

Re-Accredited 'B++' 2.86 CGPA by NAAC

VEER NARMAD SOUTH GUJARAT UNIVERSITY

University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India.

વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી

યુનિવર્સિટી કેમ્પસ, ઉદ્ધના-મગદલા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.

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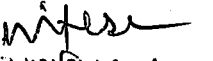
-: પરિપત્ર :-

યુનિવર્સિટી સંલગ્ન વિજ્ઞાન વિદ્યાશાખા હેઠળની તમામ કોલેજોનાં આચાર્યશ્રીઓને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૫-૨૬ થી અમલમાં આવનાર T.Y. B.Sc. Microbiology Sem.-5 & 6 Major, Minor અને SEC નો પેટાસમિતિ દ્વારા તૈયાર કરવામાં આવેલ અભ્યાસક્રમ સંદર્ભે માર્કોબાયોલોજી વિષયની અભ્યાસ સમિતિની તા.૦૨/૦૪/૨૦૨૫ ની સભાના ઠરાવ ક્રમાંક:૦૨ થી કરેલ ભલામણ સ્વીકારી વિજ્ઞાન વિદ્યાશાખાની તા.૩૦/૦૪/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંક:૧૬ થી કરેલ ભલામણ સ્વીકારી એકેડેમિક કાઉન્સિલની તા.૦૫/૦૫/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંક: ૮૩ થી મંજૂર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

બિડાણ: ઉપર મુજબ

ક્રમાંક:ઓથો./પરિપત્ર/સિલેબસ/૧૧૯૯૪/૨૦૨૫

તા.૨૬-૦૫-૨૦૨૫


કુલસચિવ

પ્રતિ,

૧) યુનિવર્સિટી સંલગ્ન વિજ્ઞાન વિદ્યાશાખા હેઠળની તમામ કોલેજોનાં આચાર્યશ્રીઓ.

.....આપશ્રીની કોલેજના સંબંધિત શિક્ષકોને જાણ કરી અમલ કરવા સારું.

૨) ડીનશ્રી, વિજ્ઞાન વિદ્યાશાખા.

૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.

.....તરફ જાણ તેમજ અમલ સારું.



**VEER NARMAD SOUTH GUJARAT UNIVERSITY,
SURAT**

**B.Sc. (Microbiology) Semester V & VI
Syllabus as per NEP 2020
(3 Years Degree & 4 Years Honors/Honors with
Research)**

(Effective from June, 2025)

POs for All UG Science Programs

PO-01: Scientific Knowledge & Conceptual Understanding: Develop a strong foundation in scientific principles, theories and concepts across disciplines, fostering interdisciplinary learning, advance knowledge and problem-solving abilities.

PO-02: Analytical & Critical Thinking: Apply critical thinking and analytical reasoning to evaluate scientific data, hypotheses and real-world problems, leading to evidence-based conclusions.

PO-03: Research & Inquiry-based Learning: Develop investigative skills through experimentation, data analysis and scientific inquiry to contribute to research and innovation.

PO-04: Laboratory & Technical Skills: Gain hands-on experience with laboratory techniques, instrumentation and computational tools relevant to scientific research and industry applications.

PO-05: Digital & Computational Literacy: Utilize digital tools, computational techniques and emerging technologies such as AI, bioinformatics and statistical modelling to enhance scientific learning and problem-solving.

PO-06: Environmental & Societal Responsibility: Understand the role of science in addressing environmental, health and societal challenges, promoting sustainability and ethical responsibility.

PO-07: Effective Communication & Collaboration: Develop proficiency in scientific communication, both written and oral, for effective dissemination of knowledge while collaborating in multidisciplinary teams.

PO-08: Innovation & Entrepreneurship: Foster an entrepreneurial mind-set by applying scientific knowledge for innovation, technology development, and industry-oriented applications. Develop sustainable solutions to address real-world challenges in research and environmental management.

PO-09: Lifelong Learning & Professional Growth: Cultivate curiosity and adaptability for continuous learning, equipping students for higher education, research, and professional careers.

PO-10: Ethical Leadership & Value-based Education: Develop leadership qualities, ethical values, and a sense of responsibility in applying science for societal progress, aligning with Indian knowledge systems and global perspectives.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program in Microbiology

Teaching and Evaluation Scheme

Semester – V & VI

[Academic Year of Implementation 2025-26]

Semester – V (Major)

| Course Code | Course Title | Teaching Schedule Hours/Week | Exam Duration & Marks | | | Total Theory/ Practical Marks | Credit |
|----------------|---|------------------------------|-----------------------|----------------------|----------------------|-------------------------------|--------|
| | | | Duration (Hours) | (CCE) Internal Marks | (SEE) External Marks | | |
| MB – MJ - 501 | Applied and Environmental Microbiology | 2 hrs. | 1 hrs. | 25 | 25 | 50 | 02 |
| MBP – MJ - 501 | Applied and Environmental Microbiology Practicals | 4 hrs. | 6 hrs. | 25 | 25 | 50 | 02 |
| MB – MJ - 502 | Vedic Microbiology | 2 hrs. | 1 hrs. | 25 | 25 | 50 | 02 |
| MBP – MJ - 502 | Vedic Microbiology Practicals | 4 hrs. | 6 hrs. | 25 | 25 | 50 | 02 |
| MB – MJ - 503 | Food & Dairy Microbiology | 2 hrs. | 1 hrs. | 25 | 25 | 50 | 02 |
| MBP – MJ - 503 | Food & Dairy Microbiology Practicals | 4 hrs. | 6 hrs. | 25 | 25 | 50 | 02 |
| | | | Total | 150 | 150 | 150 (T) + 150 (P) | 12 |

Semester – V (Minor Elective)

| Course Code | Course Title | Teaching Schedule Hours/Week | Exam Duration & Marks | | | Total Theory/Practical Marks | Credit |
|----------------|--|------------------------------|-----------------------|----------------------|----------------------|------------------------------|--------|
| | | | Duration (Hours) | (CCE) Internal Marks | (SEE) External Marks | | |
| MB – ME - 501 | Quality Control and Quality Assurance | 2 hrs. | 1 hrs. | 25 | 25 | 50 | 02 |
| MBP – ME - 501 | Quality Control and Quality Assurance Practicals | 4 hrs. | 6 hrs. | 25 | 25 | 50 | 02 |
| MB – ME - 502 | Analytical Instrumentation & Techniques | 2 hrs. | 1 hrs. | 25 | 25 | 50 | 02 |
| MBP – ME - 502 | Analytical Instrumentation & Techniques Practicals | 4 hrs. | 6 hrs. | 25 | 25 | 50 | 02 |
| | | | Total | 100 | 100 | 100 (T) + 100 (P) | 08 |

Semester – V (SEC)

| Course Code | Course Title | Teaching Schedule Hours/Week | Exam Duration & Marks | | | Total Theory/Practical Marks | Credit |
|-----------------|-----------------------|------------------------------|-----------------------|----------------------|----------------------|------------------------------|--------|
| | | | Duration (Hours) | (CCE) Internal Marks | (SEE) External Marks | | |
| MB – SEC - 501 | Hematology | 1 hrs. | 00.30 hrs. | 12 | 13 | 25 | 01 |
| MBP – SEC - 501 | Hematology Practicals | 2 hrs. | 3 hrs. | 12 | 13 | 25 | 01 |
| | | | Total | 24 | 26 | 50 | 02 |

Semester – VI (Major)

| Course Code | Course Title | Teaching Schedule Hours/Week | Exam Duration & Marks | | | Total Theory/ Practical Marks | Credit |
|----------------|------------------------------------|------------------------------|-----------------------|----------------------|----------------------|-------------------------------|--------|
| | | | Duration (Hours) | (CCE) Internal Marks | (SEE) External Marks | | |
| MB – MJ - 601 | Medical Microbiology | 2 hrs. | 1 hrs. | 25 | 25 | 50 | 02 |
| MBP – MJ - 601 | Medical Microbiology Practicals | 4 hrs. | 6 hrs. | 25 | 25 | 50 | 02 |
| MB – MJ - 602 | Immunology | 2 hrs. | 1 hrs. | 25 | 25 | 50 | 02 |
| MBP – MJ - 602 | Immunology Practicals | 4 hrs. | 6 hrs. | 25 | 25 | 50 | 02 |
| MB – MJ - 603 | Industrial Microbiology | 2 hrs. | 1 hrs. | 25 | 25 | 50 | 02 |
| MBP – MJ - 603 | Industrial Microbiology Practicals | 4 hrs. | 6 hrs. | 25 | 25 | 50 | 02 |
| | | | Total | 150 | 150 | 150 (T) + 150 (P) | 12 |

Semester – VI (Minor Elective)

| Course Code | Course Title | Teaching Schedule Hours/Week | Exam Duration & Marks | | | Total Theory/ Practical Marks | Credit |
|----------------|----------------------------------|------------------------------|-----------------------|----------------------|----------------------|-------------------------------|--------|
| | | | Duration (Hours) | (CCE) Internal Marks | (SEE) External Marks | | |
| MB – ME - 601 | Genomics & Proteomics | 2 hrs. | 1 hrs. | 25 | 25 | 50 | 02 |
| MBP – ME - 601 | Genomics & Proteomics Practicals | 4 hrs. | 6 hrs. | 25 | 25 | 50 | 02 |
| | | | Total | 50 | 50 | 50 (T) + 50 (P) | 04 |

Teaching Methodology and Evaluation

- Teaching methodology includes Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment Laboratory work, Journal preparation. The medium of instruction will be in **ENGLISH** only for students opting Microbiology as a **MAJOR, MINOR & SEC** subjects.

