



SRR & CVR GOVT. DEGREE COLLEGE (Autonomous)



PHONE NO : 0866-2430060
FAX NO : 0866-2441082

NAAC : B+ (3rd Cycle with CGPA : 2.40) - Estd: 1937
ISO 9001 : 2015 Certified
Institution is ranked by NIRF in 2021 - 2022 band at NIRF - 2021

WEBSITE : www.srrcvr.org
EMAIL : srrandcvr@gmail.com

BOARD OF STUDIES MEETING

(2022-2023)

B.Sc Microbiology

(With Effect from Admitted Batch 2020-2021)

13th July 2022



DEPARTMENT OF MICROBIOLOGY

Programme Code: 313 & 309

SRR & CVR Govt. Degree College (A), Vijayawada

DEPARTMENT OF MICROBIOLOGY

AGENDA FOR THE BOARD OF STUDIES MEETING 2022-23

Dated: 13th July 2022

The members, Board of Studies, Department of Microbiology will discuss the syllabus in CBCS pattern, CSP, Apprenticeship / Internship / On the Job Training, additional inputs, model question papers, Co-curricular activities, list of examiners and blue prints. The agenda includes.

1. Approve the Course structure of III BSc Microbiology prescribed by APSHE through affiliating University
2. Up gradation syllabus for the Semesters I & IV with additional inputs
3. New Syllabus Implementation for Semester V, BSc Microbiology as per APSHE through affiliating University from this Academic Year 2022-23
4. Model question papers, Blue Print & Panel of Paper Setter
5. Other Academic Activities of the Department (Action Plan 2022-23)
6. Value added Courses, Certificate Courses & Study Projects
7. Proposal for Community Service Projects/Extension Activities for the benefit of the Society at the end of Semester II for the academic year 2022-23
8. Proposal for Apprenticeship / Internship / On the Job Training at the end of the Semesters IV and VI for the academic year 2022-23
9. Feed back on Curriculum design and development from Students, Alumni, Teachers, Parents and industry.
10. Any other proposal with the permission of the chair.

SRR & CVR Govt. Degree College (A), Vijayawada

DEPARTMENT OF MICROBIOLOGY

7th BOARD OF STUDIES MEETING 2022-23

Dated: 13th July 2022

MINUTES

The Minutes of 7th Board of Studies meeting in Microbiology which was convened on 13th July 2022 at 10.00 AM at Department of Microbiology to discuss and approved the up gradation of the syllabus, System of examination pattern, Model question papers, Academic Activates of Department, Additional inputs in the Curriculum, Study Projects and Value added/ Certificate Courses under Chairmanship of Mrs. D. Jyothi, In- Charge of the department is as follows:

Agenda 1: To consider and approve the Course structure of III BSc Microbiology prescribed by APSHE through affiliating University

Proposal: The Chairperson BOS UG BSc Microbiology Mrs. D. Jyothi, proposed Course structure is placed before the BOS committee to approve.

Discussion: University Nominee Dr. P. Veera Bramhachari and the Members of 7th BOS go through the Course titles, Credits of Courses and framework of the Courses in Semesters V & VI and VI of III B.Sc Microbiology.

Resolution: It is resolved to approve the Courses and Credits

Agenda 2: Up gradation of syllabus with additional inputs for the Semesters I & IV for the academic year 2022-23.

Discussion: The University Nominee Dr. P. Veera Bramhachari and subject experts proposed some changes in course as additional inputs after long and fruitful discussion.

Resolution: It is resolved implement the revised syllabus for Semesters I to IV in the previous BOS 2021-22 making it skill oriented with quantifiable programme specific outcomes with following additional inputs.

Additional Inputs:

MB N- 1324: Introduction to Microbiology and Microbial Diversity: Paul Ehrlich, Chemical methods of Sterilization – Heavy Metals

MB N- 2324: Microbial Physiology and Biochemistry: Eukaryotic DNA

MB N- 3324 – Molecular biology and Microbial Genetics: Transcription and translation in Prokaryotes

MB N- 4324 –Medical Microbiology and Immunology: MHC molecules and Compliment activation pathways

Agenda 3: To consider and approve the implementation of new syllabus for Semester V with three pairs of core courses, III BSc Microbiology as per the revised CBCS based curriculum (2020–21 onwards) APSHE through affiliating University from this Academic Year 2022-23 and students has to choose one pair.

Proposal: The proposed PAIR OF CORE COURSE is A-PAIR with the following titles of the courses in Semester V selected by the students and placed before the BOS committee to approve.

MBT-A1 MB N -6324	Food, Agriculture and Environmental Microbiology
MBP-A1 MB N -6324 P	Food, Agriculture and Environmental Microbiology
MBT-A2	Management of Human Microbial Diseases and Diagnosis
MBP-A2	Management of Human Microbial Diseases and Diagnosis

Discussion: University Nominee and subject experts agreed to implement A-PAIR Courses.

Resolution: It is resolved to implement A-PAIR Courses in Semester V for III BSc Microbiology for the Academic Year 2022-2023.

Agenda 4: To consider and approve Model question papers, Blue prints & Panel of paper setters

Proposal: The proposed Model question papers, Blue print & Panel of Paper Setters is placed before the BOS committee to approve.

Discussion: University Nominee and Model question papers, Blue print & Panel of Paper Setters

Resolution: Resolved to adopt the model question paper in Section-A having answer 5 short questions carries 4 marks out of 10 and 5 essay questions with internal choice from each unit and each question carries 08 marks and prepared blue print. Listed out the names of paper setters and examiners.

Agenda 5: To consider and approve Action Plan 2022-23

Resolution: It is resolved conduct academic activities like Student Seminars, quizzes, field trips, and workshops.

Agenda 6: To consider and approve Value added Course

Resolution: It is resolved to conduct Value added Course : *Pre and Probiotics*

Agenda 7: Proposal for Community Service project at the end of Semester II for the benefit of the Society.

Resolution: It is resolved to participate the students in Community Service Project for the benefit of the Society as per the revised CBCS based curriculum (2020–21 onwards) APSHE through affiliating University.

Agenda 8: Proposal for Apprenticeship / Internship / On the Job Training for II and III BSc year students at the end of semesters IV and V respectively as per the revised CBCS based curriculum (2020–21 onwards) APSHE through affiliating University.

Resolution: It is resolved to undergo Apprenticeship / Internship / On the Job Training. This is to ensure that the students develop hands on technical skills which will be of great help in facing the world of work

Agenda9: Feedback on Curriculum design and development from Students, Alumni, Teachers, Parents and industry

Resolution: It is resolved to take Feedback on Curriculum design and development from Students, Alumni, Teacher, Parent and industry at the end of the semester.

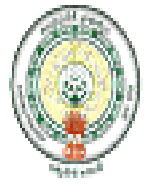
S.No	Name of BOS Members	Composition	Signature
1	Mrs. D. Jyothi	Chairperson	D. Jyothi 13/07/2022
2	Dr. P. Veera Bramhachari	University Nominee	13/7/22
3	Dr. K. Sucharitha	Subject Expert	Sucha 13/7/2022
4	Dr. A. Padmavathi	Subject Expert	on d/s 13.7.22
5	Sri. K. Premanand	Research Organization/Industry	P. Mys 13/07/2022
6	Dr. Kopuri . Aruna	Member	Aruna 13/07/2022
7	Mr. B. Viswas	Alumni	B. viswas
8	Mr. Rameshwar Reddy Ms Ameera kousar III BSc MBC	Student Representatives	Ameera kousar
	Kum. Rajaya Lakshmi II BSc MBC G. Anil kumar I MBF		P. Rajyalakshmi G. Anil kumar

Mr. Pranoy Roy II BSc MBF

Pranoy Roy



SRR & CVR GOVT. DEGREE COLLEGE (Autonomous)



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BOARD OF STUDIES MEETING **(2022-2023)**

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(With Effect from Admitted Batch 2020-2021)
13th July 2022



DEPARTMENT OF MICROBIOLOGY
Programme Code: 313 & 309

PREFACE

SRR & CVR Govt. Degree College (A), Vijayawada, is one of the prestigious educational institutions, located in Vijayawada in Krishna District, Andhra Pradesh. Vijayawada is a place of historical and cultural significance and importance. In the same way SRR & CVR Govt. Degree College, has also acquired its significance and prominence in and around Vijayawada by molding the lives of many students to become great personalities. This college is named after late Sri Raja Rangayyappa Rao and late Sri Chunduru Venkata Reddy, who have been great and noble donors of the city Vijayawada, by whose generosity the college has reached and attained such and this elevated status by way of shaping the lives of many generations of students making them worthy citizens of the country. This college has acquired great standards academically by the contributions of great teachers as well because in the history of any educational institution its teachers play a vital role. The college was established in 1937. It offers 27 undergraduate and 10 post graduate academic programmes with 86 regular faculty members. The college has total strength of around 2,800 students. which includes 1550 boys and 650 girl students at present. The institution was accredited with grade B+ with C.G.P.A 2.6 during 2017 by NAAC and the college was ranked by NIRF in 101-150 band at NIRF-2020

The Department of Microbiology was established in the Academic Year 1998-99 when restructured courses were first established in selected Government Colleges. Now Department has offering UG programme Microbiology with allied subjects Biochemistry and Chemistry has sanctioned strength of 30 students. At present the Microbiology laboratory is fully equipped with instruments such as microscopes, laminar air flow, oven, incubator, refrigerator, and sufficient glassware. The department is fully furnished. The department has its own library with books in microbiology both of Indian and foreign authors. A new job oriented restructured UG programme B.Sc MBF (Microbiology, Biochemistry & Food Technology) has introduced in the year 2017-2018 with intake of the students is 30 every year. The Department is giving importance to the student centric & skill oriented programmes.

Duration of the B.Sc Microbiology (MBC & MBF) Programme (313 & 309): 3/4 years

SRR & CVR Govt. Degree College (A), Machavaram, Vijayawada

DEPARTMENT OF MICROBIOLOGY

Constitution of the 7th Board of Studies for the Academic Year 2022-23

The Board of Studies Meeting for Microbiology Subject for the Academic Year 2022-23 is conducted on 13th July 2022 with Mrs. D. Jyothi, Lecturer in Charge Microbiology along with following members.

S.No	Name of BOS Members		Signature
1	Mrs. D. Jyothi Lecturer in Charge Microbiology SRR & CVR Government Degree College(A), Vijayawada	Chairperson	
2	Dr. P. Veera Bramhachari Professor in Biotechnology Krishna University Machilipatnam Andhra Pradesh	University Nominee	
3	Dr. K. Sucharitha Lecturer in Microbiology GDC Women (A), Guntur.	Subject Expert	
4	Dr. A. Padmavathi, Head of the Department Department of Microbiology Ch.S.D.St.Theresa's College For Women (A) Eluru, West Godavari (Dist.)	Subject Expert	
5	Sri. K. Premanand Hindustan Coco Cola Beverages Pvt. Ltd Atmakuru, Mangalagiri Guntur (Dist.)	Research Organization/Industry	
6	Dr. K. Aruna Lecturer in Microbiology SRR & CVR Govt. College (A), Vijayawada	Member	
7	Mr. B. Viswas MSc Genomic Sciences Central University of Kerala Kasargod, Kerala	Alumni	
10	Mr. Rameshwar Reddy III BSc MBC Kum. Rajaya Lakshmi II BSc MBC Mr. Anil Kumar I BSc MBF	Student Representatives	

SRR & CVR Govt. Degree College (A), Vijayawada

DEPARTMENT OF MICROBIOLOGY

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Resolution: It is resolved to take Feedback on Curriculum design and development from Students, Alumni, Teacher, Parent and industry at the end of the semester.

