
SEMESTER -IV
AGRICULTURAL MICROBIOLOGY- THEORY

1. Course Description:

Programme: M.Sc.
Course Code: P24/MIC/DSE/401
Course Type: DSE
No. of credits: 3

Max. Hours: 45
Hours per week: 3
Max. Marks: 100

2. Course objectives:

- To understand microbial processes and their application in agriculture.
- To understand the novel technologies used in current agricultural settings.

3. Course Outcomes:

CO1: Understand the concepts of advances in crop improvement, production, evaluate the plant – microbe interactions and analyze the significance of plant defense mechanisms (L II, V)

CO 2: Understand and gain knowledge about the epidemiology and control measures of plant diseases caused by bacteria, fungi and viruses (L II)

- **CO 3:** Understand different methods employed for plant disease control, analyze the advanced techniques used in monitoring plant diseases and improving plant yield. (L II, IV)

4. Course Content:**MODULE I - AGRO ECOLOGY****(15 Hrs)**

Microbes to facilitate plant growth in saline soils, Crop improvement using metal tolerant bioinoculants PGPR and sustainable Agriculture Entry and establishment of pathogens in plants, host and parasite interaction, role of toxins and enzymes in pathogenesis. Disease resistance in plants – protection and defense, mechanisms of resistance (performed and induced defense, local signals, programmed cell death, induced structural barriers, phytoalexins) Biochemical basis of disease resistance – Systemic Acquired Resistance (SAR) and Local Acquired Resistance (LAR)

MODULE II - PLANT DISEASES:**(15 Hrs)**

Epidemiology and plant disease forecasting- Principles, symptoms, molecular diagnosis and control measures of the following diseases. **Plant diseases caused by fungi:** Late blight of potato, downy mildew of grapes, Loose smut of wheat, smut of bajra, blast disease of rice. **Plant diseases caused by bacteria:** bacterial blight of paddy, angular leaf spot of cotton, common scab of potato. Plant diseases caused by viruses – tobacco mosaic, leaf curl of tomato, yellow vein mosaic of bhindi.

MODULE III - AGRO ECONOMIC PRACTICES AND MANAGEMENT: (15 Hrs)

Cultural methods, Agronomic practices (crop rotation, field and crop sanitation), Chemical control (fungicides, fumigants, inorganic copper/ sulphur compounds, dithiocarbamates), Biological control – Principle, concepts, and environmental safety – bio-pesticides (bacterial, fungal and viral). Plant disease assessment methods – visual method in the field, scales for estimating disease intensity, yield losses, multiple point model and remote sensing techniques.

5. Resources:**Text Books:**

1. R.S Mehrotra & Ashok Agarwal (2003), Fundamentals of Plant Pathology .2nd edition, Tata McGraw Hill Education Private Limited
2. G.Rangaswami, D.J Bagyaraj (2009), Agricultural Microbiology - 2nd edition. PHI learning Pvt limited.
3. Mohammed Saghir Khan, Almas Zaidi, Javed Musarrat (2009), Microbial strategies for crop improvement, Springer verlag Berlin Publisher

Reference Books:

1. Agrio, G.N. (2005), Plant pathology , 5th edition, Elsevier Publishers.
2. Alexander Martin. Textbook of Soil Microbiology, Krieger Publications
3. Benjamin Cunnings, Meriopank. California (1987), Microbial ecology, fundamentals an application.
4. Bilgrami,K.S. and H.C. Dube (2009),Modern Plant pathology , Student edition.
5. N.S. Subba Rao (2012), Soil Microbiology – 4th edition Oxford IBH Publishing Company.
6. R.S. Singh (2009),An introduction to principles of plant pathology ,Oxford & IBH publishers.

6. Syllabus Focus**a) Relevance to Local, Regional, National, and Global Development Needs**

Local /Regional/National /Global Development Needs	Relevance
National	Plant Disease management and assessment methods to control occurrence of plant diseases and improve crop yield

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Employability	Module III	Develop cultural practices for plant disease management and catering to agricultural sector <u>Activity: Plant growth assessment using different composts.</u>

7. Pedagogy:

S. No	Student Centric Methods Adopted	Type/Description of Activity
1.	Video Presentations	Participative Learning
2.	Field trip	Experiential Learning
3.	Group Discussion	Participative Learning

8. Course Assessment Plan:**a. Weightage of Marks in Continuous Internal Assessments and End Semester Examination**

COs	Continuous Internal Assessments – CIA (40%)	End Semester Examination - (60%)
CO1	CIA-1 Plant growth analysis	End Semester examination
CO2	CIA-1	
CO3	CIA-2 Presentations on Plant diseases	

b. Question Paper Pattern:

**AGRICULTURAL MICROBIOLOGY
MODEL QUESTION PAPER – THEORY**

Course Code: P24/MIC/DSE/401

Credits: 3

Max Marks: 60

Time: 2 ½ Hrs

SECTION – A**I. Answer the following:****3 x 12 = 36 M**

1. Explain about Microbes facilitating plant growth in saline soils.

OR

2. Describe Entry and establishment of plant pathogens.

3. Discuss epidemiology of Loose smut of wheat disease

OR

4. Explain about viral plant diseases.

5. Explain plant disease management.

OR

6. Describe Plant disease assessment methods



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SECTION – B**II. Answer any FOUR:****4 x 6 = 24 M**

7. What is Mycorrhiza?
8. Describe role of toxins in pathogenesis
9. Explain the epidemiology of downy mildew of grapes
10. Explain TMV disease
11. What are Biopesticides and discuss their applications?
- 12 Describe application of Remote sensing techniques in plant disease management.