Internal Evaluation Theory (CCE)

| Sr. No. | Exam Pattern | 50 Marks | 37 Marks | 25 Marks | 12 Marks |
|----------------|---------------------|-----------------|-----------------|-----------------|-----------------|
| 1. | Class Assignment | 07 | 06 | 03 | 02 |
| 2. | Home Assignment | 08 | 06 | 03 | 02 |
| 3. | Attendance | 10 | 05 | 04 | 03 |
| 4. | Class Test | 25 | 20 | 15 | 05 |

Internal Evaluation Practical (CCE)

| Sr. No. | Exam Pattern | 25 Marks | 12 Marks |
|----------------|---------------------|-----------------|-----------------|
| 1. | Attendance | 05 | 02 |
| 2. | Viva voce/Quiz | 10 | 05 |
| 3. | Lab Work Assessment | 10 | 05 |

Program-Specific Outcomes for B.Sc. Microbiology

Program-Specific Outcomes (PSOs) define what students should achieve after completing a Microbiology program. The program Outcome includes

1. Core Knowledge in Microbiology:

- Understand the fundamental concepts of microbiology, including microbial diversity, structure, function and classification.
- Explain the role of microorganism in human health, industry, agriculture and the environment.

2. Practical and Laboratory Skills:

- Perform basic microbiological techniques such as microbial staining, culturing, isolation and enumeration.
- Utilize aseptic techniques and biosafety measures in handling microorganisms.
- Operate laboratory instruments effectively.

3. Applied and Industrial Microbiology:

- Understand the role of microorganisms and their application in food, pharmaceuticals, biotechnology and environmental science.
- Demonstrate knowledge of fermentation processes, microbial biotechnology and their industrial significance.
- Demonstrate the ability to work effectively in a team and encourage entrepreneurial thinking, fostering innovative solutions and collaborative problem-solving skills.

4. Disease and Health-Related Microbiology:

- Identify pathogenic microorganisms and understand their role in infectious diseases.
- Explain antimicrobial resistance, immunity and the role of microbes in public health.

5. Critical Thinking and Problem-Solving:

- Analyze scientific data, interpret experimental results and troubleshoot laboratory issues.
- Apply microbiological knowledge to solve real-world problems in healthcare, industry, environmental management and sustainability.

6. Ethical and Professional Responsibilities:

- Follow ethical guidelines in microbiological research and laboratory work.
- Adhere to safety protocols and regulatory standards in microbiology-related fields.

A four year under graduate program with honours in Microbiology will help the students to gain theoretical knowledge and practical skills, preparing them for careers in health care, pharmaceuticals industries, food and dairy, clinical applications and research. The program helps the students to pursuit higher education and provides a strong foundations to make a career in allied fields of genetics, bioinformatics, biotechnology, genetic engineering, medical microbiology, environment and agriculture.

T. Y. B. Sc. Semester – V
MAJOR

EFFECTIVE FROM: 2025-26

MB-MJ-501

| | |
|-----------------------------------|---|
| COURSE CODE | MB-MJ-501 |
| COURSE TITLE | APPLIED AND ENVIRONMENTAL MICROBIOLOGY |
| COURSE LEVEL | 300 to 399 |
| COURSE CREDIT | 02 |
| TOTAL ENGAGEMENT | 02 Credits X 15 hrs. = 30 hrs. |
| TEACHING PER WEEK | 02 Hrs. |
| MINIMUM WEEKS PER SEMESTER | 15 Weeks |

COURSE CONTENT:

- This course provides general introductions to the diverse roles of microorganisms in natural and artificial environments.
- It will cover topics including; water and air microbiology; role of microorganisms in air and water pollution, water purification and processes involved in wastewater treatment and its disposal.

COURSE OUTCOME: CO1

- Students will be able to understand about presence of various microorganisms and their role in air and soil.
- Students will know about various sample collection methods which provide information about air and soil microbial flora as well as methods used for air sanitization.
- Students will be able to understand physical, chemical characteristics of soil and its analysis.

COURSE OUTCOME: CO2

- Students will be able to understand about presence of various microorganisms and their role in drinking water and waste water.
- Students will know about various sample collection methods which provide information about drinking water and wastewater microbial flora as well as understand the physical and chemical characteristics of wastewater.
- Students will be able to understand drinking water purification and wastewater treatment process.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|-----|------|------|------|------|------|------|
| CO1 | | | | | | |
| CO2 | | | | | | |

| | |
|---------------|--|
| UNIT 1 | AIR AND SOIL MICROBIOLOGY |
| 1.1 | SECTION A: Aero microbiology |
| 1.1.1 | Composition of air |
| 1.1.2 | Microorganisms in air |
| 1.1.3 | Enumeration of bacteria in air |
| 1.1.4 | Air Sanitation |
| 1.2 | SECTION B: Microbiology of Soil |
| 1.2.1 | Physical characteristics of soil |
| 1.2.2 | Types of Microorganisms in soil |
| 1.2.3 | Quantitative examination of soil |
| 1.2.4 | Qualitative studies of soil organisms |

| | |
|---------------|--|
| UNIT 2 | MICROBIOLOGY OF DOMESTIC WATER AND WASTEWATER |
| 2.1 | Water purification |
| 2.2 | Determining sanitary quality |
| 2.3 | Wastewater Treatment Processes |
| 2.4 | Measuring treated wastewater quality |

REFERENCES:

- Willey, J. M., Sherwood, L., and Woolverton, C. J. (2017). Prescott's Microbiology, 10th Edition., New York: McGraw-Hill Education. (978-981-3151-26-0).
- Pelczar, Chan and Krieg, (2001), *Microbiology-Concepts and Application*, 5th Edition., McGraw-Hill. (ISBN:978-0-07-462320-6)
- Salle, A. J., (1993). Fundamental Principles of Bacteriology, 7th Edition., Tata-McGraw-Hill (ISBN:0-07-099562-1)
- Purohit, S. S., (2006). Microbiology: Fundamentals and Applications, 7th Edition., Agrobios (India).
- Metcalf & Eddy Inc, (2002), Wastewater engineering: Treatment and Reuse, 4th Edition, McGraw Hill higher education. (ISBN: 9780070495395)
- Schaechter, M. (2004), The desk encyclopaedia of microbiology, 2nd Edition., Elsevier Academic Press.
- Karnwal, A. & Said Al-Tawaha, A. R. M. (2022). Environmental Microbiology: Advanced Research and multidisciplinary Applications Bentham books.
- Perkins, D. (2023). Introduction to environmental microbiology. American Academic Publisher.

E-RESOURCES:

- Microorganisms in air their importance
[<https://youtu.be/xtAaSwnrPRA?si=PA8T8K6Rjsqg115f>]
- Air sampling methods [<https://youtu.be/uB-EG8wt6UQ?si=TSq0wJiXs4t7ExJr>]
- Water quality parameters [<https://youtu.be/aYccflECWVg?si=iT1-8CQLrcgbZkVJ>]
- Wastewater treatment [<https://www.britannica.com/technology/wastewater-treatment>]
- SWAYAM (<https://swayam.gov.in>)
- SWAYAM Plus (<https://swayam-plus.swayam2.ac.in>)

PRACTICALS MBP-MJ-501

[Subject Code-2503000505016002]

| | |
|-----------------------------------|--|
| COURSE CODE | MBP-MJ-501 |
| COURSE TITLE | APPLIED AND ENVIRONMENTAL MICROBIOLOGY PRACTICALS |
| COURSE LEVEL | 300 to 399 |
| COURSE CREDIT | 02 |
| TOTAL ENGAGEMENT | 02 Credits X 30 hrs. = 60 hrs. |
| TEACHING PER WEEK | 04 Hrs. |
| MINIMUM WEEKS PER SEMESTER | 15 Weeks |

COURSE OUTCOME:

- CO1:** Students shall gain knowledge regarding the technique to study the technique to enumerate the microorganisms present in air.
- CO2:** Students shall develop the expertise regarding the techniques for analysing the quality of drinking water.
- CO3:** shall learn the technique for water analysis and develop the skills to analyse and assess the potability of drinking water.
- CO4:** Students shall learn to determine the types of microorganisms present in the soil sample.
- CO5:** Students shall develop skill to examine and enumerate the number of microbial flora present in the soil sample.
- CO6:** Students shall be aware of the treatment of drinking / wastewater by in person visit.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|------------|------|------|------|------|------|------|
| CO1 To CO6 | | | | | | |

1. Study of air microflora by settling plate technique.
2. Microbiological analysis of drinking water by MPN and PA test.
3. Detection of coliforms (Presumptive, Confirmed and Completed test).
4. Quantitative examination (SPC) of soil microflora.
5. Qualitative examination of soil microflora.
6. Visit to drinking / wastewater treatment plant.

REFERENCES:

1. Patel, R. J., & Patel, R. K., (2022). Experimental Microbiology, Vol. 1, 10th Edition, Aditya.
2. Aneja, K. R., (2003). Experiments in Microbiology 4thed., Experiments in microbiology, Plant Pathology, Tissue Culture and Mushroom Production Technology, New Age International Publishers
3. Standard method for examination of water and wastewater published by APHA

MB-MJ-502

| | |
|-----------------------------------|--|
| COURSE CODE | MB-MJ-502 [Subject Code-2503000505026001] |
| COURSE TITLE | VEDIC MICROBIOLOGY |
| COURSE LEVEL | 300 to 399 |
| COURSE CREDIT | 02 |
| TOTAL ENGAGEMENT | 02 Credits X 15 hrs. = 30 hrs. |
| TEACHING PER WEEK | 02 Hrs. |
| MINIMUM WEEKS PER SEMESTER | 15 Weeks |

COURSE CONTENT:

- This course provides fundamental knowledge of Vedic Microbiology which bridges ancient wisdom with modern microbiology for sustainable health.
- It will cover topics including; Basic principles of Vedic Microbiology, Science of pathogenic germs (KRIMIS), ancient prophylaxis towards diseases and Ayurveda.
- Explores traditional microbial techniques for food, medicine, and Ayurvedic microbiology.

COURSE OUTCOME: CO1

Upon completion of this course, students will be able to:

1. Understand microbial concepts within the Vedic and Ayurvedic framework.
2. Analyze ancient texts for microbial relevance in disease, medicine and fermentation.