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4	Dr. A. Padmavathi	Subject Expert	
5	Sri. K. Premanand	Research Organization/Industry	
6	Dr. Kopuri . Aruna	Member	
7	Mr. B. Viswas	Alumni	
8	Mr. Rameshwar Reddy	Student Representatives	
	III BSc MBC		
	Kum.Rajaya Lakshmi II BSc MBC		

DETAILS OF COURSE TITLES & CREDITS

SEM	Course Code	Title of the Course	Course type (T/L)	Hrs./ Week (Science: 4+2)	Credits (Science: 4+2)	Max. Marks Internal	Max. Marks Sem-end Exam	Total Marks
I	MB N-1324	INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY	T	4	4	40	60	100
	MB N - 1324 P	INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY	L	2	2	25	25	50
II	MB N - 2324	MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY	T	4	4	40	60	100
	MB N - 2324 P	MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY	L	2	2	25	25	50
III	MB N - 3324	MOLECULAR BIOLOGY AND MICROBIAL GENETICS	T	4	4	40	60	100
	MB N - 3324 P	MOLECULAR BIOLOGY AND MICROBIAL GENETICS	L	2	2	25	25	50
IV	MB N - 4324	MEDICAL MICROBIOLOGY AND IMMUNOLOGY	T	4	4	40	60	100
	MB N - 4324 P	MEDICAL MICROBIOLOGY AND IMMUNOLOGY	L	2	2	25	25	50
	MB N - 5324	INDUSTRIAL MICROBIOLOGY	T	4	4	40	60	100
	MB N - 3324 P	INDUSTRIAL MICROBIOLOGY	L	2	2	25	25	50
V	A- PAIR							
	MBT-A1 MB N - 6324	Food, Agriculture and Environmental Microbiology	T	4	4	40	60	100
	MBP-A1 MB N - 6324 P	Food, Agriculture and Environmental Microbiology	L	2	2	25	25	50
	MBT-A2	Management of Human Microbial Diseases and Diagnosis	T	4	4	40	60	100

	MBP-A2	Management of Human Microbial Diseases and Diagnosis	L	2	2	25	25	50
		B- PAIR						
	MBT-B1	Microbial Biotechnology and r-DNA Technology	T	4	4	40	60	100
	MBP-B1	Microbial Biotechnology and r-DNA Technology	L	2	2	25	25	50
	BMT B2	Biostatistics and Bioinformatics	T	4	4	40	60	100
	MBP B2	Biostatistics and Bioinformatics	L	2	2	25	25	50
		C- PAIR						
	MBT-C1	Microbial Quality Control and Instrumentations and Techniques	T	4	4	40	60	100
	MBP-C1	Microbial Quality Control and Instrumentations and Techniques	L	2	2	25	25	50
	BMT C2	Drug Designing, Discovery and Intellectual Property Rights	T	4	4	40	60	100
	MBP C2		L	2	2	25	25	50

Note: *Course type code: T: Theory, L: Lab

**SRR & CVR GOVT DEGREE COLLEGE (A) VIJAYAWADA: 520004
KRISHNA DISTRICT: ANDHRA PRADESH**

DEPARTMENT OF MICROBIOLOGY

B.Sc Microbiology (MBC & MBF) Programme Objectives and Outcomes

Aim and objectives of UG program BSc Microbiology:

The programme BSc Microbiology introduces students to the vast array of microbes VIZ bacteria, archaea, viruses, fungi and protozoa around us, their diversity and applications. The programme has a strong practical emphasis, providing students with the basic laboratory skills required for a career in either applied or research microbiology.

Programme outcome

Graduates will acquire adequate knowledge and basic laboratory skills required for career in either applied or research microbiology

Programme specific outcomes

Microbiology students who graduate with a Bachelor of Science with Microbiology will

PSO1: Acquire knowledge on fundamentals of Microbiology, expertise in pure culture techniques & preservation of cultures and understand microbial physiology and biochemistry

PSO2: Gain insight into the various aspects of Microbial Genetics and r DNA technology.

PSO3: Grasp the fundamental concepts of immunity, immune response and epidemiology of microbial diseases. Demonstrate on collection and handling of laboratory specimens.

PSO4: Understand the role of microbes in nutrient recycling, sustainable agriculture culture, Microbial spoilage of food, principles of food preservation and Microbial production of Industrial products.

PSO5: Realize the application-oriented aspects of Microbiology and significance of Intellectual Property Rights

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA
B.Sc MICROBIOLOGY (CBSC) SYLLABUS

BSc	MICROBIOLOGY (Semester: I)	Credits: 4
MB N-1324	INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY	Hrs/Wk: 4

Aim and objectives of Course

To understand History & Development of Microbiology, Microscopy, staining and sterilization techniques, Ultra-structure of cell, Different methods of microbial characterization

To study nature of viruses, viral classification, cultivation of viruses and Type study of TMV & HIV

Learning outcomes of Course (COs)

Up on completion of the course students able to

CO1: Students will be able to illustrate the contributions made by the prominent Scientists for development of Microbiology

CO2: Students will able to differentiate a large number of bacteria by their salient characteristics

CO3: Perform pure culture techniques and techniques for preservation and maintenance of stock cultures

CO4: Understand Principles of Microscopy, handling and uses of microscopes

CO5: Analyse various techniques used for Sterilization and Disinfection techniques.

UNIT-I: History of Microbiology & Place of Microorganisms in the living world

No. of hours: 12

History of Microbiology in the context of contributions of Anton von Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Ivanowsky.

Importance and applications of microbiology

Classification of microorganisms Whittaker's five kingdom concept, Bergey's Manual of Systematic Bacteriology.

UNIT-II: Prokaryotic microorganisms & Viruses

No. of hours: 12

Ultra-structure of Prokaryotic cell- Cell Wall, Cell Membrane, Cytoplasm, Nucleoid, Plasmid, Inclusion Bodies, Flagella Pili, Capsule, Endospore

General characteristics of Bacteria (Size, shape, arrangement, reproduction)

General characteristics of Rickettsia, Mycoplasmas, Cyanobacteria, Archaea

General characteristics of viruses, Cultivation of Viruses (in brief)

Morphology, Structure and replication of TMV and Lambda Bacteriophage

UNIT-III: Eukaryotic microorganisms

No. of hours: 12

Fungi - Habitat, nutrition, vegetative structure and modes of reproduction; outline classification

Algae - Habitat, thallus organization, photosynthetic pigments, storage forms of food, reproduction and economic importance of algae. SCP.

Protozoa – Habitat, cell structure, nutrition, locomotion, excretion, reproduction, encystment, outline classification

UNIT-IV: Isolation and Culture of Bacteria and Fungi **No. of hours: 12**

Growth media- Natural, synthetic and semi synthetic media. Selective, Enrichment, and Differential media

Pure culture techniques - dilution-plating, Streak-plate, Spread-plate, Pour-Plate and micromanipulator.

Preservation of microbial cultures - sub culturing, overlaying cultures with mineral oils, lyophilization, sand cultures, storage at low temperature.

UNIT-V: Principles of Microscopy, Sterilization and Disinfection **No. of hours: 12**

Principles of microscopy - Bright field and Electron microscopy (SEM and TEM).

Staining Techniques - Simple and Differential staining techniques (Gram staining, Spore staining).

Sterilization and disinfection techniques –

Physical methods - autoclave, hot- air oven, pressure cooker, laminar air flow, filter sterilization, Radiation methods - UV rays, Gamma rays.

Chemical methods - alcohols, aldehydes, fumigants, phenols, halogens and hypochlorites.

Additional Inputs:

Paul Ehrlich, Chemical methods of Sterilization – Heavy Metals

MB N-1324 P: INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY

TOTAL HOURS: 30

CREDITS: 2

1. Microbiology Good Laboratory Practices and Biosafety.
2. Preparation of culture media for cultivation of bacteria- Nutrient broth & Nutrient agar
3. Preparation of culture media for cultivation of fungi – Sabourauds agar
4. Sterilization of medium using Autoclave
5. Sterilization of glassware using Hot Air Oven
6. Light compound microscope and its handling
7. Microscopic observation of bacteria (Gram +ve bacilli and cocci, Gram -ve bacilli), Algae and Fungi.
8. Simple staining
9. Gram's staining
10. Hanging-drop method & temporary wet mount (TWM) for observation of living microorganisms.
11. Isolation of pure cultures of bacteria by serial dilution and Streak/Spread/Pour Plate Method.
12. Preservation of bacterial cultures by Serial subculturing & Slant Preparation with mineral oil overlay.
13. Observation of electron micrographs of bacterial cells

Recommended Text Books & Reference books:

Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993). Microbiology. 5th Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi.

Dube, R.C. and Maheswari, D.K. (2000) General Microbiology. S Chand, New Delhi. Edition), Himalaya Publishing House, Mumbai.

Power, C.B. and Dagainawala, H.F. (1986). General Microbiology Vol I & II

Prescott, M.J., Harley, J.P. and Klein, D.A. (2012). Microbiology. 5th Edition, WCB McGrawHill, New York.

Reddy, S.M. and Reddy, S.R. (1998). Microbiology □ Practical Manual, 3 rd Edition, Sri Padmavathi Publications, Hyderabad.

Singh, R.P. (2007). General Microbiology. Kalyani Publishers, New Delhi.

Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). General Microbiology, 5th Ed., Prentice Hall of India Pvt. Ltd., New Delhi.

Microbiology Edited by Prescott

Jaya Babu (2006). Practical Manual on Microbial Metabolisms and General Microbiology. Kalyani Publishers, New Delhi.

Gopal Reddy *et al.*, Laboratory Experiments in Microbiology

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA

I B.Sc Microbiology

Semester -I

Blue Print For MB N-1324: Introduction to Microbiology and Microbial Diversity

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	No of questions answered	Marks allotted
A	Short questions	2	2	2	2	2	10	5	5X4=20
B	Essay Questions	2	2	2	2	2	10	5	5X8=40

Total Marks= 60

In section-B for each question internal choice has to be given

**B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS
(WITH EFFECT FROM 2020-2021 Admitted batch)**

First Year/ Semester-I

INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY

TIME: 3 HOURS

Maximum Marks: 60 marks

Section-A

Answer any FIVE questions

5×4=20 Marks

1. Anton von Leeuwenhoek
2. Whittaker's five kingdom
3. Archae bacteria
4. TMV
5. Protozoa
6. Define selective media along with examples
7. SEM
8. Phenols
9. TMV
10. Spore staining

Section- B

Answer any FIVE questions

5×8=40 Marks

- 1). Briefly mention the Applications of Microbiology.
Or
b). Write about the contribution of Louis Pasteur and Edward Jenner.
2. a). Explain the Ultra Structure of bacteria with a neatly labelled diagram.
Or
b). Give general characters of viruses.
3. a) Give general characters of Fungi.
Or
b). Write about the structure and reproduction of Algae.
4. a). Explain isolation of pure culture of bacteria by Streak Plate and Spread Plate.
Or
b). Write about the methods of Preservation of Microbial Cultures.
5. a). Explain in detail about Gram Staining.
Or
b). Write about use of Autoclave and Hot Air Oven in sterilization

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA
B.Sc MICROBIOLOGY (CBSC) SYLLABUS

BSc	MICROBIOLOGY (Semester: II)	Credits: 4
MB N-2324	MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY	Total hours:50

Aim and objectives of Course

To understand different bio molecular, bacterial nutrition, bacterial growth and metabolism

Learning outcomes of Course (COs)

Up on completion of this course students should able to:

CO1: Students able to describe the nutritional forms of bacteria and bacterial growth kinetics and methods to measure bacterial growth

CO2: Students will understand bacterial respiration, metabolism, photosynthesis and fermentations

CO3: Knowledge on classification of carbohydrates as structural and storage components, Classification of lipids and amino acids

CO4: Students will able to understand structure and functions of nucleic acids

CO5: Students will able to understand enzyme catalysis and kinetics

UNIT-I:

No.ofhours:10

Microbial nutrition: Classification of micro organisms based on nutrients (carbon, nitrogen, other energy and electron sources). Autotrophs, heterotrophs, mixotrophs, Phototrophs (Photosynthetic pigments).