SECTION A - INTERNAL CHOICE				3Q X 12 M = 36 M
Question Number	Module	Question	CO	BTL (Blooms Taxonomy Level)
1	Module 1	Explain about Microbes facilitating plant growth in saline soils	CO 1	Level II
2	Module 1	Describe Entry and establishment of plant pathogens.	CO 1	Level II
3	Module 2	Discuss epidemiology of Loose smut of wheat disease	CO 2	Level II
4	Module 2	Explain about viral plant diseases	CO 2	Level II
5	Module 3	Explain plant disease management	CO 3	Level II
6	Module 3	Describe Plant disease assessment methods	CO 3	Level II
SECTION B - ANSWER ANY 4 OUT OF 6 (To compulsorily have ONE question from each module)				4 Q X 6M = 24M
7	Module 1	What is Mycorrhiza?	CO 1	Level I
8	Module 1	Describe role of toxins in pathogenesis	CO 1	Level I
9	Module 2	Explain Epidemiology of downy mildew of grapes	CO 2	Level II
10	Module 2	Explain TMV disease	CO 2	Level II
11	Module 3	What are Biopesticides and discuss their applications?	CO 3	Level IV
12	Module 3	Describe application of Remote sensing techniques in plant disease management.	CO 3	Level IV

SEMESTER -IV
AGRICULTURAL MICROBIOLOGY- PRACTICAL

1. Course Description

Course Code: P24/MIC/DSE/401/P

Course Type: DSE

No. of credits: 2

Max. Hours : 60

Hours per week: 4

Max. Marks: 50

2. Course objectives:

- To understand various aspects of available soil nutrients and soil health. Analyze the importance of plant- microbe interactions.
- To understand the principles of pathogenicity in plants and preventive measures to be taken to control them and to analyze the biochemical components in healthy and diseased plants by quantification methods.

3. Course Outcomes:

CO1: Gain experimental knowledge on the estimation of available nutrients like Phosphate and determine the amount of organic matter in soil necessary for soil health.

CO2: Understand the plant diseases, their symptoms and control measures and disease induction by Virus.

CO3: Analyze the biochemical changes occurring in diseased plants and quantify the changes relating to carbohydrate, protein, amino acids and chlorophyll contents.

List of Practicals

1. Solubilization of rock phosphate by microorganisms
2. Estimation of organic matter in agricultural soils to assess the soil fertility.
3. Isolation of PGPR from root nodule
4. Identification of disease specimens: leaf rots, rootrots
5. Observation and staining of Mycorrhiza
6. Determination of Disease Tolerance Index (DTI) in crop plants



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7. Biochemical changes in healthy and diseased crop plants: carbohydrates, proteins, amino acids, chlorophyll.
8. Visit to plant pathology institute.

MODEL QUESTION PAPER - PRACTICAL

Course Code: P24/MIC/DSE/401/P
Credits: 2

Max Marks: 50
Time: 3Hrs

I. MAJOR 20 M

- Determine the concentration of protein in the given plant extract by Lowry method.
Std. Concentration of protein = 100 µg/ml
- Estimate the amount of organic matter in the given soil sample.

II. MINOR 10M

- Calculate the amount of Chlorophyll b content in the given plant extract.

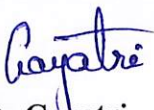


OR


- Observe and identify the Mycorrhizal reports.


IV. Identify the given spots (A-E) and write few significant points 5x2=10 M

V. Record 5M

VI. Viva 5M

Prepared by Faculty	Checked & Verified by HoD	Approved by the Principal
 Dr. Gayatri	 Dr. P. Roselin	 Dr. Uma Joseph


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SEMESTER - IV

MEDICAL BACTERIOLOGY- THEORY

1. Course Description

Programme: M.Sc
Course Code: P24/MIC/DSC/401
Course Type: DSC
No. of credits: 3

Max. Hours: 45
Hours per week: 3
Max. Marks: 100

2. Course Objectives

- To understand about various pathogenic bacteria
- To study the various ways of local or global spread of infections and emergence of newer pathogens.

