B. Effect at DNA level, transition, transversion, insertion, deletion, development of A-P Sites
- **Molecular basis of mutation (3 h)**
  - A. Chemical mutagenesis: 5-bromouracil, nitrous acid and acradine orange
  - B. Physical mutagenesis: Ultraviolet radiations
  - C. Biological Mutagenesis: Phage Mu,
- **Consequences of mutation (3 h)**
  - A. Forward - silent, missense, nonsense, frame shift
  - B. Reverse – true reversion, suppressions (intragenic and extragenic only)
- **Repair mechanisms (3 h)**
  - A. Direct repair: Photoreactivation, removal of A-P sites
  - B. Indirect repair: Excision repair, mismatch repair
  - C. SOS regulatory system

**Unit 4 Genetic Recombination**

**Number of lectures: 12**

**Weightage: 25%**

- **Fundamentals:** Horizontal and vertical gene transfer, merozygotic system (1 h)
- **Transformation:** Competence, DNA uptake in Gram positive and Gram negative bacteria (2 h)
- **Transduction:** Generalized and restricted transduction (3 h)
- **Conjugation:** Role of sex factor, transfer of genes during F + x F- , Hfr x F- and sexduction (3 h)
- **Bacterial plasmids :** General properties, Types of plasmids,
  - compatibility groups, maintenance of plasmids (3 h)
- **Transposable elements:** General Characteristics, Transposition,
- **insertion sequences (IS) and Tn elements**



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**REFERENCES:**

1. Genetics a Conceptual Approach Author- B. Lewin.
2. Genes XI, Author- B. Lewin.

**SUGGESTED REFERENCES:**

1. Principles of Genetics, Authors- Gardner, Simmons and Snustad.
2. Concepts of Genetics, Authors- Klug and Cummings.
3. Microbial Genetics, Authors- Freifelder.
4. Genetics, Authors- Arora and Sandhu.

**INSTRUCTION STRATEGIES**

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3. Teaching the topics included in the syllabus with the help of teaching aids like OHP, LCD (Power point presentation), Notes, Question Banks, References and Reprints / Copy of Articles, Models, Diagrams
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**TEACHING AND EXAMINATION**

<b>UNIT</b>	<b>Examination Scheme %Weightage</b>	<b>Teaching Scheme No. of Lecture</b>
Unit 1	25	12
Unit 2	25	12
Unit 3	25	12
Unit 4	25	12
Total	100	48



**KADI SARVA VISHWAVIDYALAYA**  
**B.Sc Microbiology Semester 5 Syllabus (W.E.F. June 2019)**

**FCG 501- Basic English – V**

**RATIONALE:** This course is designed to enable students to acquire basic understanding of English grammar. The course would help students to fortify their knowledge of English and strengthen their basic communication abilities.

**LEARNING OUTCOMES:**

- Develop language skills of reading through filling in appropriate words in blanks, correcting errors, choosing correct forms out of alternative choices, etc.
- Acquire interest in English language and literature through textbook lessons.
- Acquire translation skill through translate from English to Gujarati/Hindi exercises
- Acquire the knowledge of different kinds of dialogue writing.

**TEACHING AND EVALUATION SCHEME:** The objective of evaluation is not only to measure the performance of students, but also to motivate them for better performance. Students are evaluated on the basis of Mid Term examinations for 15 marks and End Term Examination conducted by University examination for 35 marks.