Microbial growth: Principles of growth, Kinetics of growth, measurement of growth: (Direct methods: viable plate counts, membrane filtration). Indirect methods(Metabolic activity – measurements of DNA, Protein, Microscopic counts,) electronic counters, most probable number; Batch and continuous. Synchronous and Diauxic growth,

UNIT-II:

No. of hours: 10

Aerobic respiration - Glycolysis, ED path way, TCA cycle, Electron transport, oxidative and substrate level phosphorylation. Glyoxylate cycle, hexose monophosphate (HMP) shunt, gluconeogenesis.

Anaerobic respiration Fermentation, Biochemical mechanisms of lactic acid, ethanol, and butanol fermentations. Nitrate and sulphate respiration. Outlines of oxygenic and anoxygenic photosynthesis in bacteria.

UNIT – III:

No. of hours: 10

General characters, outline classification of Carbohydrates (Mono, Di and Polysaccharides), Lipids- General characters–Triglycerides, phospholipids, glycolipids and waxes.

General characters, classification, structure and function of amino acids, Characterization of proteins and classification (primary, secondary, tertiary and quaternary)

UNIT – IV:

No. of hours: 10

Nucleic acid types, base composition, nucleosides, nucleotides, Structure and functions of DNA (Types of DNA i.e. B, C, D and Z) and RNA (types i.e. m-RNA, r-RNA, t-RNA),

UNIT- V

No. of hours: 10

Properties and classification of Enzymes, Kinetics (Michaelis – Menten equation), Factors effecting on enzyme activity (P^H , temperature, concentration) catalysed reactions (Lock &Key, Induced Fit). Co-enzymes and Co-factors.

Additional Inputs:

Eukaryotic DNA

MB N-2324 P: MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY

TOTAL HOURS: 38

CREDITS: 2

1. 1 Qualitative Analysis of Carbohydrates.
2. Qualitative Analysis of Aminoacids.
3. Colorimetric estimation DNA by diphenylamine method.
4. Estimation of RNA by Orcinol method.
5. Colorimetric estimation of proteins by Biuret / Lowry method.
6. Estimation of reducing sugar-Anthrone method.
7. Demonstration of Alcoholic fermentation.
8. Assay of amylase activity
9. Effect of temperature / pH on enzyme activity
11. Demonstration of immobilization of enzyme activity(Virtual Demo)

SUGGESTED READING:

Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company
Caldwell, D.R. (1995). Microbial Physiology and Metabolism, W.C. Brown Publications,
Iowa, USA.

Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). Principles of Biochemistry, 2 nd
Edition, CBS Publishers and Distributors, New Delhi.

Sashidhara Rao, B. and Deshpande, V. (2007). Experimental Biochemistry: A student
Companion. I.K. International Pvt. Ltd.

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA

I B.Sc Microbiology

Semester -II

Blue Print For MB N-2324: Microbial Physiology and Biochemistry

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	No of questions answered	Marks allotted
A	Short questions	2	2	2	2	2	10	5	5X4=20
B	Essay Questions	2	2	2	2	2	10	5	5X8=40

Total Marks= 60

In section-B for each question internal choice has to be given

B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS
(WITH EFFECT FROM 2020-2021 Admitted batch)
First Year/ Semester-II
MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY

TIME: 3 HOURS

Maximum Marks:
60

Section-A

Answer any FIVE questions

5×4=20 Marks

1. Mixotrophs
2. Diauxic growth
3. Glyoxylate cycle
4. Oxidative phosphorylation
5. Glycolipids.
6. Nitrate respiration
7. Ethanol fermentation
8. tRNA
9. Nuclotides
10. Co-factors and Co-enzymes

Section- B

Answer any FIVE questions

5×8=40 Marks

1. a) Explain nutritional classification of bacteria.
Or
b) Explain different method for measuring microbial growth.
2. a). Explain glycolysis
Or
b) Discuss lactic acid fermentation
3. a) Explain classification of Carbohydrates

Or
b) Write general characters and classification of amino acids
4. a) write structure and functions of DNA
Or
b) Explain structure and functions of mRNA
5. a) Properties and classification of enzymes
Or
b) Discuss factors effecting enzyme activity

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA
B.Sc MICROBIOLOGY (CBCS) SYLLABUS

BSc	MICROBIOLOGY (Semester: III)	Credits: 4
MB N- 3324	MOLECULAR BIOLOGY AND MICROBIAL GENETICS	Total hours:48

Aim and objectives of Course

To understand DNA, RNA, Protein structure and synthesis. DNA damage, mutations and repair. Gene transfer methods.

Learning outcomes of Course (COs)

Up on completion of the course students able to

CO1: Understand the structure and functions of DNA, RNA, plasmids, transposons and bacterial replication.

CO2: Students will understand various mutations

CO3: Develop knowledge on genetic code and recombination in bacteria

CO4: Students acquire basic concepts of gene expression

CO5: Get knowledge on regulation of gene expression in prokaryotes

UNIT- I

No. of hours: 8

DNA and RNA as genetic material. Structure and organization of prokaryotic DNA. Watson and Crick model of DNA. Extra chromosomal genetic elements - Plasmids and transposons. Replication of DNA - Semi conservative mechanism, Enzymes involved in replication.

UNIT- II

No. of hours: 10

Mutations - spontaneous and induced, base pair changes, frame shifts, deletions, inversions, tandem duplications, insertions.

Mutagens - Physical and Chemical mutagens. Outlines of DNA damage and repair mechanisms.

UNIT- III

No. of hours: 10

Modern concept of gene Cistron, Recon and Muton. One gene one enzyme and one gene one polypeptide hypotheses.

Types of RNA and their functions, poly and mono cistronic m-RNA.

Genetic code –genetic code, the decoding system, codon- anticodon interaction.

Structure of ribosomes.

Bacterial recombination – Bacterial transformation, Bacterial conjugation, Transduction– Generalized and specialized transductions.

UNIT- IV

No. of hours: 10

Transcription: Introduction- Basic features of RNA synthesis, *E.coli* RNA polymerase, processing of tRNA and rRNA and m-RNA.

Transcription in Eukaryotes, Eukaryotic rRNA genes, formation of eukaryotic tRNA molecules, RNA Polymerases of eukaryotes.

Translation: Outline of Translation in eukaryotes. Complex Translation units, Inhibitors and Modifiers of protein synthesis.

UNIT- V

No. of hours: 8

Gene regulation- structural, constitutive, regulatory and clustered genes. Regulation of gene expression in bacteria - operon concepts - Negative and positive control of the Lac Operon,

trp operon.

Additional Inputs:

Transcription and translation in Prokaryotes

Recommended Text Books & Reference books:

- Freifelder, D. (1990). Microbial Genetics. Narosa Publishing House, New Delhi.
- Freifelder, D. (1997). Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
- Glick, B.P. and Pasternack, J. (1998). Molecular Biotechnology, ASM Press, Washington D.C., USA.
- Lewin, B. (2000). Genes VIII. Oxford University Press, England.
- Maloy, S.R., Cronan, J.E. and Freifelder, D. (1994). Microbial Genetics, Jones and Bartlett Publishers, London.
- Ram Reddy, S., Venkateswarlu, K. and Krishna Reddy, V. (2007) A text Book of Molecular Biotechnology. Himalaya Publishers, Hyderabad.
- Sinnot E.W., L.C. Dunn and T. Dobzhansky. (1958). Principles of Genetics. 5 th Edition. McGraw Hill, New York.
- Smith, J.E. (1996). Biotechnology, Cambridge University Press.
- Snyder, L. and Champness, W. (1997). Molecular Genetics of Bacteria. ASM press,
- Strickberger, M.W. (1967). Genetics. Oxford & IBH, New Delhi.
- Verma, P.S. and Agarwal, V.K. (2004). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Co. Ltd., New Delhi.

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA

II B.Sc Microbiology

Semester -III

Blue Print For MB N-3324: Molecular biology and Microbial Genetics

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	No of questions answered	Marks allotted
A	Short questions	2	2	2	2	2	10	5	5X4=20
B	Essay Questions	2	2	2	2	2	10	5	5X8=40

Total Marks= 60

In section-B for each question internal choice has to given

**B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS
(WITH EFFECT FROM 2020-2021 Admitted batch)**

Second Year/ Semester-III

MOLECULAR BIOLOGY AND MICROBIAL GENETICS

TIME: 3 HOURS

Maximum Marks: 60

Section-A

Answer any FIVE questions

5×4=20 Marks

1. Transposons
2. Frame shift mutations
3. Ribosome
4. Griffith experiment
5. UV rays as mutagens.
6. Conjugation
7. PCR
8. Plasmid
9. RNA polymerase
10. Constitutive genes

Section-B

Answer all of the following questions

5X8=40 Marks

Draw labelled diagrams wherever necessary

1. a). Explain Watson and crick model of DNA with a neatly labeled diagram
Or
b). Explain semi conservative replication of DNA
2. a). Explain different types of mutations
Or
b). Discuss DNA damage and repair mechanisms
3. a). Explain genetic code.
Or
b). Explain generalized and specialized transduction in bacteria
4. a). Write transcription in eukaryotes
Or
b). Explain translation in eukaryotes.
5. a). Write Lac Operon in
Or
b). Discuss tryptophan Operon

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA
B.Sc MICROBIOLGY (CBSC) SYLLABUS

BSc	MICROBIOLOGY (Semester: IV)	Credits: 4
MB N- 4324	MEDICAL MICROBIOLOGY AND IMMUNOLOGY	Total hours:48

Aim and objectives of Course

To study types of immunity, immune organs, cells, antibodies and antigen-antibody interactions.

To learn diagnostic and pathogenesis of various diseases. Antimicrobial defense and different toxins and vaccines.

Learning outcomes of Course (COs)

Up on completion of the course students able to

CO1: Students will demonstrate on collection, handling and processing of laboratory specimens

CO2: Develop information on epidemiology, treatment and control of infectious diseases

CO3: Student can safeguard him& society and can work diagnostics and hospitals.

CO4: Explain No-specific body defense and the immune response

CO5: Understand structure and properties of Antigen and antibodies

UNIT- I:

No. of hours: 8

Normal flora of human body. Host pathogen interactions: infection, invasion, pathogen, pathogenicity, virulence and opportunistic infection. General account on nosocomial infection. General principles of diagnostic microbiology- collection, transport and processing of clinical samples. General methods of laboratory diagnosis - cultural, biochemical, serological and molecular methods.

UNIT- II:

No. of hours: 10

General account on microbial diseases -causative agent, pathogenesis, epidemiology, diagnosis, prevention and control.

Bacterial diseases - Tuberculosis and Typhoid

Fungal diseases – Candidiasis and Aspergillosis

Protozoal diseases – Malaria and Filaria

Viral Diseases - Hepatitis- A & C and AIDS.

UNIT- III:

No. of hours: 10

Description and pathology of diseases caused by hemoflagellates; *Leishmania donavani* and *Trypanosoma gambiense*.

Principles of chemotherapy, Antibacterial drugs – Penicillin, Anti fungal drugs – Nystatin, Anti viral agents – Ribavirin, Drug resistance in bacteria.

UNIT- IV:

No. of hours: 10

Types of immunity - innate and acquired; active and passive; humoral and cell-mediated immunity.

Primary and secondary organs of immune system - Thymus, Bursa fabricus, bone marrow, spleen and lymph nodes.

Cells of immune system – structure and functions of B and T lymphocytes, null cells, monocytes, macrophages, neutrophils, basophils and eosinophils.