COURSE OUTCOME: CO2

Upon completion of this course, students will be able to:

1. Explore microbial applications in Ayurveda, traditional health practices, and Vedic sustainability.
2. Integrate Vedic knowledge with modern microbiological practices.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|-----|------|------|------|------|------|------|
| CO1 | | | | | | |
| CO2 | | | | | | |

| UNIT 1 | FUNDAMENTALS OF VEDIC MICROBIOLOGY AND THE SCIENCE OF KRMIS |
|---------------|--|
| 1.1 | SECTION A: Historical Perspectives and Basic Principles of Vedic Microbiology |
| 1.1.1 | The origin of Vedas & Concept of Vedic period |
| 1.1.2 | Gurus of Vedic Microbiology |
| 1.1.3 | Major Characteristics of Microorganisms as per Vedas and other Sanskrit texts |
| 1.1.4 | Various names of the Krimis |
| 1.1.5 | Major groups of Krimis in Vedas & Shape and Color of Krimis |
| 1.2 | SECTION B: Human Health and Pathogenic Germs (KRIMIS) |
| 1.2.1 | Microbial diversity & Microbial Disease described during Vedic period |
| 1.2.2 | Ksudrarog in Humans |
| 1.2.3 | Pandemic/Epidemic diseases during Vedic Period |
| 1.2.4 | Disease defense by good health |
| 1.2.5 | Precautions for spread of Infectious Microorganisms |

| UNIT 2 | THE SCIENCE OF WELLNESS: PREVENTING INFECTIONS AND THE SCIENCE OF AYURVEDA |
|---------------|---|
| 2.1 | SECTION A: Prevention from Infections (Prophylaxis) |
| 2.1.1 | Precautions for spread of Infectious Microorganisms |
| 2.1.2 | Elimination of Microorganisms by Sun rays & its Germicidal properties |
| 2.1.3 | Eradication of pathogens by medicinal plants |
| 2.1.4 | Eradication of Microbes by Vaca |
| 2.1.5 | Significance of Hawan/Yajna & Scientific Validation of Agnihotra |
| 2.2 | SECTION B: Science of Ayurveda |
| 2.2.1 | Introduction |
| 2.2.2 | Tridosas |
| 2.2.3 | Body Constitution |
| 2.2.4 | Mental Components |
| 2.2.5 | Health Care |

REFERENCES:

- R. C. Dubey. (2021). Vedic Microbiology, 1st Ed., Motilal Banarsidass International. (978-93-90696-33-8).
- Chakradhar F. and Shriji Kurup (2007), 1st Ed., Dilip and Dipika Doctor International Vedic Vision, New York, In association with Indian Foundation for Vedic Science (81-87710-45-4)

- Lakshmi Chandra Mishra, (2004), Scientific Basis for Ayurvedic Therapies, CRC press LLC (0-8493-1366-X)

E-RESOURCES:

- https://www.youtube.com/live/-iUTvvkE91w?si=JWcXh6rd-z1d_5DF
- https://www.youtube.com/live/0jAyxYWQmew?si=0tg_0Ry_fr6RnJd
- <https://youtu.be/jYOVCLVLjbl?si=5GBJvlv3z73LQ3Vb>
- <https://youtu.be/QIAfZZGD3ZU?si=xt97KObtJl7Wd9Hk>
- https://youtu.be/S1-17TeZvV0?si=kGQ_m6Mr4fwwowmw
- SWAYAM (<https://swayam.gov.in>)
- SWAYAM Plus (<https://swayam-plus.swayam2.ac.in>)

[Subject Code-2503000505026002]

PRACTICALS
MBP-MJ-502

| | |
|-----------------------------------|--------------------------------------|
| COURSE CODE | MB-MJ-502 |
| COURSE TITLE | VEDIC MICROBIOLOGY PRACTICALS |
| COURSE LEVEL | 300 to 399 |
| COURSE CREDIT | 02 |
| TOTAL ENGAGEMENT | 02 Credits X 30 hrs. = 60 hrs. |
| TEACHING PER WEEK | 04 Hrs. |
| MINIMUM WEEKS PER SEMESTER | 15 Weeks |

- CO1:** Students shall gain insights regarding the usage of traditional herbs and spices to inhibit the disease causing microorganisms.
- CO2:** Students shall learn about the effect of agnihotra in reducing the number of microorganisms.
- CO3:** Students shall also gain knowledge for the importance of sunlight and its effect on the growth of microorganisms.
- CO4:** Students shall gain skill to ferment rice and for the detection of LAB in fermented rice water
- CO5:** Students shall gain skill to ferment rice and for the detection of LAB in fermented buttermilk
- CO6:** Students shall gain access to usage of Prakruti Prashikshan App and develop an insight regarding its importance

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|------------------|------|------|------|------|------|------|
| CO1 To CO6 | | | | | | |

1. Evaluation of traditional herbs & spices extracts against pathogens.
2. Effect of Agnihotra on Airborne Microbial Load.
3. Effect of Sunrays on the microorganisms.
4. LAB count in fermented rice water.

5. LAB count in fermented buttermilk.
6. Survey on Prakruti Prashikshan App.

REFERENCES:

- R.C. Dubey & D.K. Maheshwari (2008), Practical Microbiology, S. Chand Publication.
- Patel, R. J., & Patel, R. K., (2022). Experimental Microbiology, Vol. 1, 10th Edition, Aditya.
- Aneja, K. R., (2003). Experiments in Microbiology 4thed., Experiments in microbiology, Plant Pathology, Tissue Culture and Mushroom Production Technology, New Age International Publishers.
- Kailasapathy J. P. T. K., (2010). Fermented Foods and Beverages of the World, CRC Press, Taylor & Francis Group.

[Subject Code-2503000505036001]
MB-MJ-503

| | |
|-----------------------------------|------------------------------------|
| COURSE CODE | MB-MJ-503 |
| COURSE TITLE | FOOD AND DAIRY MICROBIOLOGY |
| COURSE LEVEL | 300 to 399 |
| COURSE CREDIT | 02 |
| TOTAL ENGAGEMENT | 02 Credits X 15 hrs. = 30 hrs. |
| TEACHING PER WEEK | 02 Hrs. |
| MINIMUM WEEKS PER SEMESTER | 15 Weeks |

COURSE CONTENT:

- This course provides general information regarding food spoilage, how to prevent spoilage and microbiological examination of food.
- It covers the topic of using microbes in fermentation as well as food and feed.

COURSE OUTCOME: CO1

- Students shall be acquainted with various types of food contamination and spoilage by different microorganisms, their preservation techniques
- Students shall learn about the different methods for testing and grading milk quality.

COURSE OUTCOME: CO2

- Student acquaint themselves with various alcoholic beverages and their production technology and fermented food and dairy products.
- They shall understand different microorganisms that can be used as food and their involvement in producing various fermented foods.

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|-----|------|------|------|------|------|------|
| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
| CO1 | | | | | | |

| | | | | | |
|-----|--|--|--|--|--|
| CO2 | | | | | |
|-----|--|--|--|--|--|

| | |
|---------------|--|
| UNIT 1 | FOOD AND DAIRY |
| 1.1 | SECTION A: Food Microbiology |
| 1.1.1 | Food spoilage: Intrinsic and extrinsic factors |
| 1.1.2 | Methods used to control food spoilage |
| 1.1.3 | Detection of food-borne pathogens |
| 1.1.4 | Food Safety and Standards (Food Products Standards and Food Additives) Regulation, 2011: Preservatives |
| 1.2 | SECTION B: Milk Microbiology |
| 1.2.1 | Sources of microorganisms in milk |
| 1.2.2 | Diseases from raw milk consumption |
| 1.2.3 | Methods of testing and grading of milk |
| 1.2.4 | Microscopic and cultural techniques |
| 1.2.5 | Quantitative examination of milk |
| 1.2.6 | Preservation of milk by pasteurization |

| | |
|---------------|---|
| UNIT 2 | MICROBIOLOGY OF FERMENTED FOODS |
| 2.1 | SECTION A: Fermented Food Products |
| 2.1.1 | Traditional Fermented Food of India |
| 2.1.2 | Fermented Milks |
| 2.1.3 | Cheese Production |
| 2.1.4 | Production of fermented Food and beverages: Wines & Champagnes, Beers and Ales, Bread and other Fermented foods |
| 2.2 | SECTION B: Microorganisms as Food, Feed & Supplements |
| 2.2.1 | SCP Product of Spirulina and Yeast biomass |
| 2.2.2 | Mushroom cultivation methods and control of pathogens and pests |
| 2.2.3 | Prebiotics, Probiotics and Synbiotics |

REFERENCES:

- Willey, J.M., Sherwood, L., and Woolverton, C.J. (2017). Prescott's microbiology, 11th Ed., New York: McGraw-Hill Education. (978-1-260-57002-1).
- Frazier, W. C. and Westhoff, D. C., (2006). Food Microbiology, 4thEd., Tata Mc-Graw Hill, India.
- Dubey, R. C. (2014). Textbook of Biotechnology, 5th Ed., S. Chand.