Subject Code	Subject Title	Credits	Theory			Total Marks
			Hrs.	Max Marks		
				Mid Term	End Term	
FCG - 501	Basic English – V	2	24	15	35	50

**Course Content**

<p><b>Unit 1</b> <span style="float: right;"><b>Number of lectures: 8</b></span>  <b>Weightage: 33%</b></p> <p>Lesson 1: <i>An Astrologer's Day</i> by R.K. Narayan            Lesson 6 : <i>Education: India and America</i> by Anurag Mathur            Poem 11: <i>Where the mind is without Fear</i> by Rabindranath Tagore            Poem 12: <i>Stopping by Woodsona Snowy Evening</i> by Robert Frost            Poem 13: <i>Sonnet 29</i> by William Shakespeare</p>
<p><b>Unit 2</b> <span style="float: right;"><b>Number of lectures: 4</b></span> <span style="float: right;"><b>Weightage: 17%</b></span>  <b>Text Based Vocabulary</b>  <b>Enhancing English Reading Skills</b></p> <ul style="list-style-type: none"> <li>• Importance of Reading Skill</li> <li>• Structure of paragraph</li> <li>• Skimming and Scanning</li> <li>• Reasons For poor Reading Skills</li> </ul>



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<b>Unit 3</b>	<b>Number of lectures: 8</b>	<b>Weightage: 33%</b>
Translation from English to Gujarati/Hindi		
<b>Unit 3</b>	<b>Number of lectures: 4</b>	<b>Weightage: 17%</b>
<b>Capitalization and punctuation Marks in official Correspondence</b>		

### REFERENCES

1. High School English Grammar – Wrenn & Martin
2. Contemporary English Grammar – David Green

### INSTRUCTION STRATEGIES

1. Interactions with the students to understand the level of students
2. Explaining & discussing English language structures.
3. Teaching the topics included in the syllabus with the help of teaching aids like OHP, LCD (Powerpoint presentation), Notes, Question Banks, References and Reprints/Copy of Articles, Models, Diagrams
4. Assistance in solving of questions from our question bank.

### TEACHING AND EXAMINATION

<b>UNIT</b>	<b>Examination Scheme % Weightage</b>	<b>Teaching Scheme No. of Lecture</b>
Unit 1	33	8
Unit 2	17	4
Unit 3	33	8
Unit 4	17	4
<b>Total</b>	<b>100</b>	<b>24</b>



**KADI SARVA VISHWAVIDYALAYA**  
**B.ScMicrobiology Semester 5 Syllabus (W.E.F. June 2019)**

**EGC 501 Good Laboratory Practices and Good Manufacturing Practices**

**RATIONALE:** This course is designed to enable students to acquire basic understanding of the Good Laboratory Practices and Good manufacturing Practices in Various chemical and Pharmaceutical Industries.

**LEARNING OUTCOMES:**

- To impart knowledge of various areas related to pharmaceutical industries,
- To enable the students for understanding the various practices carried out in industries for quality control of products.

**TEACHING AND EVALUATION SCHEME:** The objective of evaluation is not only to measure the performance of students, but also to motivate them for better performance. Students are evaluated on the basis End Term Examination conducted by University examination for 50 marks.

Subject Code	Subject Title	Credits	Theory Hrs.	Mid term Exam (Internal)	End term Exam	Total Marks
				Theory	Theory	
EGC-501	Good Laboratory Practices and Good Manufacturing Practices	2	36	50	--	50

**COURSE CONTENT**

<b>Unit-1</b>	<b>Number of lectures: 12</b>	<b>Weightage 50%</b>
<ul style="list-style-type: none"><li>• Introduction to GLP and GMP(1 h)</li><li>• Introduction to Pharmacopoeia: IP and USP(2 h)</li><li>• GMP Guidelines for manufacturing facilities(2 h)</li><li>• Regulatory market Inspections and their requirements(2 h)</li><li>• Quality Control and Quality assurance(2 h)</li><li>• Accrediation agencies NABL, GLP(1h)</li><li>• SOP, USFDA, WHO (2 h)</li></ul>		



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**Unit-2**

**Number of lectures: 12**  
**Weightage 50%**

- Biopharmaceuticals and introduction to animal, plant and microbial based pharmaceutical products(2 h)
- Sterility testing (1 h)
- *In vitro* and *in vivo* testing for pyrogens and endotoxins, (2 h)
- Biological and Chemical analysis of antibiotics (2 h)
- Water analysis(2 h)
- Clean Rooms and Environmental monitoring. (2 h)
- Bioburden determination(1 h)