UNIT – V:

No. of hours: 10

Antigens - types, chemical nature, antigenic determinants, haptens. Factors affecting antigenicity.

Antibodies - basic structure, types, properties and functions of immunoglobulins.

Types of antigen-antibody reactions - Agglutinations, Precipitation, Neutralization, complement fixation, blood groups.

Labeled antibody based techniques - ELISA, RIA and Immuno fluorescence.

Polyclonal and monoclonal antibodies - production and applications. (Hybridoma technology) Concept of Hypersensitivity and Autoimmunity.

Additional Inputs:

MHC molecules and Complement activation pathways

MB N-4324 P: MEDICAL MICROBIOLOGY AND IMMUNOLOGY

TOTAL HOURS: 48

CREDITS: 2

1. Identification of human blood groups.
2. Separate serum from the blood sample (demonstration).
3. Estimation of blood haemoglobin.
4. Total Leukocyte Count of the given blood sample.
5. Differential Leukocyte Count of the given blood sample.
6. Immunodiffusion by Ouchterlony method.
7. Identify bacteria - *E. coli*, *Pseudomonas*, *Staphylococcus*, *Bacillus*, using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC, urease production and catalase tests
8. Isolation of bacterial flora of skin by swab method.
9. Antibacterial sensitivity by Kirby-Bauer method
10. Study symptoms of the diseases with the help of photographs: Anthrax, Polio, Herpes, chicken pox, HPV warts, Dermatomycoses (ring worms)
11. Study of various stages of malarial parasite in RBCs using permanent mounts.

Recommended Text Books & Reference books:

- Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication.
- Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication.
- Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley-Blackwell Scientific Publication, Oxford.
- Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
- Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
- Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Microbiology. 4th edition. Elsevier Publication.
- Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education.

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA

II B.Sc Microbiology

Semester -IV

Blue Print For MB N-4324: MEDICAL MICROBIOLOGY AND IMMUNOLOGY

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	No of questions answered	Marks allotted
A	Short questions	2	2	2	2	2	10	5	5X4=20
B	Essay Questions	2	2	2	2	2	10	5	5X8=40

Total Marks= 60

In section-B for each question internal choice has to given

B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS
(WITH EFFECT FROM 2020-2021 Admitted batch)
Second Year/ Semester-IV
MEDICAL MICROBIOLOGYB AND IMMUNOLOGY

TIME: 3 HOURS

Maximum Marks:
60

Section-A

Answer any FIVE questions

5×4=20 Marks

1. Thymus
2. Macrophage
3. Hypersensitivity reactions
4. Autoimmunity
5. Nosocomial infections
6. Typhoid
7. Aspergillosis
8. ELISA
9. Antigen
10. Blood grouping

Section-B

Answer all of the following questions

5X8=40 Marks

Draw labelled diagrams wherever necessary

1. a). Write a note on collection and transportation of clinical samples
Or
b). Explain normal flora of human body
2. a). Explain causal organism, pathogenesis, epidemiology, prevention and control of tuberculosis
Or
b). Write causal organism, mode of transmission, pathogenesis, diagnosis, treatment and control of malaria
3. a). Explain mode of action of anti microbial drugs
Or
b). Discuss drug resistance in bacteria
4. a) Explain about innate immunity
Or
b) Discuss structure and functions of B cell
5. a) Write hybridoma technology and applications
B) Explain structure and functions of antibodies

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA
B.Sc MICROBIOLOGY (CBSC) SYLLABUS

BSc	MICROBIOLOGY (Semester: IV)	Credits: 4
MB N- 5324	INDUSTRIAL MICROBIOLOGY	Total hours 39

Aim and objectives of Course

To provide knowledge on important microbes and the metabolic products in various industries.

Learning outcomes of Course

Up on completion of the course students able to

CO1: Summarize the importance of microbes used in industries and understand Screening methods and techniques involved in strain improvement

CO2: Demonstrate the different types of fermenters and fermentation media

CO3: Understand role of microbes in various industries like pharmaceutical, bioleaching and textiles.

CO4: Discuss various growth parameters required for industrial products

CO5: Self-reliance in the industrial application of Microbiology in life and industry and entrepreneurship can be established with the gained knowledge.

UNIT – I

No. of hours: 7

Microorganisms of industrial importance –History, introduction and general characters of yeasts (*Saccharomyces cerevisiae*), moulds (*Aspergillus niger*) bacteria (*E.coli*), actinomycetes (*Streptomyces griseus*). Industrially important Primary and secondary microbial metabolites. Screening techniques. Techniques involved in strain improvement.

UNIT – II

No. of hours: 10

Fermentation and fermenter: concept and discovery of fermentation. Fermenter: its parts and function. Types of fermenter – batch, continuous and fed batch.

Types of fermentation processes – solid state, liquid state, batch, fed-batch, continuous.

Basic concepts of Design of fermenter.

Ingredients of Fermentation media.

Downstream processing - filtration, centrifugation, cell disruption, solvent extraction.

UNIT – III

No. of hours: 8

Therapeutic enzymes, Production of therapeutic enzymes. Enzymes used in detergents, textiles and leather industries. Production of amylases and Proteases. Role of microorganisms in bioleaching and textile industry

UNIT – IV**No.of hours: 7**

Industrial microorganisms: cell growth, microbial growth kinetics, factors affecting growth, basic nutrition, principles of production media, components of media, chemical composition of media.

Bioreactors: basic structure of bioreactor, types of bioreactors, kinetics and methodology of batch and continuous bioreactors. Sterilization of bioreactors: fibrous filter sterilization. Aeration and agitation: agitation in shake flask and tube rollers.

UNIT – V**No.of hour: 7**

Microbial production and applications of Industrial products: Citric acid, Ethanol, Penicillin, Glutamic acid, and vitamin B12.

INDUSTRIAL MICROBIOLOGY

TOTALHOURS:36

CREDITS:2

1. Production of ethanol
2. Estimation of ethanol
3. Isolation of amylase producing microorganisms from soil
4. Production of amylase from bacteria and fungi
5. Assay of amylase
6. Demonstration of fermenter
7. Production of wine from grapes
8. Growth curve and kinetics of any two industrially important microorganisms.
9. Microbial fermentation for the production and estimation of ethanol from grapes
10. Microbial fermentation for the production and estimation of citric acid

Recommended Text Books &Reference books:

- Atlas RM and Bartha R. (2000). **Microbial Ecology: Fundamentals & Applications**. 4th edition. Benjamin/Cummings Science Publishing, USA
- Barton LL & Northup DE (2011). **Microbial Ecology**. 1st edition, Wiley Blackwell, USA
- Campbell RE. (1983). **Microbial Ecology**. Blackwell Scientific Publication, Oxford, England.
- Coyne MS. (2001). **Soil Microbiology: An Exploratory Approach**. Delmar Thomson Learning.
- Lynch JM &Hobbie JE. (1988). **Microorganisms in Action: Concepts & Application in Microbial Ecology**. Blackwell Scientific Publication, U.K.
- Madigan MT, Martinko JM and Parker J. (2014). **Brock Biology of Microorganisms**. 14th edition. Pearson/ Benjamin Cummings
- Maier RM, Pepper IL and Gerba CP. (2009). **Environmental Microbiology**. 2nd edition, Academic Press
- Martin A. (1977). **An Introduction to Soil Microbiology**. 2nd edition. John Wiley & Sons Inc. New York & London. Adams MR and Moss MO. (1995). **Food Microbiology**. 4th edition, New Age International (P) Limited Publishers, New Delhi, India.
- Banwart JM. (1987). **Basic Food Microbiology**. 1st edition. CBS Publishers and Distributors, Delhi, India.

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA

II B.Sc Microbiology

Semester -IV

Blue Print MBP N -5324 Industrial Microbiology

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	No of questions answered	Marks allotted
A	Short questions	2	2	2	2	2	10	5	5X4=20
B	Essay Questions	2	2	2	2	2	10	5	5X8=40

Total Marks= 60

In section-B for each question internal choice has to given

B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS

(WITH EFFECT FROM 2020-2021 Admitted batch)

**Second Year/ Semester-IV
INDUSTRIAL MICROBIOLOGY**

TIME: 3 HOURS

Maximum Marks: 60

Section-A

Answer any FIVE questions

5×4=20 Marks

1. Molasses
2. Fermenter
3. Actinomycetes
4. Antifoaming agents
5. Crowded plate
6. Centrifugation
8. Glutamic acid
9. VitaminB12
10. Impellers

Section-B

Answer all of the following questions

5X8=40Marks

1. a). Write a note on industrially important microorganisms
Or
b). Explain methods for strain improvement
2. a). Write types of fermentation processes
Or
b). Explain techniques involved in downstream processing
3. a). Therapeutic enzyme production and applications
Or
b). Write role of microorganisms in bioleaching and textile industry
4. a). Describe production process of proteases
Or
b). Compare role of fungi and bacteria in amylase production
5. a). Write a note on industrial production of ethanol and its applications
Or
b). Write a note on industrial production of Vitamin B12

**SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA
B.Sc MICROBIOLGY (CBSC) SYLLABUS 2020**

Vth SEMEISTER PAPERS

**THERE WILL BE THREE PAIRS OF CORE COURSE.
STUDENT HAS TO CHOOSE ONE PAIR.**

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA
B.Sc MICROBIOLGY (CBSC) SYLLABUS 2020

BSc	MICROBIOLOGY (Semester: V)	Credits: 4
MB N- 6324 A- PAIR	FOOD, AGRICULTURE AND ENVIRONMENTAL MICROBIOLOGY	Total hours 44

Aim and objectives of Course

To provide knowledge on important microbes in food, Agriculture and Environmental Microbiology

Learning outcomes of Course

Up on completion of the course students able to

CO1: Demonstrate with the wide diversity of microbes and their spoilage food, food intoxication and food born infections

CO2: Able to understand principles of food preservation, fermented foods and microbes as food.

CO3: The student will acquire knowledge on application of microorganisms in agro – environmental fields

CO4: Get fundamental concepts in principles of plant disease control an industrial application of Microbiology

CO5: The student will have fundamental concepts in soil microbiology and soil water and aero microbial diversity and microbial interactions Basic concepts in treatment of drinking water. Understands the role of microorganisms in treatment of solid and liquid waste.

UNIT – 1

No. of Hours: 8

Intrinsic and extrinsic parameters that affect microbial growth in food

Microbial spoilage of food - fruits, vegetables, milk, meat, egg, bread and canned foods

Food intoxication (botulism).

Food-borne diseases (salmonellosis) and their detection.

UNIT – II

No. of Hours: 8

Principles of food preservation - Physical and chemical methods.

Fermented Dairy foods – cheese and yogurt.

Microorganisms as food – SCP, edible mushrooms (white button, oyster and paddy straw).

Probiotics and their benefits.

UNIT – III

No. of Hours: 8

Soil Microbiology: Microbial groups in soil, microbial transformations of carbon, nitrogen, phosphorus and sulphur.

Biological nitrogen fixation.

Microflora of Rhizosphere and Phyllosphere microflora, microbes in composting.

Importance of mycorrhizal inoculums, types of mycorrhizae associated plants, mass inoculums. Production of VAM, field applications of Ectomycorrhizae.

UNIT - IV

No. of Hours: 8

Beneficial microorganisms in Agriculture: Biofertilizer (Bacterial Cyanobacterial and Fungal), microbial insecticides, Microbial agents for control of Plant diseases.

Plant – Microbe interactions.

Diseases caused by bacteria and fungi to various commercial crops: groundnut rust & Citrus canker and food crops: **Rice Blast** (*Pyricularia oryzae*) Bacterial blight of rice (*Oryza sativa* and *O. glaberrima*)

Biodegradation, Biogas production, Biodegradable plastics.

UNIT – V

No. of Hours: 12

Terrestrial Environment: Soil profile and soil microflora. Aquatic Environment: Microflora of fresh water and marine habitats. Atmosphere: Aeromicroflora and dispersal of microbes. Extremophiles.