- Purohit, S. S. (2006). Microbiology: Fundamentals and Applications, 7th Ed., Agrobios (India)
- Pelczar, M. J. and Chan, E. C. S. (1998). Microbiology, 5th Ed., Tata-McGraw-Hill.
- Rawat K., Kumari A., Kumar S., Kumar R. and Gehlot R., (2018), Traditional Fermented Products of India, 7(4), pp 1873-1882.
- Ortiz Alvarenga, V. (Ed.). (2024). Basic protocols in predictive food microbiology. Springer.
- Amaresan, N., Dharumadurai, D., & Babalola, O. O. (Eds.). (2023). Food microbiology based entrepreneurship: Making money from microbes. Springer Nature.
- https://www.fssai.gov.in/upload/uploadfiles/files/Food_Additives_Regulations.pdf, pp: 424-427

E-RESOURCES:

- https://youtu.be/ms_yBSEfsWk?si:7LaBL3krGoeyv6g3
- <https://youtu.be/0XXIntGsBog?si:lbphWB8gh8yIcXeC>
- https://youtu.be/nZKaU5uAA28?si:KYEvjlOvuQ-ES_uo
- <https://youtu.be/W2V8eqEZ3Y0?si:hvoi-qhIRhFIyLWU>
- <https://youtu.be/LjOQeaVxmsw?si:VG0HL3JmCRnjwdZx>
- <https://youtu.be/JHzEkjVDaSo?si:KK9vjilwXVz312Tw>
- <http://ecoursesonline.iasri.res.in/mod/page/view.php?id:5168>
- <https://dhanusmicronotes.blogspot.com/2020/06/microbiological-analysis-of-milk.html>
- SWAYAM (<https://swayam.gov.in>)
- SWAYAM Plus (<https://swayam-plus.swayam2.ac.in>)

[Subject Code-2503000505036002]

PRACTICALS **MBP-MJ-503**

| | |
|-----------------------------------|---|
| COURSE CODE | MB-MJ-503 |
| COURSE TITLE | FOOD AND DAIRY MICROBIOLOGY PRACTICALS |
| COURSE LEVEL | 300 to 399 |
| COURSE CREDIT | 02 |
| TOTAL ENGAGEMENT | 02 Credits X 30 hrs. = 60 hrs. |
| TEACHING PER WEEK | 04 Hrs. |
| MINIMUM WEEKS PER SEMESTER | 15 Weeks |

COURSE OUTCOME:

- CO1:** Students shall develop skills to quantify the bacterial count of milk sample and also characterize the types of microorganisms present in milk.
- CO2:** Students shall develop skills to quantify the bacterial count of food sample and also characterize the types of microorganisms present in food.

CO3: Students shall develop skills of fermentation and prepare wine by fermentation of grapes.

CO4: Students shall gain skill to enumerate the microorganisms by Aerobic Plate Count.

CO5: Students shall gain expertise on the methods for detection of *Staphylococcus aureus*.

CO6: Students shall gain expertise on the Method for enumeration of *Enterobacteriaceae*

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|------------|------|------|------|------|------|------|
| CO1 TO CO6 | | | | | | |

1. Bacteriological analysis of milk- qualitative & quantitative method.
2. Bacteriological analysis of food- qualitative & quantitative method.
3. Fermentation of grapes for wine making.
4. Method for enumeration of Aerobic Plate Count (APC).
5. Method for detection of *Staphylococcus aureus*.
6. Method for enumeration of *Enterobacteriaceae*.

REFERENCES:

1. Patel, R. J., & Patel, R. K., (2022). Experimental Microbiology, Vol. 1, 10th Edition, Aditya.
2. Aneja, K. R., (2003). Experiments in Microbiology 4thed. Experiments in microbiology, Plant Pathology, Tissue Culture, and Mushroom Production Technology, New Age International Publishers.
3. Manual of Methods of Analysis – Microbiological Analysis of Food and Water, May 2024, Govt. of India-FSSAI.

[Subject code-2503000505046001]

MINOR **MB-ME-501**

| | |
|-----------------------------------|--|
| COURSE CODE | MB-ME-501 |
| COURSE TITLE | QUALITY CONTROL & QUALITY ASSURANCE |
| COURSE LEVEL | 300 to 399 |
| COURSE CREDIT | 02 |
| TOTAL ENGAGEMENT | 02 Credits X 15 hrs. = 30 hrs. |
| TEACHING PER WEEK | 02 Hrs. |
| MINIMUM WEEKS PER SEMESTER | 15 Weeks |

COURSE CONTENT:

- This course introduces microbiology students to quality control and assurance in pharmaceutical and laboratory settings. It covers GMP, GLP, regulatory compliance, and microbial safety, ensuring students understand quality standards and their applications in microbiological testing and pharmaceutical production.

- Students will learn to apply quality assurance principles, conduct stability testing, control microbial contamination, and follow biosafety guidelines. The course emphasizes regulatory compliance, risk assessment, and quality audits, preparing them for careers in laboratory management and pharmaceutical quality control.

COURSE OUTCOME: CO1

- Students will develop a strong understanding of quality assurance principles, GMP, and TQM, ensuring adherence to industry standards in pharmaceutical and microbiology laboratories.
- They will also gain insights into accreditation, certification, and regulatory frameworks such as ISO, NABL, and QCI, enabling them to assess and maintain laboratory quality effectively.

COURSE OUTCOME: CO2

- Students will learn to apply Good Laboratory Practices (GLP), hazard analysis, and quality auditing to improve laboratory safety and operational efficiency.
- Additionally, they will acquire expertise in biosafety protocols, sterilization techniques, and microbial contamination control, ensuring safe and effective microbiological testing in pharmaceutical and public health laboratories.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|-----|------|------|------|------|------|------|
| CO1 | | | | | | |
| CO2 | | | | | | |

| UNIT 1 | QUALITY ASSURANCE & QUALITY MANAGEMENT CONCEPT |
|---------------|---|
| 1.1 | SECTION A: Quality Assurance & Management |
| 1.1.1 | Quality assurance – Objectives of Quality Assurance |
| 1.1.2 | Current Good Manufacturing Practices |
| 1.1.3 | Quality Control & Quality Assurance – Objectives of Quality Control |
| 1.1.4 | Total Quality Management (TQM) -Definitions, Key Elements, Advantages, TQM in drug Industry |
| 1.1.5 | Internal Quality Control |
| 1.1.6 | Formulating Quality control charts |
| 1.2 | SECTION B: Accreditation & Certification |
| 1.2.1 | Introduction |
| 1.2.2 | ISO 15189:2007 Medical Laboratories |
| 1.2.3 | ISO 15189:2007 Medical Laboratories: Requirements for Quality & |
| 1.2.4 | Competence. |
| 1.2.5 | Quality Council of INDIA |
| 1.2.6 | NABL |
| 1.2.7 | Clinical Laboratory Improvement Amendments (CLIA) of 1988 (USA) |
| | Clinical and Laboratory Standard Institute (CLSI) |

| | |
|---------------|---|
| UNIT 2 | GOOD LABORATORY PRACTICES & GUIDELINES |
| 2.1 | SECTION A: Good Laboratory Practices |
| 2.1.1 | WHO good practices for pharmaceutical microbiology laboratories |
| 2.1.2 | General guidelines for the establishment, maintenance and distribution of chemical reference substances |
| 2.1.3 | Microbiological Hazard Analysis and Audit: The Practice |
| 2.2 | SECTION B: Guidelines |
| 2.2.1 | Biosafety Guidelines for Public Health Laboratories. |
| 2.2.2 | General Principles of Biosafety |
| 2.2.3 | Biosafety Cabinets |
| 2.2.4 | Good Microbiological Techniques-Safe laboratory procedures |
| 2.2.5 | Sterilization and Disinfection Procedures Biomedical Waste Management |

REFERENCES:

- Organization, W. H. (2024). Quality assurance of pharmaceuticals: a compendium of guidelines and related materials. Volume 2. Good manufacturing practices and inspection. World Health Organization.
- Godkar, P. B. and Godkar, D. P. (2014). Textbook of Medical Laboratory Technology, 3rd Ed., Volume 1, Bhalani Publication House Mumbai, India.
- Baird, R. M., Hodges, N. A. and Denyer, S. P. (2006). Handbook of Microbiological Quality Control, Special Indian Ed., CRC Press.
- Hewitt, S. (2003). Microbiological Assay for Pharmaceuticals Analysis: A Rational Approach, CRC Press.
- Tambwekar, S. (2009). Handbook of Quality Assurance in Laboratory Medicines, B.I. Publications.

E-RESOURCES:

- [https://www.njlm.net/articles/PDF/2351/40437_CE%5BRa1%5D_F\(SHU\)_PF1\(AG_OM\)_PF_A\(SHU\)_PB\(AG_OM\)_PN\(SHU\).pdf&ved=2ahUKewic7_qbt_KLAXWvumMGHSpXGpMQFnoECDsQAQ&usg=AOvVaw04AHdfRHkECY1aEBnCPK2p](https://www.njlm.net/articles/PDF/2351/40437_CE%5BRa1%5D_F(SHU)_PF1(AG_OM)_PF_A(SHU)_PB(AG_OM)_PN(SHU).pdf&ved=2ahUKewic7_qbt_KLAXWvumMGHSpXGpMQFnoECDsQAQ&usg=AOvVaw04AHdfRHkECY1aEBnCPK2p)
- https://www.cdc.gov/labs/pdf/SF_19_308133-A_BMBL6_00-BOOK-WEB-final-3.pdf
- <https://ncdc.mohfw.gov.in/wp-content/uploads/2024/04/File608.pdf>
- SWAYAM (<https://swayam.gov.in/>)
- SWAYAM Plus (<https://swayam-plus.swayam2.ac.in>)

PRACTICALS

MBP-ME-501

| | |
|-----------------------------------|---|
| COURSE CODE | MB-ME-501 |
| COURSE TITLE | QUALITY CONTROL & QUALITY ASSURANCE PRACTICALS |
| COURSE LEVEL | 300 to 399 |
| COURSE CREDIT | 02 |
| TOTAL ENGAGEMENT | 02 Credits X 30 hrs. = 60 hrs. |
| TEACHING PER WEEK | 04 Hrs. |
| MINIMUM WEEKS PER SEMESTER | 15 Weeks |

COURSE OUTCOME:

CO1: Students shall develop an insight regarding the quality control and become proficient to prepare and Interpret the quality of data from Levey-Jennings Chart.

CO2: Students shall gain skills to perform the Sterility Testing of Pharmaceutical Products and determine the sterility of the product.

CO3: Students shall become aware regarding the Microbial Limit Testing of Non-Sterile products.

CO4: Students shall develop skill to monitor the environment of Pharmaceutical Labs.

CO5: Students shall develop skill to monitor the Quality Control of Water for Pharmaceutical use.

CO6: Students shall become skilful in documentation Practices and learn validation of analytical methods.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|------------|------|------|------|------|------|------|
| CO1 to CO6 | | | | | | |

1. Preparation and Interpretation of Levey-Jennings Chart.
2. Sterility Testing of Pharmaceutical Products (Direct inoculation).
3. Microbial Limit Testing of Non-Sterile Products.
4. Environmental Monitoring in Pharmaceutical Labs.
5. Quality Control of Water for Pharmaceutical Use.
6. Good Documentation Practices and Validation of Analytical Methods.

