PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS)

NAAC 'B++' GRADE

KAKINADA

BOARD OF STUDIES

DEPARTMENT OF MICROBIOLOGY

2025-26

(CHOICE BASED CREDIT SYSTEM)

INDEX

PROCEEDINGS OF THE PRINCIPAL (FAC), PITHAPUR RAJAH's GOVT. COLLEGE [A], KAKINADA
Present: Dr. Kandula Anjaneyulu, M.A, Ph.D.

Rc.No.9/A.C/BOS/2025-26 **Dt.31 July 2025**

Sub: Pithapur Rajah's Government College[A] Kakinada--Academic Cell- Conduct of BOS Meetings for the Academic Year 2025-26 - Guidelines issued - Regarding.

ORDER:

The autonomous colleges, in alignment with their vision, mission, stated objectives, and core values, are mandated to design and develop their own outcome-based curricula. This must be done with due consideration for societal, local, and global industry requirements, employability, and the development of industry-ready and transferable skills. Accordingly, every programme shall prescribe Course Outcomes (COs), Programme Outcomes (POs), and Programme Specific Outcomes (PSOs) along with a suitable learning outcome assessment management system, supported by a robust and transparent evaluation mechanism to measure attainment levels among students.

Further, the A.P. State Council of Higher Education (APSCHE) has introduced a revised curricular framework effective from the Academic Year 2025-26, incorporating Skill Enhancement Courses, Multi-Disciplinary courses, the Indian Knowledge System and a revised credit structure.

Our institution, from the Academic Year 2022–23 onwards, has defined a renewed vision and mission along with updated objectives and core values, necessitating the design and reorientation of its academic and research administration in line with these directives.

In light of the above responsibilities prescribed by the institution's vision and mission, NEP–2020, NAAC, NIRF, and the APSCHE's revised and new UG and P.G. curricular framework, it is imperative to customize, design, and re-orient our academic and research activities to meet the expectations of students, industries, and government stakeholders.

Accordingly, the Chairpersons of the U.G and P.G Boards of Studies (BoS) of various departments are hereby requested to make necessary arrangements to convene their BoS meetings before **09 Aug 2025**.

The Chairpersons are further instructed to:

1. Prepare the curricula and extracurricular activities for the Academic Year 2025–26 in line with the institution's vision, mission, NEP–2020, and NIRF norms.
2. Devise an appropriate evaluation system to ensure effective learning outcomes and holistic student development.
3. Ensure that the curriculum design includes a mandatory *20% revision* of the syllabus each year without deviating from the APSCHE prescribed syllabus.
4. If the syllabus is not prescribed by APSCHE/Affiliating University, then the syllabus is to be

framed by the BOS committee concerned with duly following the mandate prescribed above.

5. Engage stakeholders viz employers, parents, and alumni, to obtain feedback on the existing curricula and to invite suggestions for improvements.
6. Invite the University nominee, subject experts, industry representatives, student representatives, and parent representatives well in advance. The meeting notice shall clearly specify the date, venue, and agenda, and a soft copy of the agenda and relevant documents shall be circulated for their perusal.
7. Ensure that the subject experts invited preferably hold a Doctorate with at least 10 years of teaching experience and have relevant expertise in designing industry-related, market- and job-oriented curricula.
8. Facilitate thorough deliberations on curriculum design, evaluation methods, incorporation of research components, measures to enhance learning experiences, and optimal utilization of existing human, physical, and ICT resources.
9. Conduct all BoS meetings in offline mode. Online participation shall be permitted only under exceptional circumstances.
10. Prescribe benchmarking and quality initiatives in pedagogy and learning, including strategies for curriculum design and teaching-learning processes, in collaboration with the IQAC Coordinator, prior to the BoS meeting.
11. Ensure that a minimum student attendance of **75%** shall be required for eligibility to appear for I & II Mid-Term Examinations under the CIA component; this shall be formally approved in the BoS meeting.
12. Approve any new programmes to be introduced for the Academic Year 2025–26, the number and frequency of certificate courses, and SWAYAM MOOCs courses.
13. Submit the approved BOS copies in the prescribed format, in **quadruplicate (hard copies)** to the Academic Cell for onward submission to the IQAC, Examination Cell, and Library, within **three days** of the meeting and upload the soft copy in their respective department web pages in the college website.
14. Ensure strict alignment of all recommendations and curriculum changes with the institution's vision and mission.
15. Submit a request to receive advance funds from the Examination cell through Principal for conducting BoS meetings.