3. Course Outcomes

CO1: Understand the significance of normal flora, Koch's postulates and virulence traits of an infectious agent leading to disease. (L II)

CO2: Evaluate, recognize and diagnose common air borne, water borne, wound infections, Nosocomial, Iatrogenic, Vector borne, Zoonotic, STDs and Emerging bacterial infections from the clinical presentation and study the interventions employed to prevent diseases. (L II, V)

CO3: Apply the knowledge of clinical infections in diagnostic microbiology and epidemiological studies. (L III, V)



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4. Course Content

MODULE I - INTRODUCTION TO MEDICAL MICROBIOLOGY: (15 Hrs)

Significance; Normal flora of mouth, gastrointestinal tract, urogenital tract, Skin. Germ free animal models, Molecular Koch's postulates. **Mechanisms of bacterial pathogenesis:** portals of entry into the human body; Virulence-adhesion, colonization & invasion; pathogenic actions of bacteria - tissue destruction, toxins - Exo, endo, entero toxins with examples. **Biofilms-** Extra cellular enzymes, mechanisms for escaping host defenses portals of exit.

MODULE II - CLINICAL MICROBIOLOGY: (15 Hrs)

General characters, Pathogenesis, Laboratory diagnosis of **Air borne-** *Streptococcus pyogenes*, *Mycobacterium tuberculosis*, *Corynebacterium diphtheriae*. **Wound** – *Clostridium perfringens* and *Clostridium tetani*. **Water borne-** *Salmonella typhi*, *Vibrio cholerae*. **STD-***Treponema pallidum*, *Neisseria gonorrhoeae*. **Urinary tract infections-** *E.coli*. **Nosocomial infections** - *Staphylococcus aureus*. **Iatrogenic infections** – *Pseudomonas aeruginosa*. **Vector borne** – *Borrelia recurrentis*, **Zoonotic infection-** *Leptospirosis*. Emerging bacterial infections.

MODULE III - EPIDEMIOLOGY & PRINCIPLES OF DIAGNOSTIC MICROBIOLOGY: (15 Hrs)

Epidemiology of infections. Transmission of Infectious Microbial Diseases: spread of disease in populations, reservoirs of infection (human, animal, and non-living reservoirs), modes of transmission (contact, vehicles, vectors). **Diagnosis of infections-** Specimen collection, Transport, Processing of samples, Advances in diagnostic Microbiology, Prophylaxis and control. **Antibiotic Resistance** methods of detection & its significance in Pathogenesis.



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5.Resources**Text books:**

1. Panikar, (2013). Medical Microbiology, 9th edition, University press.
2. Jawetz, Melnick and Adelberg's, (2007). Medical Microbiology. 24th ed. McGraw Hill Medical.
3. Collee, J.G. Fraser, A.G. Marmion, B.P. Simmons, A. (1996) Mackie and Maccartney's Practical medical microbiology 14th ed. Churchill Livingstone
4. Bailey, W.R. & Scott, E.C (2008). Diagnostic Microbiology. ASM Press.
5. Stephen Gillespie, Katheline Bamford. (2012). Medical Microbiology and infection at a glance 4th Ed, Wiley Blackwell

References Books:

1. Leslie Collier, Alberts Balow, Max Sussman. (1998). Topley and Wilson's Microbiology and microbial infections. Oxford University press.
2. Kenneth J. Ryan and C. George Ray (2014). Sherris's Medical Microbiology, Sixth Edition. McGraw-Hill Medical.
3. Dey, N. C. and Dey, T. K. (1981) A Text Book of Medical Bacteriology and Microbiology, 16th edition, Allied Agency Calcutta.
4. B. Murray et al., Ellen Jo Baron (2007). Manual of Clinical Microbiology, 9th edition.
5. Cappuccino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Limite.
6. Gopal Reddy et al. (2008). Laboratory experiments in Microbiology.
7. Prescott, Harley and Klein Wim. (2002), Laboratory Exercises in Microbiology, Mc Graw Hill Publishers.
8. R.C Dubey, D.K Maheshwari, Practical Microbiology, (2012). S Chand and Company, New Delhi.
9. Mukherjee Kanai L (2003) Medical lab technology. Vol I, II, III Tata McGraw Hill.



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6. Syllabus Focus


a. Relevance to Local, Regional, National and Global Development Needs

Local /Regional/National/ Global Development Needs	Relevance
Global	Medical bacteriology course helps the students to learn about bacteria that cause life-threatening diseases and their etiology. Medical Bacteriology transforms our lives and helps to improve health outcomes, provide a better quality of life with reduced risk of infections.

b. Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Employability	Module II	Presentations on clinical aspects of Pathogenic bacteria.
Employability	Module III	Case studies on Epidemiology, Diagnosis and Antimicrobial Chemotherapy related to pathogenic bacteria.


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7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Interactive Presentations	Participative learning
2.	Case studies	Problem solving
3.	Video presentations	Participative learning

8. Course Assessment Plan**a. Weightage of Marks in Continuous Internal Assessments and End Semester Examination**

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination-60%
CO1	CIA1-Written Exam	End semester exam
CO2	CIA – 2: Assignments	
CO3	CIA – 2: Presentations / Case studies	


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b. Question Paper Pattern:**MEDICAL BACTERIOLOGY
MODEL QUESTION PAPER – THEORY**

Course Code: P24/MIC/DSC/401
Credits: 3

Max Marks: 60
Time: 2 ½ Hrs

SECTION – A**I. Answer the following:****3 x 12 = 36M**

1. Explain the mechanisms involved in pathogenesis of infections.
OR
2. Discuss the significance of normal flora of human body.
3. Give an account on pathogenesis and laboratory diagnosis of *Mycobacterium Tuberculosis*.
OR
4. What are waterborne infections? Discuss with emphasis on cholera.
5. Describe the different factors determining the epidemiological of infections.
OR
6. Outline the different steps in diagnosis of infections.