REFERENCES:

1. Godkar, P. B. & Godkar, D. P. (2014). Textbook of Medical Laboratory Technology, 3rd Ed., Volume 1, Bhalani Publishing House, Mumbai.
2. WHO (2024). Quality Assurance of Pharmaceuticals: A Compendium of Guidelines and Related Materials, Volume 2. WHO Technical Report Series.
3. USP (United States Pharmacopeia) 43-NF 38. Microbiological Examination of Nonsterile Products: Microbial Enumeration Tests.
4. Baird, R. M., Hodges, N. A., & Denyer, S. P. (2006). Handbook of Microbiological

Quality

Control: Pharmaceuticals and Medical Devices, CRC Press. (Page No. 221-238).

5. WHO (2024). Quality Assurance of Pharmaceuticals: Water for Pharmaceutical Use, WHO Technical Report Series.
6. Hewitt, S. (2003). Microbiological Assay for Pharmaceutical Analysis: A Rational Approach, CRC Press.

MB-ME-502

[Subject Code-2503000505056001]

| | |
|-----------------------------------|--|
| COURSE CODE | MB-ME-502 |
| COURSE TITLE | ANALYTICAL INSTRUMENTATION & TECHNIQUES |
| COURSE LEVEL | 300 to 399 |
| COURSE CREDIT | 02 |
| TOTAL ENGAGEMENT | 02 Credits X 15 hrs. = 30 hrs. |
| TEACHING PER WEEK | 02 Hrs. |
| MINIMUM WEEKS PER SEMESTER | 15 Weeks |

COURSE CONTENT:

- This course provides general information regarding different instruments, working principles and able to interpret experimental data and relate these techniques to advancements in molecular biology.
- It covers the usage of instruments and techniques for betterment of future.

COURSE OUTCOME: CO1

Students will understand the theoretical principles and applications of instruments in numerous ways like quantitative and qualitative analysis by identification of substance, concentration determination, etc.

COURSE OUTCOME: CO2

Student acquaint themselves by learning analytical techniques, which helps them to implement in various fields, like Medicine, Environment, Genetic disorders, Agriculture, etc. for human welfare.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|-----|------|------|------|------|------|------|
| CO1 | | | | | | |
| CO2 | | | | | | |

| | |
|---------------|---|
| UNIT 1 | EQUIPMENTS & INSTRUMENTS |
| 1.1 | Spectrometry |
| 1.2 | Colorimetry and Photometry |
| 1.2.1 | Filter Photometers and Spectrophotometers |
| 1.2.2 | Infrared and Raman Spectroscopy |
| 1.3 | Flow Cytometry |
| 1.4 | Laminar Air Flow |
| 1.5 | Biosafety cabinets |

| | |
|---------------|------------------------------|
| UNIT 2 | ANALYTICAL TECHNIQUES |
| 2.1 | Electrophoresis |
| 2.2 | Blotting techniques |
| 2.3 | Chromatography |
| 2.4 | Polymerase chain reaction |

REFERENCES:

- Godkar, P. B., & Godkar, D. P. (2014). *Textbook of medical laboratory technology*. Bhalani publishing house. 3rd Edition, Volume 1 (ISBN: 978 93 81496 19 0).
- Wilson, K., & Walker, J. (Eds.). (2010). *Principles and techniques of biochemistry and molecular biology*. Cambridge university press. 7th Edition (ISBN: 978-0-521-17874-7).
- Ghosal, S., & Avasthi, A. S. (2018). *Fundamentals of bioanalytical techniques and instrumentation*. PHI Learning Pvt. Ltd. (ISBN: 978-93-87472-39-6).
- Skoog, D. A., Holler, F. J., & Crouch, S. R. (2007). *Instrumental analysis*. Cengage learning (ISBN: 978-81-315-0542-7).
- Murray, P. R., Baron, E. J., Jorgensen, J. H., Landry, M. L., & Pfaller, M. A. (2005). *Manual of Clinical Microbiology*. Ed. 9th (ISBN: 1-55581-255-4).

Recommended learning E-RESOURCES:

- <https://youtu.be/EQXPJ7eeesQ?si=Rjc8-IDUUR4XnUhQ>
- <https://youtu.be/pxC6F7bK8CU?si=5qES7H9e2pHFK2yK>
- <https://youtu.be/OiukFtC8E04?si=CSbcNgtQseLiRHpP>
- <https://youtu.be/hue2TrYXY54?si=p0nwF-DHqqCb1nL8>
- <https://youtu.be/hLzQ9pMUF6k?si=YEYsxmogCuO37XNU>
- https://youtu.be/PvHvx7k7UPU?si=Fq0TK3zSLI3_Tgbr
- https://youtu.be/wBrNbbAIAFo?si=aTqDUR7uCL_UsD2q
- <https://youtu.be/saJIWFUGEbw?si=R29hCLBI0nNQstD>
- SWAYAM (<https://swayam.gov.in>)
- SWAYAM Plus (<https://swayam-plus.swayam2.ac.in>)

PRACTICALS
(MBP-ME 502)

| | |
|-----------------------------------|---|
| COURSE CODE | MBP-MJ-502 |
| COURSE TITLE | ANALYTICAL INSTRUMENTATION & TECHNIQUES PRACTICALS |
| COURSE LEVEL | 300 to 399 |
| COURSE CREDIT | 02 |
| TOTAL ENGAGEMENT | 02 Credits X 30 hrs. = 60 hrs. |
| TEACHING PER WEEK | 04 Hrs. |
| MINIMUM WEEKS PER SEMESTER | 15 Weeks |

COURSE OUTCOME:

CO1: Students shall learn to preparation the phosphate buffer and also develop skill to use pH meter to determine pH.

CO2: Students shall develop skill to estimate Amino acids/Sugar by paper chromatography.

CO3: Students to determine the unknown concentration of a coloured solution and gain skill to use Photometric instruments.

CO4: Students shall learn the turbidometric method and prepare the Mac Farland scale.

CO5: Students shall gain knowledge of Horizontal gel electrophoresis and its application.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|------------|------|------|------|------|------|------|
| CO1 TO CO5 | | | | | | |

1. Preparation of 200 ml phosphate buffer and Determination of pH by using a pH meter.
2. Estimation of Amino acids/Sugar by paper chromatography.
3. Determination of unknown concentration of a colored solution by Photometric method.
4. Demonstration of Horizontal gel electrophoresis.
5. Study of Mac Farland scale by turbidometric method.

References:

- Godkar, P. B., & Godkar, D. P. (2014). *Textbook of medical laboratory technology*. Bhalani publishing house. 3rd Edition, Volume 1 (ISBN: 978 93 81496 19 0).
- Patel R. J. and Patel R.K. (2016) *Experimental microbiology Volume II*, 9th Edition. Aditya Publications, Ahmedabad.

[Subject code-2503000505066001]

SEC

MB- SEC -501

| | |
|-----------------------------------|--------------------------------|
| COURSE CODE | MB- SEC -501 |
| COURSE TITLE | HAEMATOLOGY |
| COURSE LEVEL | 300 to 399 |
| COURSE CREDIT | 02 |
| TOTAL ENGAGEMENT | 01 Credits X 15 hrs. = 15 hrs. |
| TEACHING PER WEEK | 01 Hrs. |
| MINIMUM WEEKS PER SEMESTER | 15 Weeks |

COURSE CONTENTS:

- This course provides general introduction to the principles of hematology.
- The course will also describe the different types of blood cells and their precursors in the bone marrow.
- It will cover the topics of determination of hemoglobin, Red blood cell indices, Microscopic study of blood smear.
- The course will discuss the blood diseases and important laboratory findings regarding them.

COURSE OUTCOME: CO1

- Student shall learn about the diverse scopes and importance of hematology in medical practice.
- Students will learn to identify and describe the different types of blood cells, including red blood cells, white blood cells and platelets.
- Students will understand the principles, potential errors, interpretation and clinical significance for accurate diagnosis in hematology.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|-----|------|------|------|------|------|------|
| CO1 | | | | | | |

| UNIT 1 | FUNDAMENTALS OF HAEMATOLOGY |
|---------------|--|
| 1.1 | Introduction to haematology, Components of blood and their functions |
| 1.2 | Haematopoietic system of the body |
| 1.3 | Collection and processing of blood specimen |
| 1.4 | Determination of haemoglobin concentration: Cynmethaemoglobin method |
| 1.5 | Determination of haematocrit |
| 1.6 | Red blood cell indices |
| 1.7 | Enumeration of formed elements |
| 1.8 | Differential count and examination of stained blood smears |
| 1.9 | Interpretation of laboratory findings in haematology: Anaemia, leukaemia and miscellaneous disorders |

REFERENCES:

- Mukherjee, K. L. (1988). Medical Laboratory Technology, Vol 1, 3rd Ed., Tata McGraw Hill Publishing.
- Godkar, P. B. (2003). Textbook of Medical Laboratory Technology, Vol.2, 3rd Ed., Bhalani Publishing House.
- Cheesbrough, M. (2006). District Laboratory Practice in Tropical Countries – Part-2nd Ed., Cambridge University Press.
- Ochei, J. and Kolhatkar, A. (2000). Medical Laboratory Science-Theory and Practice, Tata McGraw Hill.

E-RESOURCES:

- <https://youtu.be/0deCbmh7PHs?si=dJXS0kRdJzXDFEjs>
- <https://youtu.be/XBaJSwXbwFw?si=YiDrhiOX7YILPK7b>
- https://youtu.be/9vf_sdn53LQ
- <https://youtu.be/mAmwdDdbkUI?si=Kd43flpkm2OCikGv>
- <https://youtu.be/6CqptdZyUaU?si=kdEEL52wX0-RvawL>
- <https://www.youtube.com/watch?v=0deCbmh7PHs>
- <https://www.youtube.com/watch?v=XBaJSwXbwFw&t=66s>
- SWAYAM (<https://swayam.gov.in>)
- SWAYAM Plus (<https://swayam-plus.swayam2.ac.in>)

SEC PRACTICAL

(MBP-ME 502)

| | |
|-----------------------------------|--------------------------------|
| COURSE CODE | MBP-ME-502 |
| COURSE TITLE | HAEMATOLOGY PRACTICALS |
| COURSE LEVEL | 300 to 399 |
| COURSE CREDIT | 01 |
| TOTAL ENGAGEMENT | 01 Credits X 30 hrs. = 30 hrs. |
| TEACHING PER WEEK | 02 Hrs. |
| MINIMUM WEEKS PER SEMESTER | 15 Weeks |

COURSE OUTCOME:

CO1: Students shall develop skills to separate serum and plasma from blood.