Methods to detect portability of water samples.

Outlines of Solid Waste management: Sources and types of solid waste, Methods of solid waste disposal (composting and sanitary landfill).

Liquid waste management: Composition and strength of sewage (BOD and COD), Primary, secondary and tertiary sewage treatment.

MBP N 6324 – FOOD, AGRICULTURE AND ENVIRONMENTAL MICROBIOLOGY

Total hours: 40

Credits: 2

1. Isolation of bacteria and fungi spoiled bread / fruits / vegetables
2. Preparation of yogurt / dahi
3. Determination of microbiological quality of milk sample by MBRT
4. Enumeration of bacteria, fungi and actinomycetes from soil
5. Enumeration and identification of rhizosphere micro flora
6. Isolation of rhizobium from root nodules.
7. Isolation of azatobcter from soil.
8. Observation description of any three bacterial and fungal plant diseases
9. Staining and observation of VAM.
10. Analysis of soil - pH, Moisture content and water holding capacity.
11. Study of air flora by petriplate exposure method.
12. Analysis of potable water: SPC, Presumptive, confirmed and completed test, determination of coli form count in water by MPN.
13. Determination of Biological Oxygen Demand (BOD) of waste water samples.

SUGGESTED READINGS:

- Atlas RM and Bartha R. (2000). *Microbial Ecology: Fundamentals & Applications*. 4th edition, Benjamin/Cummings Science Publishing, USA
- Barton LL & Northup DE (2011). *Microbial Ecology*. 1st edition, Wiley Blackwell, USA
- Campbell RE. (1983). *Microbial Ecology*. Blackwell Scientific Publication, Oxford, England.
- Coyne MS. (2001). *Soil Microbiology: An Exploratory Approach*. Delmar Thomson Learning.
- Lynch JM & Hobbie JE. (1988). *Microorganisms in Action: Concepts & Application in Microbial Ecology*. Blackwell Scientific Publication, U.K.
- Madigan MT, Martinko JM and Parker J. (2014). *Brock Biology of Microorganisms*. 14th edition. Pearson/ Benjamin Cummings.
- Maier RM, Pepper IL and Gerba CP. (2009). *Environmental Microbiology*. 2nd edition, Academic Press.
- Martin A. (1977). *An Introduction to Soil Microbiology*. 2nd edition. John Wiley & Sons Inc. New York & London.
- Okafor, N (2011). *Environmental Microbiology of Aquatic & Waste systems*. 1st edition, Springer, New York.
- Singh A, Kuhad, RC & Ward OP (2009). *Advances in Applied Bioremediation*. Volume 17, Springer-Verlag, Berlin Hedeilberg
- Stolp H. (1988). *Microbial Ecology: Organisms Habitats Activities*. Cambridge University Press, Cambridge, England.
- Subba Rao NS. (1999). *Soil Microbiology*. 4th edition. Oxford & IBH Publishing Co. New Delhi.
- Willey JM, Sherwood LM, and Woolverton CJ. (2013). *Prescott's Microbiology*. 9th edition. McGraw Hill Higher Education.

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA

III B.Sc Microbiology

Semester -V

**Blue Print For MB N-6324: FOOD, AGRICULTURE AND ENVIRONMENTAL
MICROBIOLOGY**

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	No of questions answered	Marks allotted
A	Short questions	2	2	2	2	2	10	5	5X4=20
B	Essay Questions	2	2	2	2	2	10	5	5X8=40

Total Marks= 60

In section-B for each question internal choice has to be given

**B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS
(WITH EFFECT FROM 2020-2021 Admitted batch)**

Third Year/ Semester-V

FOOD, AGRICULTURE AND ENVIRONMENTAL MICROBIOLOGY

TIME: 3 HOURS

Maximum Marks: 60 marks

Section-A

Answer any FIVE questions

5×4=20 Marks

1. Canned Foods
2. SCP
3. Spoilage of Eggs
4. Yogurt
5. VAM
6. Rhizosphere
7. Bio fertilizers
8. Poly hydroxyl butyrate
9. BOD
10. Soil profile

Section- B

Answer any FIVE questions

5×8=40 Marks

1. a). Write a note on salmonellosis and their detection methods.
Or
b). Write about Intrinsic and extrinsic parameters that affect microbial growth in food.
2. a). Write in detail about food preservation methods.
Or
b). Explain about production of cheese and different types of cheeses.
3. a) Explain types of mycorrhizae associated plants, mass inoculums and production of VAM
Or
b). Explain symbiotic nitrogen fixation.
4. a). Explain plant and microbe interactions.
Or
b). Explain Diseases caused by bacteria and fungi to various commercial crops.
5. a). Methods to detect portability of water samples.
Or
b). Discuss about solid waste management.

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA
B.Sc MICROBIOLOGY (CBCS) SYLLABUS 2020

BSc	MICROBIOLOGY (Semester: V)	Credits: 4
MB N- 6324 A- PAIR: A2	MANAGEMENT OF HUMAN MICROBIAL DISEASES AND DIAGNOSIS	Total hours 36

Aim and objectives of Course

To realize the principles of prevention and treatment of microbial diseases and to understand the concepts and development of microbial diseases in animals

Learning outcomes of Course

Up on completion of the course students able to

CO1: Develop knowledge and skills on microbiological laboratory skills for identification of pathogens

CO2: Students will demonstrate the collection of clinical samples

CO3: Students will get knowledge on staining techniques

CO4: Students able to perform diagnostic techniques

CO5: To understand drug resistance

UNIT – I

No.of Hours: 8

Definition and concept of health, disease, infection, and pathogen.

Bacterial Diseases: Cholera, Pneumonia, and Dysentery.

Viral Diseases: COVID-19, Poliomyelitis & Chicken pox,

Fungal diseases: Dermatormycosis and Athletes foot.

Protozoan Diseases: Amoebiasis.

UNIT- II

No. of hours: 8

Collection of clinical samples (oral cavity, throat, skin, blood, CSF, urine and faeces) and precautions required.

Method of transport of clinical samples to laboratory and storage.

UNIT- III

No. of hours: 8

Mechanism of bacterial pathogenicity, colonization and growth, virulence, virulence factors, exotoxins, enterotoxins, endotoxins and neurotoxins.

Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis,

Giemsa-stained thin blood film for malaria.

Preparation and use of culture media - Blood agar, Chocolate agar, Lowenstein-Jensen medium, Mac Conkey agar.

Distinct colony properties of various bacterial pathogens.

UNIT- IV

No. of hours: 6

Serological Methods - Agglutination, ELISA, immunofluorescence, Nucleic acid based methods - PCR, Nucleic acid probes.

Diagnosis of Typhoid, Dengue and HIV, Swine flu.

UNIT- V

No. of hours: 6

Importance, Determination of resistance/sensitivity of bacteria using disc diffusion method, Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial double dilution method. Problems of drug resistance and drug sensitivity.

Drug resistance in bacteria.

**MBP N-6324 A- PAIR: A2: MANAGEMENT OF HUMAN MICROBIAL DISEASES
AND DIAGNOSIS**

TOTAL HOURS: 40

CREDITS: 2

1. Collection transport and processing of clinical specimens (Blood, Urine, Stool and Sputum).
Receipts, Labeling, recording and dispatching clinical specimens.
2. Physical, Chemical & microscopic examination of clinical samples – urine, stool, puss, sputum.
3. Isolation and identification of following pathogens from clinical samples: *E.coli*, *Salmonella* and *Psedumonas*.
4. Demonstration of permanent slides of the following parasites:
 - a) *Entamoeba histolytica*
 - b) *Ascaris spp.*
 - c) *Plasmodium spp.*
 - d) *Mycobacterium tuberculosis* & *Mycobacterium leprae*
5. Estimation of hemoglobin (Acid hematin and cyan methanoglobin method).
6. ESR and PCV determination.
7. Immuno hematology: Blood group typing by slide test & tube for ABO & Rh systems.
8. Isolation of bacteria in pure culture and Antibiotic sensitivity.

SUGGESTED READING

- Ananthanarayan R and Paniker CKJ (2009) Textbook of Microbiology, 8th edition, Universities Press Private Ltd.
- Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication.
- Collee JG, Fraser, AG, Marmion, BP, Simmons A (2007) Mackie and McCartney Practical Medical Microbiology, 14th edition, Elsevier.
- Randhawa, VS, Mehta G and Sharma KB (2009) Practicals and Viva in Medical Microbiology 2nd edition, Elsevier India Pvt Ltd.
- Tille P (2013) Bailey's and Scott's Diagnostic Microbiology, 13th edition, Mosby.

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA

III B.Sc Microbiology

Semester -V

**Blue Print For MB N-6324 A- PAIR: A2: MANAGEMENT OF HUMAN
MICROBIAL DISEASES AND DIAGNOSIS**

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	No of questions answered	Marks allotted
A	Short questions	2	2	2	2	2	10	5	5X4=20
B	Essay Questions	2	2	2	2	2	10	5	5X8=40

Total Marks= 60

In section-B for each question internal choice has to be given

B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS
(Admitted batch 2019-2020)
Third Year/ Semester-V

MB N-6324 A- PAIR: A2:

MANAGEMENT OF HUMAN MICROBIAL DISEASES AND DIAGNOSIS

TIME: 3 HOURS

Maximum Marks: 60

Section-A

Answer any FIVE questions

5×4=20

Marks

1. Cholera
2. Ziehl-Neelson staining
3. RT PCR
4. Mac Conkey agar
5. Transport media
6. MIC
7. WIDAL test
8. ELISA
9. Athletes foot
10. Methods for collection of urine

Section- B

Answer any FIVE questions

5×8=40

Marks

11. a) Write causal organism, mode of transmission, pathogenesis, treatment and control of Diphtheria

(or)

b). Explain transmission and control of COVID-19
12. a) Explain methods for collection of clinical samples

(or)

b) Write methods for transport of clinical samples to laboratory and storage
13. a) Describe Preparation and use of Chocolate agar and Lowenstein-Jensen

(or)

b). Distinct colony properties of various bacterial pathogens
14. a) Explain serological methods

(or)

b). Write diagnostic tests for Dengue and Swine flu

(or)
15. a) Explain disc diffusion method

(or)

b). Explain serial double dilution method for determination of MIC of drug

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA
B.Sc MICROBIOLOGY (CBSC) SYLLABUS 2020

BSc	MICROBIOLOGY (Semester: V)	Credits: 3
MB N- 6324 B- PAIR: B1	MICROBIAL BIOTECHNOLOGY AND r – DNA TECHNOLOGY	Total hours 37

Aim and objectives of Course

To study applications of microbial biotechnology and r DNA technology.

Learning outcomes of Course

Up on completion of the course students able to

CO1: Students should be able to demonstrate with the wide diversity of microbes and their potential use in medicine, agriculture and industry biotechnology regulation and ethics.

CO2: Students will get knowledge on restriction enonuclease in r DNA technology and selection of transformed cells

CO3: Students will get knowledge on cloning vehicles in r DNA technology

CO4: Student will able to understand gene sequencing methods

CO5: Students will get knowledge on of genetically modified crops. And role of microorganisms in creation of transgenic animals and plants.

UNIT – I

No. of hours: 8

Introduction to microbial biotechnology, Bacterial genes, genomes and genetics. Recombinant microbial biotechnology products, biotechnology regulation and ethics. Biomass and bio fuels: plant biomass (cellulose, starch, pectin, gum materials). Animal biomass (chitin, milk, whey, slaughter, house waste). Microbial biomass (alagal blooms, in fresh and sea water), fungal mushrooms, fermentation waters by yeasts, and bacterial biomass.