SECTION – B**II. Answer any Four :****4 x 6 = 24M**

7. Describe about Biofilms
8. Write notes on Molecular Koch postulates
9. Explain Pathogenesis of *Streptococcus pyogens*
10. Write notes on Antigenicity of *Salmonella typhi*
11. Explain Modes of transmission
12. Write notes on Antibiotic resistance



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SECTION A - INTERNAL CHOICE				3Q X 12 M = 36 M
Question Number	Module	Question	CO	BTL (Blooms Taxonomy Level)
1	Module 1	Explain the mechanisms involved in pathogenesis of infections.	CO 1	Level II
2	Module 1	Discuss the significance of normal flora of human body	CO 1	Level II
3	Module 2	Give an account on pathogenesis and laboratory diagnosis of <i>Mycobacterium Tuberculosis</i>	CO 2	Level II
4	Module 2	What are waterborne infections? Discuss with emphasis on cholera.	CO 2	Level II
5	Module 3	Describe the different factors determining the epidemiology of infections	CO 3	Level II
6	Module 3	Outline the different steps in diagnosis of infections.	CO 3	Level II
SECTION B - ANSWER ANY 4 OUT OF 6 (To compulsorily have ONE question from each module)				4 Q X 6M = 24M
7	Module 1	Describe about Biofilms	CO 1	Level II
8	Module 1	Write notes on Molecular Koch postulates	CO 1	Level II
9	Module 2	Explain Pathogenesis of <i>Streptococcus pyogenes</i>	CO 2	Level II
10	Module 2	Write notes on Antigenicity of <i>Salmonella typhi</i>	CO 2	Level II
11	Module 3	Explain Modes of transmission	CO 3	Level II
12	Module 3	Write notes on Antibiotic resistance	CO 3	Level II



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a) Question Paper Blueprint

Modules	Hours Allotted in the Syllabus	COs Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	CO-1	2	12	2	6
2	15	CO-2	2	12	2	6
3	15	CO-3	2	12	2	6

9. CO-PO Mapping

CO	PO	Cognitive Level	Class room sessions (hrs)
1	1, 2	Understand	15
2	1, 2, 5	Understand, Evaluate	15
3	1, 2, 7	Evaluate, Apply	15

SEMESTER - IV
MEDICAL BACTERIOLOGY- PRACTICALS

Course Objectives:

- To comprehend various culture media and their applications in diagnosis of infections.
- To understand bacteriological techniques for isolation of pure cultures and be able to perform routine culture handling tasks safely and effectively.

Course Outcomes:

CO 1: To understand the various methods for identification of unknown microorganisms

CO 2: To identify an antibiotic resistant bacterium

CO 3: To identify the virulence phenotypes in bacteria

List of Practicals

1. Preparation of different types of culture media and observation of growth pattern. Mannitol salt agar, MacConkey Agar, Lowenstein jenson media, Wilson and Blair bismuth sulphite media, Cetrimide agar, Blood agar, Anaerobic media-RCM. Transport media.
2. Preparation and study of growth on Triple sugar iron agar
3. Biochemical media- Sugar fermentation tests, IMViC, SIM, Nitrate reduction, Phenyl alanine deamination, Decarboxylase, Oxidation reduction,



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- Hydrogen sulphide, Gelatinase, Oxidase, coagulase and catalase tests, Biofilm production
4. Staining Technique – Gram staining, AFB staining, Capsular staining, metachromatic staining, Lipid granule staining
 5. Bacteriological examination of sample (any two) from patients -Aerobic and anaerobic cultivation. Isolation and identification of pathogenic bacteria by biochemical performing tests.
 6. Use of Rapid tests for biochemical testing API 20 E /Enterotube test.
 7. Preparation of Mac Farlands standards
 8. Antibiotic sensitivity tests.

Practical Model Paper

Course Description:

Course Code: P24/MIC/DSC/401/P

Time: 3h

No. of credits: 2

Max.Marks:50

I. MAJOR

[20M]

Identify the given culture based on morphological, cultural and biochemical characters.