CO2: Students shall learn to estimate haemoglobin by Cyanmethaemoglobin / Sahli's method.

CO3: Students shall become skilful to determine the total count of RBC and WBC.

CO4: Students shall acquire the ability to Differentiate the leucocytes and determine the blood count of Leucocytes.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|------------|------|------|------|------|------|------|
| CO1 to CO4 | | | | | | |

1. Separation of serum and plasma from blood.
2. Estimation of haemoglobin by Cyanmethaemoglobin / Sahli's method.
3. Total count of RBC and WBC.
4. Differential count of Leucocytes.

Recommended Learning Resources

1. Patel, R. J., & Patel, R. K., (2022). Experimental Microbiology, Vol. 1, 10th Edition, Aditya.
2. Godkar, P. B. (2003). Textbook of Medical Laboratory Technology, Vol.2, 3rd Ed., Bhalani Publishing House.

T. Y. B. Sc. Semester – VI

MAJOR

EFFECTIVE FROM: 2025-26

MB-MJ-601

| | |
|-----------------------------------|--------------------------------|
| COURSE CODE | MB-MJ-601 |
| COURSE TITLE | MEDICAL MICROBIOLOGY |
| COURSE LEVEL | 300 to 399 |
| COURSE CREDIT | 02 |
| TOTAL ENGAGEMENT | 02 Credits X 15 hrs. = 30 hrs. |
| TEACHING PER WEEK | 02 Hrs. |
| MINIMUM WEEKS PER SEMESTER | 15 Weeks |

COURSE CONTENT:

- This comprehensive curriculum explores the complex interactions between pathogens, their virulence factors, and hosts, providing a deep understanding of the mechanisms underlying infectious diseases.
- Specifically, this course covers the interactions between pathogens and hosts that lead to infection, the emergence, development, and control of disease outbreaks, various modes of microbial infection, including: Vector-borne transmission, Direct contact transmission, Foodborne transmission, Waterborne transmission, Airborne transmission, Healthcare-Associated Infections (HAIs).

COURSE OUTCOME: CO1

- Students shall learn to describe the principles of pathogenicity, virulence factors in microorganisms, patterns and transmission dynamics of infectious diseases.
- Students shall develop skills to analyze the factors contributing to the emergence and re-emergence of infectious diseases.
- Students shall develop insight regarding epidemic rise, control, and prevention strategies.
- Students shall be able to interpret the impact of emerging and re-emerging diseases, as well as healthcare-associated infections (HAIs), on public health.

COURSE OUTCOME: CO2

- Students will be able to understand the role of various modes of transmission in causing infectious diseases and pathogenicity of disease causation.
- Students shall become skillful to Identify and determine the causative agents of various infectious diseases from clinical samples.
- Students shall gain an understanding regarding the principles of prevention and treatment strategies of infectious diseases including vaccination and immunization, antibiotic therapy, environmental and behavioral interventions.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|-----|------|------|------|------|------|------|
| CO1 | | | | | | |
| CO2 | | | | | | |

| | |
|---------------|---|
| UNIT 1 | PATHOGENICITY, INFECTIOUS DISEASE AND EPIDEMIOLOGY |
| 1.1 | SECTION A: Host microbe interaction to cause infection |
| 1.1.1 | Principle of infectious disease |
| 1.1.2 | Establishment of infection |
| 1.1.3 | Virulence factors |
| 1.2 | SECTION B: Epidemiology |
| 1.2.1 | Basic concepts of Epidemiology |
| 1.2.2 | Chain of infection |
| 1.2.3 | Epidemiological studies |
| 1.2.4 | Public health Surveillance and Remote sensing |
| 1.2.5 | Emerging and Re-Emerging infectious disease |
| 1.2.6 | Nosocomial infection |

| | |
|---------------|--|
| UNIT 2 | INFECTIOUS DISEASE |
| 2.1 | SECTION A: AIR-BORNE, CONTACT AND VECTOR BORNE DISEASES |
| 2.1.1 | Tuberculosis |
| 2.1.2 | Influenza |
| 2.1.3 | Pneumonia |
| 2.1.4 | COVID-19 |
| 2.1.5 | Aspergillosis |
| 2.1.6 | Staphylococcal infections |
| 2.1.7 | Syphilis |
| 2.1.8 | AIDS |
| 2.1.9 | Malaria |
| 2.1.10 | Dengue |
| 2.2. | SECTION B: FOOD AND WATER-BORNE DISEASES |
| 2.2.1 | <i>E. coli</i> Gastroenteritis |
| 2.2.2 | Salmonellosis |
| 2.2.3 | Amoebic dysentery |
| 2.2.4 | Hepatitis |

REFERENCES:

- Willey, J. M., Sherwood, L., and Woolverton, C. J. (2017). Prescott's microbiology, 10th Ed., New York: McGraw-Hill Education (978-981-3151-26-0).
- Bauman, R. W. (2012). Microbiology: With diseases by body system (4th ed.). Pearson Education (978-0-321-73267-5).
- Nester, E.W. (2012) Microbiology: A Human Perspective. 8th Edition, McGraw-Hill, Boston (ISBN- 9780072919240) .

- Greenwood, D., Slack, R., and Barer, M. (2012). Medical Microbiology A Guide to Microbial Infections, 18th Ed., Churchill Livingstone, Elsevier (978-070-2040-90-0).
- Pelczar, Chan, and Krieg (1993). Microbiology – Concepts and Application International Ed., McGraw-Hill Education (0-07-462320-6).
- Ananthnarayan, R and Paniker C. K. (2009). Textbook of Microbiology, 7th Ed., Universities Press (India) Pvt. Limited (9788173716744).
- Goering, R. V., Dockrell, H. M., Zuckerman, M., & Chiodini, P. L. (2019). Mims' medical microbiology and immunology (6th ed.). Elsevier.
- Carroll, K. C., & Pfaller, M. A. (Eds.). (2023). Manual of clinical microbiology (13th ed.). ASM Press; John Wiley & Sons.

E-RESOURCES:

- <https://www.youtube.com/watch?v=PBmdlEgAJY>
- <https://www.youtube.com/watch?v=GKzXWctAMuw&t=34s>
- <https://www.youtube.com/watch?v=fJ7RKwdLI-I&t=26s>
- https://www.youtube.com/watch?v=-kYfs1_bC0c
- <https://www.youtube.com/watch?v=q1P3QupjhYo>
- SWAYAM (<https://swayam.gov.in>)
- SWAYAM Plus (<https://swayam-plus.swayam2.ac.in>)

[Subject Code-2603000506016002]

PRACTICALS **MBP-MJ-601**

| | |
|-----------------------------------|--|
| COURSE CODE | MB-MJ-601 |
| COURSE TITLE | MEDICAL MICROBIOLOGY PRACTICALS |
| COURSE LEVEL | 300 to 399 |
| COURSE CREDIT | 02 |
| TOTAL ENGAGEMENT | 02 Credits X 30 hrs. = 60 hrs. |
| TEACHING PER WEEK | 04 Hrs. |
| MINIMUM WEEKS PER SEMESTER | 15 Weeks |

COURSE OUTCOME:

- CO1:** Students shall gain skill to relate the suspected organisms associated with the medical problems related to blood and determine the isolated causative agent from the clinical blood sample.
- CO2:** Students shall gain skill to relate the suspected organisms associated with the medical problems related to blood and determine the isolated causative agent from the clinical stool sample.
- CO3:** Students shall gain skill to relate the suspected organisms associated with the medical problems related to blood and determine the isolated causative agent from the clinical purulent exudates, wound, and abscess sample.
- CO4:** Students shall gain skill to relate the suspected organisms associated with the medical problems related to blood and determine the isolated causative agent from the clinical

urine sample.

CO5: Students shall be able to determine the susceptible antibiotic against the isolated pathogen and conclude the MIC.

CO6: Students shall learn about arthropod vector (Aedes/Anopheles) and malarial parasite.

[Subject Code- 2603000506016002]

MBP MJ-601

Medical Microbiology Practical

1. Bacteriological investigation of medical problems related to blood.
2. Bacteriological investigation of medical problems related to stool.
3. Bacteriological investigation of medical problems related to purulent exudates, wound, and abscess.
4. Bacteriological investigation of medical problems related to urine.
5. Determination of Antibiotic Susceptibility (Agar disc method) and MIC.
6. Study of arthropod vector (Aedes/Anopheles) and various stages of malarial parasite in RBCs using permanent slides.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|------------|------|------|------|------|------|------|
| CO1 to CO6 | | | | | | |

Recommended Learning Resources

- Patel, R. J. and Patel, R. K. (2015). Experimental Microbiology, Vol. 1, 9th Ed., Aditya.
- Patel, R. J. and Patel, R. K. (2015). Experimental Microbiology, Vol. 2, 9th Ed., Aditya.
- Cappuccino, J.G. and Sherman N. (2005). Microbiology: A Laboratory Manual, 6th Ed., Pearson Education (Singapore) Pvt. Ltd.
- Cappuccino, J.G. and Sherman N. (2005). Microbiology: A Laboratory Manual, 10th Ed., Pearson Benjamin Cummings.
- Aneja, K.R., (2003). Experiments in Microbiology, Plant Pathology, Tissue Culture And Mushroom Production Technology, New Age International Publishers.