**REFERENCES:**

- |  |
|--|
| 1. Biopharmaceuticals Biochemistry and Biotechnology Authors-Gary Walsh    |
| 2. Hugo and Russel's Pharmaceutical Microbiology:Authors Hugo and Russel's |
| 3. Pharmaceutical Biotechnology Authors-S. P.Vyas and D.V. Kohli           |

**TEACHING AND EXAMINATION**

<b>Course Content</b>	<b>Examination Scheme %Weightage</b>	<b>Teaching Scheme No. of Lecture</b>
Unit-1	50	12
Unit-2	50	12
Total	100	24





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**B.Sc Microbiology Semester 5 Syllabus (W.E.F. June 2019)**

**EMB 501 A Food Microbiology III**

**RATIONALE:** This course is designed to enable students to acquire basic understanding of the various bacteria and fungi involved in the preparation as well as spoilage of food.

**LEARNING OUTCOMES:**

- To impart knowledge of food born pathogen
- The knowledge of microorganisms involved in food pathogenesis.

**TEACHING AND EVALUATION SCHEME:** The objective of evaluation is not only to measure the performance of students, but also to motivate them for better performance. Students are evaluated on the basis End Term Examination conducted by University examination for 50 marks.

Subject Code	Subject Title	Credits	Theory+ Practical	End term Exam(Internal)		Total Marks
			Hrs.	Theory	Practical	
EMB- 501 A	Food Microbiology -III	2 (1 hr Theory + 2 hrPracticalhr	36	20	30	50

**COURSE CONTENT**

**Number of lectures: 12**

- Common Food borne Bacteria, (1hr)
- Role of Molds and yeasts. (1.5 hr)
- Significance of Microorganisms in Foods.(1.5 hr)
- Methods for detection of microorganisms in food: Meat diary, sea foods, vegetables(1hr)
- Physical, Chemical Immunological and biochemical assays. (2 hr)
- Food spoilage and food borne diseases(1hr)
- Common food borne pathogens, Entero pathogens and diseases: Applications of food microbiology(2hr)
- Staphylococcal, Ecoli, Salmonellosis, shigellosis, Listerial infections. Mycotoxins, Aflatoxins Alternaria Toxins, Toxigenic Phytoplanktons and viruses.(2hr)



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**LIST OF EXPERIMENT (24 hours and 100% weightage )**

• Isolation of food borne microorganism(4 hr)
• Isolation of food borne molds(4hr)
• Isolation of food borne Yeast(4 hr)
• Determination of chemical assay of milk(4 hr)
• To Perform MBRT Test(2hr)
• Isolation of Food Poisoning Gram Positive bacteria(3 hr)
• Isolation of Food Poisoning Gram Negative bacteria(3 hr)

**REFERENCES:**

1. Essentials of Food Microbiology. Edited by John Garbult. Arnold International Students Edition.
2. Microbiology, Authors- Pelczar, Chan and Kreig.
3. Microbiology of Foods by John C. Ayres. J. OrwinMundt. William E. Sandinee. W. H. Freeman and Co.
4. Bacterial Pathogenesis A Molecular Approach. 2 nd Edition. 2001 by Abigail A. Salyers and Dixie D. Whitt. ASM Publications.
5. Food Microbiology :Fraizer

**TEACHING AND EXAMINATION**

<b>Course Content</b>	<b>Examination Scheme %Weightage</b>	<b>Teaching Scheme No. of Lecture</b>
Theory	40	12
Practical	60	24
Total	100	36



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**EMB- 501 B Pathology-III**

**RATIONALE:** This course is designed to enable students to acquire basic understanding of the Immune system, immune system and immunity of human.