II. MINOR

[10 M]

Perform capsule staining / Capsular staining/metachromatic staining/Lipid granule staining of given culture

IV. Identify the given spots (A-E) and write few significant points




[5x2=10 M]

V. Record

[5M]

VI. Viva

[5M]

Prepared by	Checked & Verified by HoD	Approved by the Principal
 D. Sunita	 Dr. P. Roselin	 Dr. Uma Joseph

SEMESTER – IV
MICROBIAL BIOTECHNOLOGY-THEORY

1. Course Description:**Program: M.Sc****Course Code: P24/MIC/DSC/402****Course Type: DSC****No. of Credits: 3****Max. Hours: 45****Hours per week: 3****Max. Marks: 100****2. Course Objectives:**

- To provide the students a platform to understand the process of production of industrially important products.
- Course provides an overview of application of rDNA technology to produce microbial insecticides and recombinant proteins

3. Course Outcomes:

CO1: Understand and apply knowledge gained for production of different alcoholic beverages and organic acids. (L II, III)

CO2: Understand the importance of growth factors and action and analyze the concept of enzymes and their production (L II, III)

CO3: Understand production of antibiotics. Apply knowledge about microbial insecticides for pest control and r DNA technology for genetically modified proteins. (L II, III)



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4. Course Content:**MODULE I - PRODUCTION OF ALCOHOLIC BEVERAGES AND ORGANIC ACIDS:**
(15 Hrs)

Fermentative production of Alcohol: -uses, raw materials, microorganisms, inoculum preparation, fermentation and recovery of Alcohol

Beer –malt, malt adjuncts, hops, water. Preparation of wort, wort boiling, fermentation, cold storage maturation, carbonation, packing and preservation

Wine – Fruit selection, picking, crushing, sulphite addition, processing, fermentation, aging and bottling. Uses, microorganism, inoculums preparation, medium preparation, fermentation, recovery and mechanism of production - Citric acid

MODULE II - PRODUCTION OF GROWTH FACTORS : (15 Hrs)

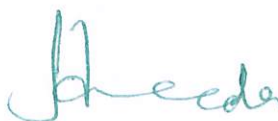
Uses, microorganism, inoculums preparation, medium preparation, fermentation, recovery and mechanism of production Vitamin B12, Glutamic acid L-Lysine. Production and application of microbial enzymes. – uses, microorganisms, inoculum preparation, production medium, fermentation and recovery Amylases, lipases and proteases

MODULE III - PRODUCTION OF ANTIBIOTICS AND PRODUCTS USING r DNA: (15 Hrs)

Antibiotics – uses, microorganism, inoculum preparation, production medium, fermentation, recovery of Benzyl penicillin, and semi- synthetic penicillin, Tetracycline – uses, chlortetracycline, oxy- tetracycline, tetracycline and semi synthetic tetracyclines, Microbial biopesticides: history, useful microbes, biomass production, formulation, economics, safety, advantages and disadvantages: Microbial products from genetically modified (cloned) organisms eg. Insulin

5. Resources**Text Books:**

1. L.E.Casida,(2010), Industrial microbiology, New age international publishers.
2. A.H.Patel, (2012), IndustialMicrobiologyby, 2ndedition, Mac Millan India pvt ltd.
3. Michael J Waites,(2001), Industrial Microbiology-Blackwell ScienceLtd
4. Ed. Cruger&Cruger, (2005), Biotechnology (A text book of industrial microbiology), 2nd edition, Pancinapublishers.



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Reference Books:

1. Hugo & Russell's (2013), Pharmaceutical Microbiology, 8th edition, Wiley Blackwell publishers.
2. Molecular cloning, T A Brown.
3. S. Ram Reddy, M.A Singara Charya. A Text Book of Microbiology (Applied Microbiology), Volume IV. Himalaya publishing house
4. Arnold, (2004), Manual of Industrial Microbiology and Biotechnology, 2nd edition, ASM press.
5. Gopal Reddy et al, (2008), Laboratory experiments in microbiology, 3rd edition, Himalaya publishers.
6. S.M. Reddy, S. Ram Reddy, (2000), Microbiology A Laboratory manual, BSC Publishers and Distributors.
7. James G. Cappuccino, Sherman, (2010) Microbiology Laboratory Manual, 9th edition, Pearson Education.
8. Pharmaceutical Microbiology, (2008) Saluja A.K. Purohit S.S. Kakrani H.N. Agrobios
9. Bernard R. Glick and Jack. J. Pasternak, Molecular Biotechnology. 3rd edition

6. Syllabus focus**a) Relevance to Local, Regional, National and Global Development Needs**

Local /Regional/National /Global Development Needs	Relevance
Global	Microbial solutions to three key global problems including energy security (Ethanol and Biodiesel), environmental challenges (Lipase-Oil Spills), and infectious diseases (Secondary Metabolites).


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b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Entrepreneurship	Module 1: Productions	Wine Production using different substrates on a small scale
Skill Development	Module 2: Productions	Production and recovery of industrially important products

7. Pedagogy:

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Presentation/Seminars	Participative Learning
2.	Productions/Science Experiments	Experiential Learning
3.	Case Studies	Problem solving

8. Course Assessment Plan:

a. Weightage of Marks in Continuous Internal Assessments and End Semester Examination

COs	Continuous Internal Assessments - CIA (40%)	End Semester Examination (60%)
CO1	CIA-2 Production of industrial products-eg: wine	End Semester examination
CO2	CIA-1	
CO3	CIA-1	
CO3	Assignment	



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b) Question paper pattern:

**MICROBIAL BIOTECHNOLOGY
MODEL QUESTION PAPER -THEORY**

Course Code: P24/MIC/DSC/402

Credits: 3

Max Marks: 60

Time: 2 ½ Hrs

SECTION – A

I. Answer the following:

3 x 12 = 36 M

1. Explain Production of Beer.
OR
2. Explain in detail production of Citric Acid
3. Define Growth factors and write about the production of Vitamin B12
OR
4. Describe & analyze fermentation conditions for production of proteases
5. Explain in detail about Antibiotic Production
OR
6. Explain the concept of r DNA technology and its application in production of Insulin.