UNIT- II

No. of hours: 8

Restriction and Modification: Classification of restriction endonucleases. Enzymes used in molecular cloning; Polymerases, ligases, phosphatases, kinases and nucleases; Advanced Molecular biology techniques, Electrophoresis and Blotting techniques.

Cutting and joining DNA: (cohesive end ligation, methods of blunt end ligation).

Transfection and transformation. Selection of transformed cells. Screening methods (Genetic marker and blue white screening).

UNIT- III**No. of hours: 7**

Cloning vehicles - Plasmid, Bacteriophage, Construction of genomic and cDNA libraries. Advantages of cDNA libraries. Concept of single cell proteins, probiotics and their applications. Microbial production of fuels: alcohols, hydrogen and methane. Microbial production of polymers: xanthenes gums.

UNIT- IV**No. of hours: 7**

Methods of gene sequencing – Maxam - Gilberts and Sanger's dideoxy chain termination methods; Polymerase chain reaction technique (Components in PCR and PCR conditions).

Methods of gene transfer in fungi, yeast and higher plants using microinjection, microprojectile bombardment (gene gun method, Electroporation and *Agrobacterium* mediated transformation.

Expression of cloned genes in bacteria, yeast, plant and animal cells.

Basic principles and application of biosensors. Nucleic acid probe technology.

UNIT- V**No. of hours: 7**

Concept of genetically modified microorganisms. Bt cotton : production, advantages and limitations.

Probable advantages and disadvantages of genetically modified crops.

Role of microorganisms in creation of transgenic animals and plants.

MBT- BI : MICROBIAL BIOTECHNOLOGY AND r – DNA TECHNOLOGY**TOTALHOURS: 36****CREDITS: 2**

1. Culturing of mushrooms
2. Isolation of yeast from grapes.
3. Production of wine
4. Production of ethyl alcohol
5. Isolation of Plasmid DNA from E.coli
6. Tissue culture: callus cultivation
7. Fermentative production of ethyl alcohol
8. Transformation in Bacteria using plasmid.
9. Restriction digestion of DNA and its electrophoretic separation.
10. Ligation of DNA molecules and their testing using electrophoresis.
11. Activity of DNAase and RNAse on DNA and RNA.
12. Isolation of Plasmid DNA.
13. Demonstration of PCR.

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA

III B.Sc Microbiology

Semester -V

Blue Print For MB N-6324 B- PAIR: B1:

MICROBIAL BIOTECHNOLOGY AND r – DNA TECHNOLOGY

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	No of questions answered	Marks allotted
A	Short questions	2	2	2	2	2	10	5	5X4=20
B	Essay Questions	2	2	2	2	2	10	5	5X8=40

Total Marks= 60

In section-B for each question internal choice has to be given

B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS

(Admitted batch 2019-2020)

Third Year/ Semester-V

MB N-6324 B- PAIR: B1:

MICROBIAL BIOTECHNOLOGY AND r – DNA TECHNOLOGY

TIME: 3 HOURS

Maximum Marks: 60

Section-A

Answer any FIVE questions

5×4=20

Marks

1. Yeast
2. Bio- fuels
3. Polymerases
4. Genetic markers
5. c DNA libraries
6. Microbial production of Hydrogen
7. PCR
8. Biosensors
9. Transgenic animals
10. Bt. cotton

Section- B

Answer any FIVE questions

5×8=40

Marks

11. a) Write Recombinant microbial biotechnology products for human therapeutics
(or)
b). Discuss bio fuel production from plant biomass
12. a) Discuss various restriction endo nucleases
(or)
b) Write any two blotting techniques
13. a) Describe various cloning vehicles
(or)
b). Explain microbial production of alcohol
14. a) Explain gene sequencing methods
(or)
b). Write gene transfer methods
(or)
15. a) Discuss production, advantages and limitations of Bt. cotton
(or)
b). Explain Role of microorganisms in creation of transgenic plants

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA
B.Sc MICROBIOLGY (CBSC) SYLLABUS 2020

BSc	MICROBIOLOGY (Semester: V)	Credits: 3
MB N- 6324 B- PAIR: B2	BIostatISTICS AND BIOINFORMATICS	Total hours 36

Aim and objectives of Course

To understand Biostatistics and Bioinformatics

Learning outcomes of Course

Up on completion of the course students able to

CO1: Understand biological data bases

CO2: Summarize Searching sequence data bases

CO3: students able to use appropriate tests for bio variable analysis

CO4: Able to understand analytical tests and Construction of Phylogenetic trees by clustering methods

CO5: Able to understand protein modelling methods

UNIT – I

No. of hours: 7

Definition, nature and scope of bioinformatics. Bioinformatics versus computational biology. Branches of bioinformatics. Basic concepts in bioinformatics. Introduction to Biological data bases: NCBI, EMBL, EXPASY, PIR, Pfam. Concept of World Wide Web: HTML, HTTP.

UNIT – II

No. of hours: 7

Searching sequence data bases using BLAST. Multiple sequence alignment– progressive alignment–profiles–multi dimensional dynamic programming. Biostatistics: Measures of Central tendency and distribution–mean, median, mode, range, standard deviation, variance.

UNIT – III

No. of hours: 7

Basic principles of probability theory, Bayes theorem, Normal distribution, statistical inference –Types of errors and levels of significance. Comparison of variance (F-test), small sample test, t-test for comparison of means, chi square test. Analysis of variance–one way and two way, multiple comprises.

UNIT – IV

No. of hours: 7

Correlation and Linear regression. Sequence Analysis: Introduction to hidden Markov models.

Genomics and proteomics: Molecular phylogenetics: Construction of Phylogenetic trees using parsimony method and branch & bound method. Clustering methods– UPGMA &

neighbor-joining. Fragment assembly, peptide sequencing using mass and spectroscopy data. Comparative genomics.

UNIT – V

No. of hours: 8

Modeling: Protein secondary structure prediction–Chou Fasmanrules– Neural networks– discriminant analysis. Prediction of transmembrane segments in Membrane proteins. Protein3D structure prediction– homology– threading – Potential energy functions–energy minimization–molecular dynamics–simulated annealing.

MBP B2 - BIOSTATISTICS AND BIOINFORMATICS

TOTALHOURS:36

CREDITS: 2

1. Isolation of plasmid DNA from *E.coli* cells
2. Quantitative and qualitative analysis of proteins / DNA by using spectrophotometer.
3. Demonstration of Southern hybridization
4. Demonstration of amplification DNA by PCR.
5. Use of software for sequence analysis of nucleotides and proteins.
6. Problem related to t – test and χ^2 test.
7. Use of Internet/software for sequence analysis of nucleotides and proteins:
8. Studies of public domain data bases for nucleic acid and protein sequences.
9. Determination of protein structure (PDB).
10. Genome sequence analysis
11. Problems related to measures of central tendency, dispersion, t-test and chi Square test.

SUGGESTED READINGS:

1. Daniel, 2006, Biostatistics, Eighth Edition. John Wisley and sons.
2. Durbin, Eddy, Krogh, Mithison, Biological sequence analysis.
3. T.A.AttwoodandD.J.parry–smith, 2001, Introduction of Bioinformatics.
4. A.D.Baxevaris,1998, Bioinformatics:Apracticalguidetotheanalysisof Genes and proteins,(Edited) B.F.Publication.
5. David W, 2005, Bio-informatics;sequenceandGenomeAnalysis,2ndEdition By Mount CB Spublishers.

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA

III B.Sc Microbiology

Semester -V

Blue Print For MB N-6324 B- PAIR: B2:

BIOSTATISTICS AND BIOINFORMATICS

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	No of questions answered	Marks allotted
A	Short questions	2	2	2	2	2	10	5	5X4=20
B	Essay Questions	2	2	2	2	2	10	5	5X8=40

Total Marks= 60

In section-B for each question internal choice has to be given

B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS
(Admitted batch 2019-2020)
Third Year/ Semester-V

MB N-6324 B- PAIR: B2:

BIostatISTICS AND BIOinformatics

TIME: 3 HOURS

Maximum Marks: 60

Section-A

Answer any FIVE questions

5×4=20

Marks

1. NCBI
2. HTML
3. Standard deviation
4. BLAST
5. F- test
6. Chi square test
7. Genomics
8. Proteomics
9. Protein modelling
10. Simulated annealing

Section- B

Answer any FIVE questions

5×8=40

Marks

11. a) What are the structural domain resources
(or)
b). List three major DNA sequence databases
12. a) Discuss the dynamic programming in sequence alignment.
(or)
b) Write Bayes thermo
13. a) Discuss correlation and regression
(or)
b). Write on analysis of variance
14. a) Describe peptide sequencing
(or)
b). Write gene transfer methods
(or)
15. a) Discuss protein secondary structure prediction methods.
(or)
b) Explain protein 3D secondary structure prediction methods

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA
B.Sc MICROBIOLGY (CBSC) SYLLABUS 2020

BSc	MICROBIOLOGY (Semester: V)	Credits: 3
MB N- 6324 C- PAIR: C1	MICROBIAL QUALITY CONTROL, INSTRUMENTATION AND TECHNIQUES	Total hours 36

Aim and objectives of Course

To study quality control in food and pharmaceutical industries and analytical techniques

Learning outcomes of Course

Up on completion of the course students able to

CO1: Develop skills on disinfection of instruments and equipment's in laboratory and Hospitals and documentation

CO2: To understand the working principle of basic laboratory equipments

CO3: To understand the techniques like MPN and direct microscopic methods

CO4: To understand and demonstrate Principles of Microscopy, handling and uses of microscopes

CO5: To understand and demonstrate the various analytical and separation techniques

UNIT – I

No. of hours: 7

Microbial quality control definition, history and introduction. Standard Methods involved in assessment of microbial quality control. Q.A and Q.C definitions and importance. Traditional Microbiological Quality Controlling methods: Sampling methods, TVC, APC and serial dilution techniques. Microbiological criteria. Laboratory facility design for quality control: Sterilization, disinfection and decontamination. Personnel training: Hygiene and handling techniques. Documentation. Good laboratory practices.

UNIT – II

No. of hours: 8

Culture media used in QC and QA: Design of specialized media for identification of pathogens. Good laboratory practices in culture media preparation: raw material, water, pH. Uses of media.

Selective and indicator media used in pharmaceutical and food industries. Instruments associated in QC and QA: Principle involved, working conditions, uses and precautions of Laminar Air Flow (LAF), Autoclave, Incubator, pH meter, Colony counter, Hot air oven, Centrifuges and storage devices.

UNIT – III

No. of hours: 7

Techniques for enumeration of microorganisms: sample preparation from Aqueous, soluble, insoluble, medical and pasteurized materials. Counting methods: pour plate, spread plate, membrane filtration. Most Probable Number (MPN) and MIC. Turbidimetric methods. Staining techniques for identification bacteria and Fungi.

UNIT – IV

No. of hours:7

Microscopy – Principles of light, phase, fluorescent & electron microscopes; Microscopic techniques: Basic principles and applications of phase – contrast microscopy, fluorescent microscopy and electron microscopy, types of electron microscopy– scanning and transmission. Radio isotopes: radiometric analysis, stable and radioactive isotopes, preparation, labeling, detection and measurement of isotope.

UNIT - V

No. of hours: 7

Principles of Centrifugation – Centrifugation techniques – preparative and analytical methods, density gradient centrifugation. General principles and applications of chromatography – Paper, Column, Thin layer, Gas, Ion exchange, Affinity chromatography, HPLC, FPLC, GCMS and Gel filtration. Electrophoresis- moving boundary, zone (Paper Gel) electrophoresis. Immuno electrophoresis. Immuno blotting. Isoelectric focusing, 2-Delectrophoresis, Principles of colorimetry

MBP-C1 : MICROBIAL INSTRUMENTATION AND BIOTECHNIQUES

Total hours: 36

Credits: 2

1. Isolation and enumeration of bacteria from food / pharmaceutical source.
2. Quality Assurance of water by MPN method.
3. Preparation of any two selective and indicator media commonly used Q.A & Q.C
4. Microbial quality of in and around laboratory conditions.
5. Isolation and Identification of fungi by using selective media and staining procedures.
6. Identification of MIC of any one antibiotic.
7. Colorimetric and spectroscopic estimation of nucleic acids.
8. Microscopic observations of examination of bacteria, fungi and actinomycetes.
9. Separation of cell components by centrifugation technique.
10. Demonstration of immune electrophoresis.
11. Demonstration of HPLC.