[Subject Code-2603000506026001]

MB-MJ-602

| | |
|-----------------------------------|--------------------------------|
| COURSE CODE | MB-MJ-602 |
| COURSE TITLE | IMMUNOLOGY |
| COURSE LEVEL | 300 to 399 |
| COURSE CREDIT | 02 |
| TOTAL ENGAGEMENT | 02 Credits X 15 hrs. = 30 hrs. |
| TEACHING PER WEEK | 02 Hrs. |
| MINIMUM WEEKS PER SEMESTER | 15 Weeks |

COURSE CONTENT:

- This course provides general introductions to the Immune system, innate host resistance, and adaptive immunity. It will cover topics including; Adaptive immunity, Immune defense mechanism and immune defects like immune tolerance, autoimmune diseases, immunodeficiencies and hypersensitivity.

COURSE OUTCOME: CO1:

- Students will be able to differentiate between the innate and adaptive immune systems.
- Students will be able to describe the concepts of antigen recognition, T-cell and B-cell activation and antibody production.

COURSE OUTCOME CO2:

- Students will be able to use what they've learned to explain the causes and consequences of immune dysfunctions, such as autoimmune diseases and immunodeficiencies.
- Students will be able to describe the concepts of immune tolerance and immune defects like autoimmune diseases and hypersensitivity.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|-----|------|------|------|------|------|------|
| CO1 | | | | | | |
| CO2 | | | | | | |

| | |
|---------------|---|
| UNIT 1 | INNATE HOST RESISTANCE AND ADAPTIVE IMMUNITY |
| 1.1 | SECTION A: Innate host resistance |
| 1.1.1 | Innate resistance and adaptive defence |
| 1.1.2 | Physical and mechanical innate barriers |
| 1.1.3 | Chemical mediators of Innate immunity |
| 1.1.4 | Cells of the immune system: Structure and functions |
| 1.1.5 | Lymphoid organs of the Immune system |
| 1.2 | SECTION B: Adaptive Immunity |
| 1.2.1 | Antigens and its properties |
| 1.2.2 | Types of Adaptive Immunity |
| 1.2.3 | Recognition of foreignness |
| 1.2.4 | T-cell |
| 1.2.5 | B-cell |

| | |
|----------------|---|
| UNIT 2 | DEFENSE MECHANISM, IMMUNIZATION AND IMMUNE DEFECTS |
| 2.1 | SECTION A: Immune defense mechanism |
| 2.1.1 | Innate defense mechanism: |
| 2.1.1.1 | Phagocytosis |
| 2.1.1.2 | Inflammation |
| 2.1.2 | Antibody: Structure, types & functions |
| 2.1.2.1 | Clonal selection theory |
| 2.1.3 | Vaccines: Types and vaccination schedule in India |
| 2.2 | SECTION B: Immune defects |
| 2.2.1 | Immune tolerance |
| 2.2.2 | Autoimmune diseases |
| 2.2.3 | Immunodeficiencies |
| 2.2.4 | Hypersensitivity (Type I, II, III & IV) |

REFERENCES:

- Willey, J. M., Sherwood, L., and Woolverton, C.J. (2017). Prescott's Microbiology, 10th Edition., New York: McGraw-Hill Education. (978-981-3151-26-0).
- Owen, J. A, Punt, J., Stranford, S. A. and Jones, P. P. (2013). Kuby Immunology, 6th Ed., W. H. Freeman and Company.
- Delves, P. J., Martin, S. J., Burton, D. R. and Roitt, I. M. (2011). Roitt's Essential Immunology, 6th Ed., Wiley-Blackwell Publishers.
- Abbas, A. K., Lichtman, A. H. and Pillai, S. (2012). Cellular and Molecular Immunology, 7th Ed., Elsevier-Saunders Publication.
- Mohapatra, A. D., & Sahu, P. S. (Eds.). (2024). Advances in immunology and immuno-techniques: Updated concepts and recent applications. Springer.

E-RESOURCES:

- <https://youtu.be/BFeJlxIldAI?si=cJjdj2XA-0y1I-ad>
- https://youtu.be/5lrAehqruco?si=piL8H3kXpVw_4ViW
- <https://youtu.be/bserR4ZDDAQ?si=TJXxvuaCdBgbmRzZ>
- https://youtu.be/RjInWRFecuE?si=jld4ADeUNn41r_6O
- <https://youtu.be/uc6IV85mf3s?si=1QtWiX88PCg-HulW>
- https://youtu.be/TNK3WyeI3r8?si=yUCXAfAcu_JB66wg
- <https://youtu.be/2YK5vBUm9C8?si=aT4e9VQoGzTIUX6E>
- SWAYAM (<https://swayam.gov.in>)
- SWAYAM Plus (<https://swayam-plus.swayam2.ac.in>)

MBP MJ-602
PRACTICALS

| | |
|-----------------------------------|--------------------------------|
| COURSE CODE | MB-MJ-602 |
| COURSE TITLE | IMMUNOLOGY PRACTICALS |
| COURSE LEVEL | 300 to 399 |
| COURSE CREDIT | 02 |
| TOTAL ENGAGEMENT | 02 Credits X 15 hrs. = 30 hrs. |
| TEACHING PER WEEK | 02 Hrs. |
| MINIMUM WEEKS PER SEMESTER | 15 Weeks |

COURSE CONTENT:

This course provides general introductions to the Immune system, innate host resistance, and adaptive immunity. It will cover topics including; Adaptive immunity, Immune defense mechanism and immune defects like immune tolerance, autoimmune diseases, immunodeficiencies and hypersensitivity.

COURSE OUTCOME:

- CO1:** Students shall learn about typhoid disease and its detection. Students shall gain knowledge regarding the titre determination and interpreting the severity of the disease. Students shall be serologically discriminate infections caused by *Salmonella typhi*, *Salmonella paratyphi A* and *Salmonella paratyphi B*.
- CO2:** Students shall become skilful to screen for syphilis and detect the occurrence of syphilis by using RPR test.
- CO3:** Students shall develop skill in antigen detection of widely spread diseases like HIV and HBs Ag by using rapid flow through method.
- CO4:** Students will be getting knowledge about different phagocytic and lymphocytic cells of Immune system of human in blood sample.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|-----|------|------|------|------|------|------|
| CO1 | | | | | | |
| CO2 | | | | | | |

1. Widal test by Dreyer's double dilution technique.
2. Detection of Syphilis by RPR test (Qualitative).
3. Detection of HIV by rapid flow through method.
4. Detection of HBsAg by rapid flow through method.
5. ABO blood grouping (slide method)

6. Observation and Identification of Phagocytic and Lymphocytic cells of immune system
From human blood.

REFERENCES:

1. Patel, R. J. and Patel, R. K. (2015). Experimental Microbiology, Vol. 1, 9th Ed., Aditya.
2. Patel, R. J. and Patel, R. K. (2015). Experimental Microbiology, Vol. 2, 9th Ed., Aditya.
3. Cappuccino, J.G. and Sherman N. (2005). Microbiology: A Laboratory Manual, 6th Ed., Pearson Education (Singapore) Pvt. Ltd.
4. Cappuccino, J. G. and Sherman N. (2005). Microbiology: A Laboratory Manual, 10th Ed., Pearson Benjamin Cummings.
5. Gurtler, V. & Pavia, C. S. (2020) Immunological Methods in Microbiology (Vol 47) Elsevier.

[Subject Code-2603000506036001]

MB-MJ-603

| | |
|-----------------------------------|--------------------------------|
| COURSE CODE | MB-MJ-603 |
| COURSE TITLE | INDUSTRIAL MICROBIOLOGY |
| COURSE LEVEL | 300 to 399 |
| COURSE CREDIT | 02 |
| TOTAL ENGAGEMENT | 02 Credits X 15 hrs. = 30 hrs. |
| TEACHING PER WEEK | 02 Hrs. |
| MINIMUM WEEKS PER SEMESTER | 15 Weeks |

COURSE CONTENT:

- This course provides general introductions to the diverse roles of microorganisms in industrial microbiology
- It will cover topics including; screening of industrially important microorganisms, strain improvement, media designing, and fermenter design and down steam processes.

COURSE OUTCOME: CO1

- Students will be able to understand the evolution of fermentation technology, the historical advancements in industrial microbiology and the key components of the fermentation process.
- Students will be able to understand the screening techniques, inoculum development for industrial applications, culture maintenance, and strain improvement techniques.
- Students will be able to understand industrial microbial strains and fermentation media, the role of fermentation media composition in optimizing microbial growth and metabolite production.

COURSE OUTCOME: CO2

- Students will be able to understand the bioreactor design and operations and fermentation processes to optimize industrial applications.

- Students will be able to assess the impact of bioreactor types and operating conditions on microbial productivity.
- Students will be able to apply downstream processing techniques for cell harvesting, disruption, and product recovery in industrial microbiology.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|-----|------|------|------|------|------|------|
| CO1 | | | | | | |
| CO2 | | | | | | |

| | |
|---------------|---|
| UNIT 1 | FUNDAMENTALS OF INDUSTRIAL MICROBIOLOGY |
| 1.1 | SECTION A: Development of industrial microbiology |
| 1.1.1 | Historical developments in fermentation technology |
| 1.1.2 | Isolation of microorganism and culture collections |
| 1.1.3 | Screening for new metabolites |
| 1.1.4 | Screening Techniques: Primary and Secondary |
| 1.2 | SECTION B: Industrially Important Strains and fermentation |
| 1.2.1 | Industrial Strains and strain improvement |
| 1.2.2 | Strain stability |
| 1.2.3 | Inoculum development |
| 1.2.4 | Fermentation media |
| 1.2.5 | Fermentation types and process |

| | |
|---------------|--|
| UNIT 2 | BIOREACTOR & PRODUCT RECOVERY |
| 2.1 | SECTION A: Bioreactor Components and Design |
| 2.1.1 | Bioreactor |
| 2.1.2 | Design of Bioreactor |
| 2.1.3 | Bioreactor types |
| | |
| 2.2 | SECTION B: Product Recovery |

| | |
|-------|---------------------|
| 2.2.1 | Cell harvesting |
| 2.2.2 | Cell disruption |
| 2.2.3 | Product recovery |
| 2.2.4 | Distillation |
| 2.2.5 | Finishing step |
| 2.2.6 | Product development |

REFERENCES:

- Patel, A. H. (2016). Industrial Microbiology, 2nd Ed., Trinity press; An imprint of Laxmi publications Pvt. Ltd. (978-9385750250).
- Waites, M. J. (2001). Industrial microbiology: An Introduction, 1st Ed., Blackwell publishing. (978-0632053070).
- Shivkumar, P. K., Joe, M. M. and Sukesh, K. (2010). An Introduction to Industrial Microbiology, S. Chand Publishers. (978-8121935197).
- Okafor, N. (2007). Modern Industrial Microbiology and Biotechnology. Taylor and Francis, an imprint of CRC Press. (978-1315147161).
- Stanbury, P., Whitaker, A. and Hall, S. J. (2016). Principles of fermentation technology, 3rd Ed., Butterworth-Heinemann. (978-0080999531).