SECTION – B


II. Answer any FOUR:

4x6 = 24 M

1. List Carbon sources for Alcohol Production
2. Describe the Biochemistry in production of alcoholic beverages
3. Action of Amylase and Lipase
4. Explain production of L-Lysine using dual fermentation
5. Application of Baculoviruses as Insecticides
6. Describe the structure of Insulin

SECTION A - INTERNAL CHOICE			3Q X 12 M = 36 M	
Question Number	Module	Question	CO	BTL (Blooms Taxonomy Level)
1	Module 1	Explain Production of Beer.	CO 1	II
2	Module 1	Explain in detail production of Citric Acid	CO 1	II
3	Module 2	Define Growth factors and write about the production of Vitamin B12	CO 2	I
4	Module 2	Describe & analyse fermentation conditions for production of proteases	CO 2	IV
5	Module 3	Explain in detail about Antibiotic Production	CO 3	II
6	Module 3	Explain the concept of r DNA technology and its application in production of Insulin.	CO 3	II
SECTION B - ANSWER ANY 4 OUT OF 6 (To compulsorily have ONE question from each module)			4 Q X 6M = 24M	
7	Module 1	List Carbon sources for Alcohol Production	CO 1	I
8	Module 1	Describe the Biochemistry in production of alcoholic beverages	CO 1	II
9	Module 2	Action of Amylase and Lipase	CO 2	III
10	Module 2	Explain production of L-Lysine using dual fermentation	CO 2	II
11	Module 3	Application of Baculoviruses as Insecticides	CO 3	IV
12	Module 3	Describe the structure of Insulin	CO 3	I


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C. Question Paper Blue Print:

Modules	Hours Allotted in the Syllabus	COs Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	CO-1	2	12	2	6
2	15	CO-2	2	12	2	6
3	15	CO-3	2	12	2	6

9.CO-PO Mapping:

CO	PO	Cognitive Level	Classroom Session (Hrs)
1	1,7,8	Understand & Analyze	15
2	1,7,8	Understand & Analyze	15
3	1,6, 7,8	Understand & Analyze	15

SEMESTER – IV
MICROBIAL BIOTECHNOLOGY -PRACTICAL

1. Course Description:

Course Code: P24/MIC/DSC/402/P

Course Type: DSC

No. of Credits: 2

Max. Hours: 60

Hours per week: 4


Max. Marks: 50

2. Course Objectives:

- To acquaint students with technical and biological aspects of fermentation technology.
- To motivate students to set up a small scale Industry.



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3. Course Outcomes:

- CO1:** Analyze various parameters required for fermentation, produce the products, extract and measure using qualitative and quantitative methods and increase the scale.
- CO2:** Equip with different techniques- Immobilization, colorimetry and titrimetry
- CO3:** Apply theoretical and practical aspects of this course to meet the demands of the industry.

List of Practicals

1. Production of ethanol by flask fermentation, recovery of ethanol by distillation and calculation of fermentation efficiency
2. Preparation of Beer by Microbial fermentation
3. Preparation of wine from grapes/fruits by fermentation
4. Production of citric acid by fungal fermentation, recovery and estimation
5. Production of amino acid (Glutamic acid) by fermentation
6. Production and estimation of penicillin by flask fermentation
7. Production of Industrial Enzyme
8. Production of Laccases
9. Immobilized bacteria enzyme in fermentation
10. Immobilised yeast in fermentation
11. Immobilized enzyme in fermentation
12. Production of Biopesticides.

MODEL QUESTION PAPER-PRACTICAL

Course Code: P24/MIC/DSC/ 402/P
Credits: 2

Max Marks: 50
Time: 3 Hrs

I. MAJOR

20M

Fermentation was carried out using 100ml fermentation broth. Initial sugar 12gm. The amount of final sugar in the broth is estimated to be 0.5gm. Calculate the practical yield in the given 100ml distillate. Calculate the sugar utilized, theoretical yield and fermentation efficiency. Concentration of standard alcohol is 7.9mg/ml.



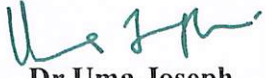
II. MINOR

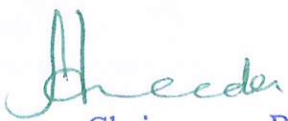
10M


Estimate the amount of Total acidity in wine.