**LEARNING OUTCOMES:**

- To acquire the knowledge of immune system and immunity power
- Gain knowledge about the antigen and foreign compound for the body

**TEACHING AND EVALUATION SCHEME:** The objective of evaluation is not only to measure the performance of students, but also to motivate them for better performance. Students are evaluated on the basis End Term Examination conducted by University examination for 50 marks.

Subject Code	Subject Title	Credits	Theory+ Practical	End term Exam(Internal)		Total Marks
			Hrs.	Theory	Practical	
EMB- 501B	Pathology - III	2 (1 hr Theory+ 2 hr Practical)	36	20	30	50

**COURSE CONTENT**

**Number of lectures: 12 Immuno Pathology**

- Immune system (2hr)
- Types of antibodies (2hr)
- Antigen (2hr)
- Cells and Organs (2hr)
- Genetic Basis of Ab Structure(2hr)
- The T Cell Receptor: Structure and Genetic Basis (2hr)

**List of Experiments (24 hours and 100% weightage )**

• To Perform Serologic tests for human retroviruses including:HIV-1,HIV-2(3hr)
• To Perform Serologic tests for viral hepatitis including:Hepatitis B, Hepatitis C(3hr)
• To perform Widal test for typhoid detection (3hr)
• To Perform RIA (Radial immune assay)(3hr)
• To Perform Pregnancy detection test(3hr)
• To Perform VDRLTest(3hr)
• To Perform ODD (3hr)
• To perform ELISA(3hr)



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**REFERENCES:**

1. Technical Manual - America Association of Blood Banks
2. Introduction of Transfusion Medicine - Latest edition – Dr.Z.S.Barucha
3. Compendium to Transfusion Medicine - Dr.R.N.Makroo
4. Blood Transfusion in Clinical Medicine - P.L.Mollison
5. Blood group Serology - Dodd &Boorman

**TEACHING AND EXAMINATION**

<b>Course Content</b>	<b>Examination Scheme %Weightage</b>	<b>Teaching Scheme No. of Lecture</b>
Theory	40	12
Practical	60	24
Total	100	36



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**PMB 501 Microbiology Practical- V**

**RATIONALE:** This course is designed to enable students to acquire basic understanding of the microbiological physiology and nutrition and its metabolic diversity.

**LEARNING OUTCOMES:**

- Understand the concept of various analytical techniques used for Microbiology
- Develop an understanding of fermentation technology and genetics.
- To study the various environmental parameters affecting the water and waste water analysis.

**TEACHING AND EVALUATION SCHEME:** The objective of evaluation is not only to measure the performance of students, but also to motivate them for better performance. General viva-voce will be conducted to analyze the knowledge of the student.

Subject Code	Subject Title	Credits	Practical		Total Marks
			Hrs.	Max Marks	
PMB- 501	Microbiology practical- V	6	12	200	200

**LIST OF EXPERIMENTS**

1. To study and isolate air flora
2. To study and isolate skin flora
3. To isolate non-symbiotic nitrogen fixers from soil.
4. To isolate symbiotic nitrogen fixers
5. To isolate actinomycetes.
6. To isolate phosphorous solubilizing bacteria/fungus from soil sample.
7. To isolate Xanthomonas spp. from citrus canker
8. To isolate antibiotic producer from soil sample. Crowded plate and wilkins method
9. To isolate enzyme producer from soil sample. Amylase, Protease and Lipase
10. To isolate organic acid producer from soil sample.
11. To study Bioassay of penicillin.



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12. Sterility testing of pharmaceutical products- injectibles, eye and ear drops.
13. Determination of $\lambda$ (Absorption Maxima -wavelength selection)
14. To Separate aminoacids/carbohydrates by Paper chromatography.
15. To Separate amino acids by TLC.
16. To Separate biomolecules by Agarose Gel Electrophoresis- Demonstration
17. Quantitative estimation of DNA by DPA method.
18. Quantitative estimation of RNA by orcinol method.
19. To study UV survival in <i>E.coli</i>
20. To isolate UV induced lac <sup>-</sup> Mutants
21. To Isolate Pigment Mutants of <i>Serratia sp.</i>
22. To isolate bacterial Genomic DNA.
23. To isolate fungal Genomic DNA.
24. To isolate Plasmid DNA.