E-RESOURCES:

- <https://www.youtube.com/watch?v=r04e-KvOiG4>
- <https://www.youtube.com/watch?v=pQnfiledQNwI>
- <https://www.youtube.com/watch?v=SsozxmGX6cM>
- <https://www.youtube.com/watch?v=mUDXupn2Dhk>
- SWAYAM (<https://swayam.gov.in>)
- SWAYAM Plus (<https://swayam-plus.swayam2.ac.in>)

PRACTICALS

MBP-MJ 603

[Subject Code-2603000506036002]

| | |
|-----------------------------------|---|
| COURSE CODE | MB-MJ-603 |
| COURSE TITLE | INDUSTRIAL MICROBIOLOGY PRACTICALS |
| COURSE LEVEL | 300 to 399 |
| COURSE CREDIT | 02 |
| TOTAL ENGAGEMENT | 02 Credits X 30 hrs. = 60 hrs. |
| TEACHING PER WEEK | 04 Hrs. |
| MINIMUM WEEKS PER SEMESTER | 15 Weeks |

COURSE OUTCOME:

CO1: Students shall develop skills to screen and characterize amylase & organic acid producing microorganisms.

CO2: Students shall develop skills to screen and characterize antibiotic producing

microorganisms.

CO3: Students shall develop skills for the lab scale production of microbial amylase.

CO4: Students shall gain knowledge of Penicillin bioassay.

CO5: Students shall develop the analytical skill for the estimation of reducing sugars by Cole's method from fermented broth.

CO6: Students shall develop the analytical skill for the estimation of protein by Folin Lowry's method from fermented broth.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|------------------|------|------|------|------|------|------|
| CO1 To CO5 | | | | | | |

1. Screening of amylase & organic acid producing microorganisms.
2. Screening of antibiotic producing microorganisms.
3. Fermentative production of amylase and its estimation.
4. Bioassay of Penicillin.
5. Estimation of reducing sugars by Cole's method from fermented broth.
6. Estimation of protein by Folin Lowry's method from fermented broth.

REFERENCES:

1. Patel, R. J., & Patel, R. K., (2022). Experimental Microbiology, Vol. 1, 10th Edition, Aditya.
2. Patel, R. J., & Patel, R. K., (2022). Experimental Microbiology, Vol. 2, 10th Edition, Aditya
3. Aneja, K. R., (2003). Experiments in Microbiology 4thed. Experiments in microbiology, Plant Pathology, Tissue Culture and Mushroom Production Technology, New Age International Publishers.

MINOR

MB-ME-601 [Subject Code-2603000506046001]

| | |
|-----------------------------------|--------------------------------|
| COURSE CODE | MB-ME-601 |
| COURSE TITLE | GENOMICS AND PROTEOMICS |
| COURSE LEVEL | 300 to 399 |
| COURSE CREDIT | 02 |
| TOTAL ENGAGEMENT | 02 Credits X 15 hrs. = 30 hrs. |
| TEACHING PER WEEK | 02 Hrs. |
| MINIMUM WEEKS PER SEMESTER | 15 Weeks |

COURSE CONTENT:

- The course focuses on various structural aspects of bioinformatics with respect to study of genes their functions and proteins produced by those genes.

- It also includes the fundamental concepts of genomics and proteomics and its role in genome sequencing, expression and its application in molecular biology.

COURSE OUTCOME: CO1

- Students shall learn about the fundamental principles of genomics.
- Students will gain a deep knowledge about genomics, its applications and develop proficiency in bioinformatics tools necessary to analyze large genome datasets.
- Student shall gain skills in determining the nucleotide and genome sequences, annotation and mapping.
- Students shall develop insights regarding functional and comparative genomics.

COURSE OUTCOME: CO2

- Students shall study the importance of proteome.
- Students shall gain knowledge regarding the various techniques to study proteomics and interaction of proteins.
- Students will learn the techniques for the analysis of protein expression, its modifications, protein interactions, and its applications.
 - Students shall apply proteomics for the benefits of human health.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|-----|------|------|------|------|------|------|
| CO1 | | | | | | |
| CO2 | | | | | | |

| UNIT 1 | GENOMICS |
|---------------|--|
| 1.1 | Genomics |
| 1.1.1 | Determining DNA sequences |
| 1.1.2 | Genome sequencing |
| 1.2 | Genome annotation |
| 1.2.1 | GO annotation for cytochrome C oxidase |
| 1.3 | Genome Mapping |
| 1.4 | Functional Genomics |
| 1.4.1 | DNA and RNA level (Transcriptomics) |
| 1.5 | Comparative Genomics |

| UNIT 2 | PROTEOMICS |
|--------|---|
| 2.1 | Importance and Scope of Proteomics |
| 2.2 | Technology of Protein Expression Analysis |
| 2.3 | Posttranslational Modification |
| 2.4 | Protein-Protein Interaction |
| 2.5 | Pharmaceutical proteomics |

REFERENCES:

- Twyman, R. (2004). *Principles of Proteomics* (1st edition). Taylor & Francis. <https://doi.org/10.4324/9780203507391>
- Willey, J.M., Sherwood, L.M., & Woolverton, C. J. (2017)- 10th edition. *Prescott Microbiology*. McGraw-Hill.
- Xiong,J. (2006).. *Essential Bioinformatics*, 1st Ed., Cambridge University Press
- Weaver, R. (2011). *EBOOK: Molecular Biology*. McGraw Hill.
- Prasad, A., Bhargava, H., Gupta, A., Shukla, N., Rajagopal, S., Gupta, S., ... & Suravajhala, P. (2021). Next generation sequencing. *Advances in bioinformatics*, 277-302.
- Primrose, S. B., & Twyman, R. (2006). *Principles of gene manipulation and genomics*. John Wiley & Sons.
- *Discovering Genomics, Proteomics and Bioinformatics*, 2nd Edition. Campbell AM & Heyer LJ, Benjamin Cummings 2007; CSH Press, NY. ISBN-10: 81317155902.
- *Bioinformatics and Functional Genomics – Jonathan Pevsner - 2nd edition*, Wiley-Blackwell, 2009. ISBN-10: 047121004

E-RESOURCES:

- <https://www.coursera.org/courses?query=proteomics>
- <https://www.ncbi.nlm.nih.gov/>
- <https://www.ensembl.org/>
- <https://www.internationalgenome.org/>
- <https://www.uniprot.org/>
- <https://www.ebi.ac.uk/pride/>
- <https://www.expasy.org/>
- <https://global.oup.com/academic/product/introduction-to-genomics-9780198831402>
- <https://www.ncbi.nlm.nih.gov/books/>
- <https://www.coursera.org/courses?query=proteomics>
- <https://www.khanacademy.org/science/biology>
- https://www.youtube.com/playlist?list=PLU14u3cNGP63O_lpsuKq6xiwvKfCmI6gR
- <https://www.ibiology.org/>
- https://www.ted.com/talks/eric_lander_secrets_of_the_human_genome
- SWAYAM (<https://swayam.gov.in>)
- SWAYAM Plus (<https://swayam-plus.swayam2.ac.in>)

[Subject Code-2603000506046002]

PRACTICALS

MBP-MJ 601

| | |
|-----------------------------------|---|
| COURSE CODE | MBP-ME-601 |
| COURSE TITLE | GENOMICS AND PROTEOMICS PRACTICALS |
| COURSE LEVEL | 300 to 399 |
| COURSE CREDIT | 02 |
| TOTAL ENGAGEMENT | 02 Credits X 30 hrs. = 60 hrs. |
| TEACHING PER WEEK | 04 Hrs. |
| MINIMUM WEEKS PER SEMESTER | 15 Weeks |

COURSE CONTENT:

- The course focuses on various structural aspects of bioinformatics with respect to study of genes their functions and proteins produced by those genes.
- It also includes the fundamental concepts of genomics and proteomics and its role in genome sequencing, expression and its application in molecular biology.

COURSE OUTCOME:

CO1: Students shall learn about the genomics databases.

CO2: Students shall gain access to the various protein databases

CO3: Students shall retrieve data regarding the nucleotide sequences and sequences from NCBI.

CO4: Students shall learn to access the Entrez genomes page at NCBI. Students shall gain skill to correlate the nucleotide and protein sequences. Students shall become skilful in using tools and techniques to study nucleotides and proteins sequences.

CO5: Students shall study about protein separation techniques. Students shall develop proficiency in bioinformatics tools necessary to analyse large genome datasets

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|------------------|------|------|------|------|------|------|
| CO1 to CO5 | | | | | | |

PRACTICALS:

1. To study about Genomic Databases.
2. To study about Protein databases.
3. To study retrieval of gene, genome and protein sequence from NCBI.
4. To study ENTREZ, BLAST, GeneMark.
5. To study SDS-PAGE (demonstration).

REFERENCES:

- Saraswathy N. and Ramalinga P. 2011. *Concepts and Techniques in Genomics and Proteomics*. Biohealthcare publishing (oxford) limited.
- C.S.V Murthy. 2003 *Bioinformatics.*, Himalaya Publishing House.
- Twyman, R. 2004. *Principles of Proteomics* (1st edition). Talor & Francis.
<https://doi.org/10.4324/9780203507391>
- Xiong,J. 2006. *Essential Bioinformatics*, 1st Ed., Cambridge University Press.