S.No	Vol of wine	Burette Reading		Vol.ofNaOH-1N
		Initial	Final	
1.	10ml	0	0.2	0.2
2.	10ml	0	0.2	0.2

- III. Observe / Identify the given Spots and Write few significant points 5 x 2 = 10M
 IV. Record 5 M
 VI. Viva 5 M

Prepared by Faculty	Checked & Verified by HoD	Approved by the Principal
 Dr.P.Roselin	 Dr.P.Roselin	 Dr.Uma Joseph


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SEMESTER -IV**PROJECT****Programme: M.Sc.****Course Code: P24/MIC/PRJ/401****Type of course: Project****No. of credits: 5****Hours per week: 5****Max. Marks: 150****1. Course Objectives:**

Post Graduates will be able to design an experimental procedure, tabulate and interpret the obtained results.

3. Course Outcome:

CO1: Plan appropriate research topics through review of literature.

CO 2: Prepare to work autonomously in an effective manner, setting and meeting deadlines.

CO 3: Design experiments, prepare appropriate methodologies, perform critical analysis and interpretation of results.

CO 4: Compose project to thesis that includes aim, objectives, methodologies, and potential outcomes.



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PROJECT PLAN & ASSESMENT


- Every student has to complete one project.
- Each faculty of the Dept. will supervise 4 – 5 students.
- The topic of the project would be selected by each student in consultation with the faculty to whom she is assigned.
- The students will be trained to retrieve the literature and collate the information sufficient to make a presentation, the collated literature would also prepare the base for initiating the research.
- The student would carry out experiments in the lab to achieve the planned objectives.
- The collation and analysis of experimental data would lead to the presentation of the result in the form of a Dissertation.
- Dissertation to go through Plagiarism check and the report to be attached.
- The evaluation includes submission of project report and viva. Continuous evaluation includes punctuality, hard work, record keeping, intellectual inputs, data presentation, interpretation etc.
- Any student who publishes a research paper or present a paper in conference will earn 2 Non CGPA credits


Scheme of evaluation

Internal Evaluation of Project-50 M

- | | |
|---|--------|
| 1. Synopsis - Submission & Presentation | (10 M) |
| 2. Mid Term Evaluation | (20 M) |
| 3. Project Presentations | (20 M) |

External Evaluation -100 M (External Examiner)


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SEMESTER – IV
RESEARCH DESIGN TOOLS AND DATA ANALYSIS-THEORY

1.Course Description:

Program: M.Sc

Course Code: P24/MIC/DSE/402

Course Type: DSE

No. of Credits: 3

Max. Hours: 45

Hours per week: 3

Max. Marks: 100

2. Course Objectives:

- To provide the students a platform to understand the research tools and apply the same for designing the experiments
- Course provides an overview of application of various tools for analyzing the data

3. Course Outcomes:

CO1: Understand and apply knowledge gained for Research Designs (L II, L III)

CO2: Understand and Apply knowledge of Statistical tools for Data Analysis (L II, L III)

CO3: Apply computer based tools for process optimization (L IV).

4. Course Content:**MODULE 1: INTRODUCTION TO RESEARCH METHODOLOGY (15Hrs)**

Introduction, Scope, Identification of problem, Formulation of Research Objectives, Hypothesis Testing, Components of research design (Sample design and analysis) Data Collection: Types, Methods and Tools Normal, Binomial, distributions: Properties and Significances. Measures of Central Tendency and Dispersion.

MODULE 2: RESEARCH DESIGNS & STATISTICAL TOOLS: (15Hrs)

Hypothesis testing – Errors in Hypothesis testing - large sample test (Z – test) single and two tailed test, Small sample test (t – test)-Single mean -Two mean - Paired t -test, F – test, Chi – square test –Single Variance-Goodness of fit, SPSS Software, Anova – one way and two way. – CRD, RBD Designs.

RSM (Response Surface Methodology). Designs for First-Degree Models, 2k Factorial Design, Plackett–Burman Design/Nonregular Factorial Design (Plackett and Burman 1946).Designs for Second-Degree Models, 3k Factorial Design, Central Composite Design (CCD), Box–Behnken Design (BBD)



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MODULE 3: COMPUTER ORIENTED STATISTICAL TECHNIQUES: (15Hrs)

Computer oriented statistical techniques. RSM: methods for process optimization, set up CCD, Box Behnken, optimal RSM design and regression models. FDS curves, surface contours, multilinear constraints and categorical factors to optimal design.

Scaling measurements – Techniques – Types of scale. Correlation – Meaning and definition - Scatter diagram – Karl Pearson's correlation coefficient. Rank correlation. Regression: Regression in two variables – Regression coefficient problems – uses of regression.