The details of honorarium to be paid to the University Nominee and Subject Experts attending the Board of Studies (BOS) meeting are as follows

UG BOS for AY 2025-26

S.No	Designation	Honorarium (Rs)	TA
1	University Nominee	1000	Below 20 Km @Rs.200/- (Local Conveyance) Above 20 Km, Bus fare/Train fare (Whichever is less)
2	Subject Expert	500	Below 20 Km @Rs.200/- (Local Conveyance) Above 20 Km, Bus fare/Train fare (Whichever is less)
3	Industrialist	500	Below 20 Km @Rs.200/- (Local Conveyance) Above 20 Km, Bus fare/Train fare (Whichever is less)

PG BOS for AY 2025-26

S.No	Designation	Honorarium (Rs)	TA
1	University Nominee	1000	Below 20 Km @Rs.200/- (Local Conveyance) Above 20 Km, Bus fare/Train fare (Whichever is less)
2	Subject Expert	500	Below 20 Km @Rs.200/- (Local Conveyance) Above 20 Km, Bus fare/Train fare (Whichever is less)
3	Industrialist	500	Below 20 Km @Rs.200/- (Local Conveyance) Above 20 Km, Bus fare/Train fare (Whichever is less)

- Binding charges limited to Rs.250/- per program.
- The Bills/Vouchers shall be in compliance with applicable rules and norms.

Following contents shall be presented in the BOS document in the order

1. Proceedings of the Principal pertaining to BOS
2. Composition of BOS
3. Vision and Mission of the department
4. Agenda: It shall include ATR on the previous BOS meeting first, resolutions, etc., later.
5. Table showing the Allocation of Credits in the following table for both theory and Practicals' in case of science subjects

S. No	Semester	Title of the Course (Paper)	Hrs./week	Max. Marks (SEE)	Marks in CIA	Credits
1	III	Physical Chemistry-1	3	50	50	4

6. Resolutions adopted in the meeting with detailed discussion that took place during the meeting.
7. Each BOS Chairman shall, immediately after syllabus, tabulate the changes made in the syllabus/ paper along with justification.
8. Attendance of Members present with signatures in the tabular form.
9. List of Examiners & Paper setters (Minimum 20 members and at least 02 members from other states)
10. Syllabus for each course (both theory & Practical in case of Science subjects) followed by model question papers (theory & practical) and allocation of CIA (50marks) for each course with structure.
11. Each student (2025-26 AB) has to complete one MOOCS course from SWAYAM in any subject per year.

CIA structure for Single Major system

- Out of 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- Mid examinations are to be conducted in offline mode at college level
- Mid examination to be conducted in offline mode in which the student should attempt **one essay** question for ten marks out of two questions, **three short** answer questions with five marks each out of five questions
- The remaining 25 marks for CIA are allocated as per the following structure.

Project-10M	Seminar- 5M	Assignment- 5M	Viva on theory- 3M	Clean & green and Attendance- 2M

TEMPLATE FOR BOS COMPOSITION

PROCEEDINGS OF THE PRINCIPAL(FAC), P.R. GOVERNMENT COLLEGE(A), KAKINADA

Present: Dr. Kandula Anjaneyulu, M.A, Ph.D.

R.C.No.2/A.C/BOS – Members Nomination/2025-26 Dated: 31.07.2025

SUB: P.R. Government College(A), Kakinada- UG/PG Board of Studies (BOS) - Nomination of Members - Orders issued.

REF: Proc.RC.No.1/A.C/BOS/2025-26 dated:31 July 2025 of the Principal, Pithapur Rajah's Government College(A) Kakinada.

ORDER:

The Principal, P.R. Government College(A), Kakinada is pleased to constitute UG/PG Boards of Studies in ----------for framing the syllabi in respective Subject for all Semesters duly following the norms of the UGC Autonomous guidelines.

S. No	Name of the Person	Designation
1		Chairman & Lecturer Incharge, Department.
2		University Nominee
3		Subject Expert -I Lecturer in.
4		Subject Expert - II Lecturer in
5		Representative from Industry
6		Member
7		Member
8		Member
9		Member
10		Member
11		Member
12		Member
13		Member
14		Member
15		Student Alumni Member
16		Student Member
17		Student Member

The above members are requested to attend the BoS meeting on - -2025 and share their valuable reviews, and suggestions on the following functionaries.

- Prepare syllabi for the subject keeping in view the objectives of the college and interest of the stake holders for consideration and approval of the IQAC and Academic Council.
- Suggested methodologies for innovative teaching and evaluation techniques.
- Suggest the panel of Names to the academic council for appointment of Examiners.
- Coordinate research, teaching, extension and other activities in the Department.

PRINCIPAL
P. R. Government College(A), Kakinada

The Chairpersons of all Boards of Studies are hereby instructed to comply with these directives in letter and spirit to ensure the highest standards of academic and administrative excellence.

PRINCIPAL
P.R. Govt. College (Autonomous)
KAKINADA-533 001

PRINCIPAL
Pithapur Rajah's Government College(A)
Kakinada

Copy to:

1. Lecturers-in-Charge (BOS Chairmen) of all the departments
2. Academic Coordinator
3. IQAC coordinator
4. Controller of Examinations
5. Office

PRINCIPAL
Pithapur Rajah's
Government
Autonomous College
Kakinada

Vision and mission of
Department of Microbiology

HISTORY:

P.R.Govt. Degree College, (Autonomous) was established in 1884 by Pithapuram Maharaja, Sri. R.V.K M. SURYARAO BAHADUR MAHARAJ.