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**B.Sc. MICROBIOLOGY Semester- V**  
**PMB-501 Microbiology Practical- V**  
**Practical Examination Skeleton( 3 Days Examination)**

**TIME : 10 TO 5**

**TOTAL MARKS 200**

**Day-1**

**EX 1 Write the Principle and Working of Instrument 10**

- a) Microscope
- b) Autoclave
- c) Hot Air oven
- d) Incubator
- e) Centrifuge
- f) pH meter
- g) Colorimeter- Spectrophotometer

**EX 2 Write the Principle , Requirement and Procedure for the given experiment and perform. 30**

1. To study and isolate air flora
2. To study and isolate skin flora
3. To isolate symbiotic nitrogen fixers
4. To isolate non-symbiotic nitrogen fixers from soil.
5. To isolate phosphorous solubilizing bacteria/fungus from soil sample.
6. To isolate Xanthomonas spp. from citrus canker
7. To isolate actinomycetes.

**EX 3 Write the Principle , Requirement and Procedure for the given experiment and perform. 30**

1. To isolate antibiotic producer from soil sample by crowded plate method
2. To isolate antibiotic producer from soil sample by Wilkin's method
3. To isolate Amylase producer from soil sample.
4. To isolate Protease producer from soil sample.
5. To isolate Lipase producer from soil sample.
6. To isolate organic acid producer from soil sample.

**Day-2**

**Ex- 4 Write the Principle , Requirement and Procedure for the given experiment and perform. 30**

1. Quantitative estimation of DNA by DPA method.
2. Quantitative estimation of RNA by orcinol method.
3. To Separate sugars/ Amino acids by Paper chromatography.



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4. To Separate amino acids by TLC.

**EX 5 Write the Principle , Requirement and Procedure for the given experiment and perform. 30**

1. To study Bioassay of penicillin.
2. Sterility testing of pharmaceutical products- injectibles, eye and ear drops
3. To study UV survival in *E.coli*
4. To isolate UV induced lac<sup>-</sup> Mutants
5. To Isolate Pigment Mutants of *Serratia sp.*

**Day-3**

**EX 6 Write the Principle , Requirement and Procedure for the given experiment. 15**

1. To isolate bacterial Genomic DNA.
2. To isolate fungal Genomic DNA.
3. To isolate Plasmid DNA.
4. Determination of  $\lambda$  (Absorption Maxims -wavelength selection)

**EX 7 Spotting 20**

**EX 8 Viva 20**

**EX 9 Journal (10 ) and Slide Box (5) 15**





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**EX-7 Spotting**

**20**

<b>Spot No.</b>	<b>Question</b>	<b>Marks</b>
1	Identify the part of Instrument and give its use.	1
2	Identify the glassware/plasticware /lab accessories and give its use.	1
3	Definition	1
4	Full Name/ Full Form	1
5	Fill in the blank	1
6	Give the use of Chemical /Dye/Reagent	1
7	Give the use of Chemical /Dye/Reagent	1
8	Mathematical conversion	1
9	Give examples of two symbiotic Nitrogen fixer/ Non symbiotic N Fixers/ phosphorous solubilisers/actinomycetes	1
10	Give two examples of Antibiotic/Amylase/Lipase/ Protease/ Organic acid Producers	1
11	Identify the growth and name medium	1
12	Give the composition of _____ medium	1
13	Identify the slides	1
14	How will you prepare _____ Solution.?	1
15	Give the principle of _____	1
16	Give the principle of instrument.	1
17	How will you sterilize the specimen?	1
18	Give applications of Amylase/Protease/Lipase/ Organic acids/ Nitrogen fixers/ P solubilizers	1
19	Give the contribution of Scientist	1
20	Give the contribution of Scientist	1