5. Resources:**Text Books**


1. Handbook of Design and Analysis of Experiments Edited by: Angela Dean , Max Morris , John Stufken , Derek Bingham, Print publication date: June 2015
2. Handbook of Statistics 13: Design and Analysis of Experiments, Author(s): S. Ghosh, C. R. Rao, Publisher: Elsevier Science Pub Co, Year: 1996
3. Handbook of design and analysis of experiments, Bingham, Derek; Dean, Angela; Morris, Max; Stufken, John, Series: Chapman & Hall/CRC handbooks of modern statistical methods, Publisher: CRC Press, Year: 2015
4. C.R.Kothari. (2004). Research Methodology - Methods and Techniques. (2 nd ed). New Age International Private Limited. ISBN: 9788122424881
5. Chap T. Le, Lynn E. Eberly. (2016). Introductory Biostatistics. (2 nd ed). Wiley Interscience. ISBN: 9780470905401


Reference books:

1. Marcello Pagano, Kimberlee Gauvreau. (2018). Principles of Biostatistics. (2 nd ed). CRC Press Taylor& Francis Group. ISBN: 9781138593145
2. Uwe Flick. (2015). Introducing Research Methodology. (2 nd ed). SAGE Publications India Pvt Ltd. ISBN: 9781446294246

6.Syllabus focus:**a) Relevance to Local , Regional , National and Global Development Needs**

Local /Regional/National /Global Development Needs	Relevance
Global	Research Designs and Data Analysis tools can be applied to solve any problem across the Globe.


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b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill Development	Module 2,3 : Research Design and Tools for Data Analysis	Mini project


7. Pedagogy:


S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Presentation/Seminars	Participative Learning
2.	Design Science Experiments	Experiential Learning
3.	Case Studies	Problem solving

8. Course Assessment Plan:

a. Weightage of Marks in Continuous Internal Assessments and End Semester Examination

COs	Continuous Internal Assessments - CIA (40%)	End Semester Examination - (60%)
CO1	CIA-2 Design of Experiments /Analysis of data	End Semester examination
CO2	CIA-1	
CO3	CIA-1	
CO2	Assignment	


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b. Question Paper Pattern -THEORY**RESEARCH DESIGN TOOLS AND DATA ANALYSIS
MODEL QUESTION PAPER -THEORY**

Course Code: P24/MIC/DSE/402

Credits: 3

Max Marks: 60

Time: 2 ½ Hrs

SECTION – A

3 x 12 = 36 M


I. Answer the following:


1. Explain components of Research Design
OR
2. Explain Measures of Central Tendency
3. Explain CRD, RBD
OR
4. Describe Plackett–Burman Design/Nonregular Factorial Design
5. Explain in detail about Types of Scale
OR
6. Analyze the data and establish relationship between variables using Correlation

SECTION – B**II. Answer any FOUR:**


4x6 = 24 M

7. Explain Measures of Dispersion
8. Describe Binomial Distribution
9. Define and explain application of Central Composite Design
10. Describe Chi Square
11. Describe Regression and its application
12. List out types of scales


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SECTION A - INTERNAL CHOICE				3Q X 12 M = 36 M
Question Number	Question	Question	CO	BTL (Blooms Taxonomy Level)
1	Module 1	Explain components of Research Design	CO 1	II
2	Module 1	Explain Measures of Central Tendency	CO 1	II
3	Module 2	Explain CRD, RBD	CO 2	II
4	Module 2	Describe Plackett–Burman Design/Nonregular Factorial Design	CO 2	IV
5	Module 3	Explain in detail about Types of Scale	CO 3	II
6	Module 3	Analyse the data and establish relationship between variables using Correlation	CO 3	II
SECTION B - ANSWER ANY 4 OUT OF 6 (To compulsorily have ONE question from each module)				4 Q X 6M = 24M
7	Module 1	Explain Measures of Dispersion	CO 1	II
8	Module 1	Describe Binomial Distribution	CO 1	II
9	Module 2	Define and explain application of Central Composite Design	CO 2	III
10	Module 2	Describe Chi Square	CO 2	II
11	Module 3	Describe Regression and its application	CO 3	III
12	Module 3	List out types of scales	CO 3	I


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SEMESTER – IV
RESEARCH DESIGN TOOLS AND DATA ANALYSIS -PRACTICAL

1. Course Description:

Course Code: P24/MIC/DSC/402/P

Course Type: DSE

No. of Credits: 2

Max. Hours: 60

Hours per week: 4

Max. Marks: 50

2. . Course Objectives:

- To acquaint students with technical aspects of Research Design
- To acquaint students with tools for Analysis of data.

3.Course Outcomes:

CO1: Analyze various parameters in Research Design

CO2: Equip students with different tools for analyzing data

CO3: Apply theoretical and practical aspects of this course to meet the demands of Research and industry.

List of Practicals

1. Single-factor execution
2. 2-factor execution
3. 3-factor execution
4. Graphical Analysis, terms to analyze and interpret the results
5. Mean,Median Mode
6. Standard Deviation and error graphs
7. Correlation
8. Chi Square
9. Anova

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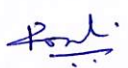

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MODEL QUESTION PAPER-PRACTICAL

Course Code: P24/MIC/DSC/ 402/P
Credits: 2

Max Marks: 50
Time: 3 Hrs

V. MAJOR	20M
VI. MINOR	4 x 5 = 20 M
VII. Record	5 M
IV. Viva	5 M

Prepared by Faculty	Checked & Verified by HoD	Approved by the Principal
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