Suggested readings:

1. Hand book of Microbial Quality control by Rosamund. M, Baird Norman. A, Hodges and Stephen. P, Denyer. CRC press.
2. The Microbiological Quality of Food, 1st Edition, Editors: Antonio Bevilacqua Maria Rosaria Corbo Milena Sinigaglia eBook ISBN: 9780081005033 Imprint:Wood head Publishing.
3. Guide to Microbiological Control in Pharmaceuticals and Medical Devices, Second Edition, Stephen P. Denyer, Rosamund M. Baird, CRC Press.
4. WILSON & WALKER, Practical Biochemistry: Principles and techniques, Academic publishers.
5. UPADHYAY, UPADHYAY &NATH, Biophysical Chemistry: Principles and techniques, Himalaya Publishers.

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA

III B.Sc Microbiology

Semester -V

Blue Print For MB N-6324 C- PAIR: C1

MICROBIAL QUALITY CONTROL, INSTRUMENTATION AND TECHNIQUES

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	No of questions answered	Marks allotted
A	Short questions	2	2	2	2	2	10	5	5X4=20
B	Essay Questions	2	2	2	2	2	10	5	5X8=40

Total Marks= 60

In section-B for each question internal choice has to be given

B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS

Third Year/ Semester-V

MB N-6324 C- PAIR: C1:

MMICROBIAL QUALITY CONTROL, INSTRUMENTATION AND TECHNIQUES

TIME: 3 HOURS

Maximum Marks: 60

Section-A

Answer any FIVE questions

5×4=20

Marks

1. APC method
2. Quality Assurance
3. Working conditions for Hot air oven
4. Selective media in
5. MPN
6. MIC
7. Fluorescent microscopy
8. Applications of Phase contrast microscopy
9. HPLC
10. Colorimetry

Section- B

Answer any FIVE questions

5×8=40

Marks

11. a) Write standard Methods involved in assessment of microbial quality control.
(or)
b). Explain various microbial quality control methods
12. a) Discuss Good laboratory practices in culture media preparation
(or)
b) Write various culture media used in QA and QC
13. a) Describe techniques for enumeration of microorganisms
(or)
b). Explain methods for determination of MIC
14. a) Explain principle and applications of scanning electron microscope
(or)
b). Write radiometric analysis and measurement of isotopes
(or)
15. a) Define electrophoresis and immune blotting methods
(or)
b). Explain principle and applications of affinity chromatography

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA
B.Sc MICROBIOLOGY (CBSC) SYLLABUS 2020

BSc	MICROBIOLOGY (Semester: V)	Credits: 3
MB N- 6324 C- PAIR: C2	DRUG DESIGN, DISCOVERY AND INTELECTUAL PROPERTY RIGHTS (IPR)	Total hours 36

Aim and objectives of Course

To study drug design, discovery and IPR

Learning outcomes of Course

Up on completion of the course students able to

CO1: Students should be able to understand approaches for drug design, sources of drugs and molecular mechanism of drugs

CO2: Students should be able to understand drug development process

CO3: Get knowledge on vaccines, gene therapy and gene based vaccines

CO4: Students will get knowledge on outlines of intellectual property rights, ISI and Bio standards

CO5: Students will understand concepts Bio safety an ethics

Unit – I

No. of Hours: 7

Introduction- History of drug design, Current approaches and philosophies in drug design, Molecular mechanisms of diseases and drug action with examples. Pharmaceutical products of microbial origin (antibiotics) animal origin (sex hormones), plant origin (Alkaloids & Morphine). Sources of Drugs- Microbial drugs, Plants as a source of drugs, *E. coli* as a source of recombinant therapeutic proteins.

Unit – II

No. of Hours: 7

Expression of recombinant proteins in yeasts, animal cell culture systems. Rational drug design and Combinatorial approaches to drug discovery. Drug development process- Impact of genomics and related technologies upon drug discovery: Gene chips, Proteomics, Structural genomics and Pharmacogenetics. Drug manufacturing process- Guides to good manufacturing practice.

Unit – III

No. of Hours: 7

Vaccines and adjuvant- Traditional vaccine preparations, Attenuated and inactivated viral and bacterial vaccines, Toxoids. Peptide vaccines. Adjuvant technology. Nucleic acid as drugs- Gene therapy: Basic approach to gene therapy, Vectors used in gene therapy - Manufacture of viral vectors, Non-viral vectors. Gene therapy and genetic disease, cancer, Gene therapy and AIDS. Gene based vaccines.

Unit – IV**No. of Hours: 8**

Introduction: general introduction to IPR (parent, plant breeder's right). Trademarks, industrial design, trade secrets (or) undisclosed information integrated circuit designs.

Patenting principle, international – standards and patent validity (neem and relaxins), recent developments in patent system and patentability of biotechnology, invention IPR issues of the Indian context. Copy right and rights related to copy right, International standards as per WHO, ISI, bio safety and validation.

Unit – V**No. of Hours: 7**

Biotechnology and hunger: challenges for the Indian biotechnological research and industries. Bio safety: the Cartagena protocol on bio safety.

Bio safety management: key to the environmentally responsible use of biotechnology, ethical implications of biotechnology product techniques, social and ethical implications of biological weapons

MBT – C2: DRUG DESIGN, DISCOVERY AND INTELECTUAL PROPERTY RIGHTS (IPR)

TOTALHOURS:40

CREDITS: 3

1. Isolation of antibiotic producing bacteria from soil samples
2. Isolation of drug resistant plasmid from bacteria (E.coli).
3. Isolation of Actinomycetes from soil.
4. Identification of antibacterial activity of actinimycetes.
5. Identification of antibacterial activity of fungi
6. Identification of antagonistic activity of any two fungal species.
7. Assay of any one antibiotic (Penicillin).
8. Determination of MIC of any one antibiotic (penicillin / streptomycin).
9. Study of components and design of a BSL – III laboratory
10. Filing applications for approval from bio safety committee
11. Filing primary applications for patents
12. Study of steps of patenting process
13. A case study of patent.
14. Study of bio safety measures in pharmaceutical industry.
15. Study on QA & QC parameters followed in R&D laboratory.

SUGGESTED READINGS:

1. W.B.Hugo & A.D.Russell, Pharmaceutical Microbiology edited, 6thEdition, Black Well science.
2. Shanson D.C., Microbiology in clinical practice, 2ndedition, London; Wright.
3. T Sammes Ellis Horwood, opicin Antibiotic chemistry VolItoV.
4. Wulf Crueger, Biotechnology – A text book of Industrial Microbiology, 2nd Edition, Panima publishers
5. A.H.Patel,1984, Industrial Microbiology, Macmilan India Limited.
6. Coulson C.J., London; Taylor and Francis, Molecular mechanisms of drugaction.
7. DenyesS.P.&Baird R.M.Chichester, Ellis Horwood, Guide to microbiological Control in Pharmaceuticals.
8. Murray S.Cooper,Quality control in the Pharmaceutical Industry-Edt., Vol-II, Academic press, NewYork.
9. Sydney H.Willin, Murray M.Tuckerman,William S.Hitchings IV, Good Manufacturing practices of pharmaceuticals, second Edt., Mercel Dekker NC Nework.
10. RajeshBhatia,RattanlalIhhpunjani,QualityassuranceinMicrobiology,CBS

Publisher&Distributors,NewDelhi.

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA

III B.Sc Microbiology

Semester -V

Blue Print For MB N-6324 C- PAIR: C2:

DRUG DESIGN, DISCOVERY AND ITELECTUAL PROPERTY RIGHTS (IPR)

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	No of questions answered	Marks allotted
A	Short questions	2	2	2	2	2	10	5	5X4=20
B	Essay Questions	2	2	2	2	2	10	5	5X8=40

Total Marks= 60

In section-B for each question internal choice has to be given

**B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS
Third Year/ Semester-V**

MB N-6324 C- PAIR: C2:

DRUG DESIGN, DISCOVERY AND INTELECTUAL PROPERTY RIGHTS (IPR)

TIME: 3 HOURS

Maximum Marks: 60

Section-A

Answer any FIVE questions

5×4=20

Marks

1. Recombinant therapeutic proteins
2. Gene chips
3. Proteomics
4. Gene therapy
5. Toxoids
6. Copy rights
7. Patent
8. Trademarks
9. Bio safety
10. Biological weapons

Section- B

Answer any FIVE questions

5×8=40

Marks

11. a) Write methods for drug design
(or)
b). Discuss ant two molecular mechanisms of diseases and drugs
12. a) Discuss various drug discovery methods Drug development process
(or)
b) Write a note on pharmacogenesis
13. a) Discuss gene therapy
(or)
b). Explain types of vaccines
14. a) Write Copy rights and trade marks
(or)
b). Write Outlines of Intellectual Property Rights
(or)
15. a) Discuss Bio safety management
(or)
b). Discuss challenges for the Indian biotechnological research and industries.

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA

Practical Examination pattern for Semester End Examinations

Practical examination in Department of MICROBIOLOGY is held before end of semester exams twice in a year to test practical skills among the students.

Total marks allotted for practical are **50** marks which are divided as 25 for internal and 25 for external for the duration of **two** hours in each semester

The division of marks is as follows

External

Major Experiment	Minor Experiment	To identify the instrument to give the working principle	Record	Viva-Voce
8 Marks	4 Marks	2 X 2 ½ =5 Marks	5Marks	3Marks

Internal

Record	Project viva	Continuous assessment
10 Marks	10 Marks	5 Marks

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA
Student Evaluation Policy and Procedure

1. EVALUATION POLICY AND PROCEDURE

Students are evaluated for 100 marks in each course. These 100 Marks are spitted into Continuous Internal Assessment (CIA) and Semester End Evaluation (SEE). 40 marks are allocated to CIA and 60 marks for SEE.

CONTINUOUS INTERNAL ASSESSMENT (CIA) FOR 40 MARKS

Out of a maximum of 100 marks in each theory paper, 40 marks shall normally be allotted for continuous internal assessment. The Assessment shall be made by the teacher handling that paper in the manner prescribed here under. Where the same paper is handled by two or more teachers, the Head of the Department shall decide upon the teacher, who shall make the internal assessment or fix the proportion of the marks among the teachers for the internal assessment of the students.

Out of these 40 marks, 10 marks are allotted to Continuous Internal Exams. Two Continuous Internal exams are conducted for 20 marks in each exam and the average of these two exams scale down to 10 marks shall be deemed as the marks obtained by the student in Continuous Internal Exams.

Out of these 40 marks, 10 marks are allotted to Assignments. Two assignments are given to the students during the course. 5 marks are allotted for each assignment and total of these two assignments are included in Continuous Internal Assessment.

Out of these 40 marks, 10 marks are allotted to Project Work/ Group Discussion. Students will be assigned student study project for 10 Marks under CIA. Then the student has to submit a project report under the supervision of Faculty Member. These 10 marks may also be assigned to group discussion also. Student will be evaluated here based on his/her way of expression, conceptual strength, attitude, listening -understanding skills and level of participation in the discussion.

Out of these 40 marks, 5 marks are allotted to Student Seminar and 5 marks for Viva-Voce. Each Student may give student seminar to the peer team. This student seminar will carry 5 marks. Here feedback will be collected on 5 points scale from the participants in the student seminar [or] Viva- Voce will be conducted by the concerned subject faculty for 5marks.

The summarized continuous internal assessment is

1. Average of Two Continuous Internal exams	-	10 Marks
2. Total of Two Assignments	-	10 Marks
3. Project Work/Group Discussion	-	10 Marks
4. Student Seminar	-	5 Marks
5. Feedback/Viva-Voce	-	5 Marks

1.2 CIA IN PROJECT WORK AND COMPREHENSIVE SEMINAR

Each student has to conduct Industry/Laboratory oriented Research work in his/her interested area and has to prepare Project Report by using either primary data or secondary data. This is different from student study project. It is research oriented Industrial/laboratory project conducted under the supervision of Faculty Member of the department. The students have to submit the project work report to the supervision of Faculty at the end of VI Semester End Evaluation process. After submitting project work report, the students have to give Comprehensive Seminar by explaining their research in the industry/Lab. Project Work carries 40 Marks and Comprehensive Seminar carries 10 Marks.

Every student is required, to take every test for Continuous internal Assessment, unless he/she is permitted by the Principal to write at a later date on valid reasons, before the test is conducted. In case where permission is not obtained, the decision of the Principal to hold or not to hold separate examination for such candidate is final.

Permission to write Internal Assessment test at the end of corresponding Semester – end exams may be given on medical grounds and other valid grounds. For such candidates, test/s is/are conducted by the faculty member concerned in consultation with the Head of the Department with a different question paper.

The Student has to get minimum 40 per cent (16 Marks) marks in the Continuous Internal Assessment to complete the Course Paper.

Suggestive Question paper pattern for CIA/SEE (Based on Bloom Taxonomy)

Though the faculty concerned is empowered to adopt their own pattern for question paper, a general and suggestive model for question paper is given below based on Blooms Taxonomy.

S. No	Learning Objective	Percentage of Marks
1	Memory based (Remember)	10
2	Understand (Comprehension)	10
3	Application	15
4	Analysis	15
5	Evaluation	25

6	Creativity	25
Total		100

SRR & CVR GOVT.DEGREE COLLEGE (A)

Vijayawada, Krishna (Dist.)

List of Subject Experts/Paper Setters in Microbiology

S.NO	NAME OF THE EXPERT	UNIVERSITY	CONTACT NUMBER
1	Ms. D. Jayasri, Lecturer in Microbiology	Head Department of Microbiology Arts College (A), Rajahmundry	8121000338
2	Smt. T. Sony	SCIM Govt. Degree College, Tanuku, West Godavari (Dist.)	9966252410
3	Dr. A. Padmavathi Lecturer in Microbiology	Head Department of Microbiology Ch.S.D.St. Theresa's College For Women(A), Eluru, West Godavari (Dist.)	9440581035
4	Dr. Y.Neeraja Lecturer in Microbiology	Department of Microbiology Ch.S.D.St. Theresa's College For Women(A), Eluru, West Godavari (Dist.)	9440159390
5	Sri ASSDV Prasad Raju. V Lecturer in Microbiology	Department of Microbiology B. V. Raju Degree College Bhimavaram West Godavari (Dist.)	9989454855
6	Sri S V V S N Murthy Lecturer in Microbiology	Department of Microbiology S K S D MahilakalasaTanuku, West Godavari (Dist,)	9491714268
7	Smt. R. Sakuntala Lecturer in Microbiology	D.N.R Degree College Bhimavaram West Godavari (Dist.)	9912124420

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA
B.Sc MICROBIOLGY

Certificate Course Syllabus

Advances in Probiotics and Functional Fermented Foods

Course Code:

Aim and objectives of Course

To impart current knowledge of probiotics, prebiotics and functional dairy foods for the health benefits .

Learning outcomes of Course (COs)

Up on completion of the course students able to

CO1: Students will be able to get knowledge in pre and probiotics and functional fermented foods

CO2: Students will able to differentiate a large number of Probiotic bacteria by their salient characteristics

Modules:

Total: 40 Hrs

1. **Prebiotics:** concept, definition, criteria, types and sources of prebiotics, prebiotics and gut microflora.
Prebiotics and health benefits: mineral absorption, immune response, cancer prevention, IBD, elderly health and infant health, prebiotics in foods. **10 Hrs**
2. **Characteristics of Probiotics for selection:** Tolerance to additives, stability during storage, stability during passage to intestinal sites, minimum effective dose, maintenance of probiotic microorganisms. **04 Hrs**
3. **Role of probiotics in health and disease:** prevention and treatment of gastrointestinal bacterial infection. treatment and prevention of constipations, treatment of hepatic encephalopathy, chronic urinary tract infection, antitumor and antihypertensive, cholesterol level **06 Hrs**
4. **Mechanism of probiotics:** complete exclusion, production of antimicrobial substances, modulation of immune system, alteration of intestinal bacterial metabolite action, alteration of microecology of healthy humans and patients **05 Hrs**
5. **Health benefits of functional fermented dairy products:** such as dahi, lassi, yoghurt, kefir, cheese, koumiss, Yakult, fermented whey drinks, and dairy based cereal foods, soy based yoghurt containing probiotics. **05 Hrs**

Practicals**10 Hrs**

1. Growth of probiotic LAB in broth, milk and whey.
2. Preparation of probiotic fermented milks like dahi, yoghurt, lassi and whey drink.
3. Effect of prebiotics on the growth of LAB in milk and broth.
4. Survivability of probiotic organisms in fermented milks.
5. Antimicrobial potential of the functional dairy products. .

Suggested readings

1. Salminen. S and Wright , A. V. 1998. Lactic Acid Bacteria, Marcel Dekker
2. Glenn R. G. Marcel R. 2008. Handbook of Prebiotics CRC press
3. Lee Y K, Salminen S 2009. Handbook of Probiotics and Prebiotics . A John Willey and Sons Inc. Publication
4. Sandholm T. M. Saarela M. 2003. Functional Dairy Products CRC Woodhead Publishing Ltd

SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA

B.Sc Microbiology

Blue Print For Certificate Course

Course Code:

Advances in Probiotics and Functional Fermented Foods

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	Marks allotted
A	Multiple questions	6	6	6	6	6	30 X 1/2M	15
B	Short Questions	1	1	1	1	1	5 X 2M	10
C	Practical	Major experiment and Identification of Spotters					2	15

Total Marks= 40

SRR & CVR Govt Degree College (A) Vijayawada
Department of Microbiology

Certificate Course 2022-23

Advances in Probiotics and Functional Fermented Foods
Model Question Paper

TIME: 3 HOURS

Maximum Marks: 40

Section-A

Answer All questions

30×1/2=15 M

- 1 Which of the following microbe is used in the production of blue cheese?
 - a) Streptococcus thermophilus
 - b) Lactobacillus bulgaricus
 - c) Penicillium roqueforti
 - d) Rhizopus stolonifer

2. Pickled cucumber is made from fermented salt-stock pickles.
 - a) True
 - b) False

3. Bacterial cell grown on hydrocarbon wastes from the petroleum industry are a source of --
 - a) carbohydrates
 - b) proteins
 - c) vitamins
 - d) fats

4. Yeast-cell crops harvested from the vats are used to produce which of the following compounds?
 - a) alcoholic beverages
 - b) enzymes
 - c) antibiotics
 - d) organic acids

5. How many tons of protein can be produced by algae grown in pond in a year?
 - a) 1000
 - b) 1
 - c) 50
 - d) 20

6. What is the range of protein content in yeast cells?
 - a) 69%
 - b) 12-15%
 - c) 20-40%
 - d) 40-50%

7. Which of the following microorganism have high vitamin content?
 - a) bacteria
 - b) yeast
 - c)algae

8. The principal microorganism for yogurt is _____

- a) Streptococcus thermophilus
- b) Leuconostoc citrovorum
- c) Lactobacillus acidophilus
- d) Streptococcus lactis

9. Which of the following products have higher acidity and lacks aroma?

- a) Cultured buttermilk
- b) Cultured sour cream
- c) Bulgarian milk
- d) Acidophilus milk

10. Shredded cabbage is the starting product for which of the following fermented food?

- a) Sauerkraut
- b) Pickles
- c) Green olives
- d) Sausage

11. These are live bacteria that can be consumed in foods like yogurt.

- a. Probiotics
- b. Prebiotics
- c. Microbes
- d. Dairy pathogens
- e. Activites

12. These act as fertilizer for the bacterial community residing in the colon.

- a. Probiotics
- b. Prebiotics
- c. Amino acids
- d. Short chain fatty acids
- e. Glucose molecules

13. Which of the following term is used refer beneficial bacteria.

- a. Antipests
- b. Prebiotics
- c. Antiviral
- d. Antibody

15. The probiotic term is coined by.

- a. Lilly
- b. Watson
- c. Stilwell
- d. Both A and B

16. ----- term is referred to the microorganisms that have a beneficial effect on the host intestinal microbial balance.

- a. Antibiotics

- b. Probiotics
- c. Interfrons
- d. Both A and C

17. Which of the following is common type of microbes used as probiotics.

- a. Zika virus
- b. LAB
- c. Aspergillus
- d. Both A and C

18. Probiotics are present in Fermented Foods.

- a. Yes
- b. No

19. The probiotics are same as Prebiotics.

- a. True
- b. False

20. Which of the following is aprobiotic fungi.

- a. Sacchromyces boulardi
- b. Lactobacillus
- c. Bifido bacterium
- d. Fructooligosaccharide

21. Lactobacillus reduces the lactose content of dairy productcs.

- a. True
- b. False

22. Human breast milk is rich with prebiotics.

- a. True
- b. False

23. The probiotics are rarely causes infection.

- a. True
- b. False

24. Probiotics are effective in which of the following diarrheas:

- a. Antibiotic associated diarrhea
- b. Rota virus associated diarrhea
- c. Radiation induced diarrhea
- d. All the above

25. Besides intestinal infections, probiotics have been found to be useful in:

- a. True
- b. False
- c. Stilwell
- d. Both A and B

26. A synbiotic is a product that contains:

- a. A probiotic with antibiotic
- b. A prebiotic with antibiotic
- c. A prebiotic with postbiotic

27. What is a prebiotic.

- a. Bacteria
- b. Gutmicrobiota
- c. Food like Artichokel
- d. Dietary Fiber

28. Which of the following is produced by fermenting soybeans?

- a) Yogurt
- b) Kombucha
- c) Miso
- d) Jiang

29. Where did Kefir originate?

- a) America
- b) Canada
- c) Europe
- d) London

30. Where did Tempeh originate?

- a) Thailand
- b) Indonesia
- c) Philippines
- d) Auckland

Section-B

Answer All questions

5X 2=10M

- 1. Neutaceuticals
- 2. Functional foods
- 3. Antimicrobil substances
- 4. Prebiotics
- 5. Koumiss

Section-C (Practicals)

1. Major Experiment

10M

2. Identification of Spotters

05M

**SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA
DEPARTMENT OF MICROBIOLOGY 2022-23**

**Certificate Course-Enrollment Form
Advances in Probiotics and Functional Foods**

Course Code:

Name : **Fix Passport Size**

Register No : **Photograph**

Class & Semester :

Mail ID :

Contact No :

Address :

Have you completed any Other Certificate Course:

Signature :

**SRR & CVR GOVT. DEGREE COLLEGE (A), VIJAYAWADA
DEPARTMENT OF MICROBIOLOGY 2022-23**

Certificate Course-Modalities

Advances in Probiotics and Functional Foods

Course Code:

- Instruction period or Duration of the Certificate Course is 40 Hrs
- Internal Assessment 10 Marks
- External Assessment 40Marks
- Issue of Completion Certificate with Grade A+ above 80% of marks obtained both internal and external assessment; Grade A above 70%, Grade B above 60% and Grade C above 50%.
- Minimum fee of Rs: 200 (Rupees Two hundred only)