After the college opted for Autonomous system in 2001, the department has started the restructured course in Microbiology with Botany combination from 2002-2003.

Till 2019 department of Microbiology is under the Headship of Biotechnology and then the Department of Microbiology was established as a separate department from 2021.

VISION:

Our vision is to impart knowledge in the field of Microbiology and equip students with practical skills relevant to the industry and self-employment needs.

MISSION:

To provide quality laboratory facilities which are on par with the industry standards.

To encourage all the students who enroll the course to take up Microbiology as their future carrier option.

To attain 100% success rate in the examination.

Action Taken Report

The appropriate actions taken by the Department of Microbiology as per the suggestions given by the members of Board of Studies and other administrators in the meeting held on

Suggestions	Action taken
To conduct any student centric seminar/webinar	A National webinar is organized on Undergraduate research focusing on the employability and entrepreneur opportunities in Microbiology
To plan any industrial visit to the students	Students were taken for Samalkota Biofertilizer unit
Introduce any certificate course	As Suggested by the BOS committee members the certificate course will be started on biofertilizers

Agenda

1. Action taken report (ATR) of the A.Y.2023-24
2. Introduction of B.Sc Microbiology- Major and B.Sc Microbiology Minors w.e.f the academic year 2024-25 a per the directions given by APSCHE and Council of Higher education, A.P.
3. Model question papers, Assignments question for each course as part of continuous internal assessment & blue prints for each course.
4. Panel of Question Paper Setters & Examiners.
5. SEE: CIA evaluation
6. Proposal for Extension Activities like Community Service/Field Trips/ Study tours/Student Study projects/Industrial Visits/Extension Lectures/Green Initiatives for the students
7. Enrolling students in SWAYAM/MOOC courses of Microbiology & IPRS
8. Streamlining of regularity in attendance to follow the benchmark of 75% attendance to appear in the Examinations without the payment of fine and 90% attendance for Practicals
9. Collaboration with industry and third-party sector organization in view of industrial internship.
10. Make students access to ICT infrastructure for enhanced quality in higher education.
11. Remedial coaching for slow learners and project/research work for advanced learners
12. Allocation of extra credits for extracurricular activities.
13. Conduct of parent teacher meeting.
14. Panel of Question papersetters and Examiners
15. Action plan for the academic year 2024-25. Any other with the permission of the chair.

P.R GOVERNMENT DEGREE COLLEGE (A)
KAKINADA.
DEPARTMENT OF MICROBIOLOGY
ALLOCATION OF CREDITS

Year	Semester	Course	Title	Hr/ week	credits
I	I	1	Introduction to Microbiology and Microbial Diversity	5	4
		2	Principles of Bacteriology and Microbial Techniques	5	4
	II	3	Introduction to Microbiology	3	3
			Introduction to Microbiology	2	1
		4	Bacteriology and Virology	3	3
			Bacteriology and Virology	2	1
II	III	5	Eukaryotic microorganisms	3	3
			Eukaryotic microorganisms	2	1
		6	Biomolecules & Enzymology	3	3
			Biomolecules & Enzymology	2	1
		7	Microbial and Analytical Techniques	3	3
			Microbial and Analytical Techniques	2	1
		8	Cell Biology and Genetics	3	3
			Cell Biology and Genetics	2	1
	IV	9	Molecular Biology and Microbial Genetics	3	3
			Molecular Biology and Microbial Genetics	2	1
		10	Microbial Physiology and Metabolism	3	3
			Microbial Physiology and Metabolism	2	1
		11	r DNA technology, Biostatistics& Bioinformatics	3	3
			r DNA technology, Biostatistics &Bioinformatics	2	1
III	V	12	Immunology & Medical Microbiology	3	3
			Immunology & Medical Microbiology	2	1
		13	Applied Microbiology	3	3
			Applied Microbiology	2	1
		14	Industrial Microbiology	3	3
			Industrial Microbiology	2	1
		15	Food and Dairy Microbiology	3	3
			Food and Dairy Microbiology	2	1
	VI		Internship		

Note 1: For Semester–V, for the domain subject **MICROBIOLOGY**, any one of the threepairs of SECs shall be chosen as courses 6 and 7, i.e., 6A & 7A or 6B & 7B or 6C& 7C. The pair shall not be broken (ABC allotment is random, not on any prioritybasis).

Note 2: One of the main objectives of Skill Enhancement Courses (SEC) is to inculcate field skills related to the domain subject in students. The syllabus of SEC will bepartially skill oriented. Hence, teachers shall also impart practical training to students on the field skills embedded in the syllabus citing related real field situations.

Note 3: To insert assessment methodology for Internship/ on the Job Training/Apprenticeship under the revised CBCS as per APSCHE Guidelines.

- **First internship (After 1st Year Examinations):** Community Service Project. To inculcate social responsibility and compassionate commitment among the students, the summer vacation in the intervening 1st and 2nd years of study shall be for Community Service Project (the detailed guidelines are enclosed).
- **Credit For Course: 04**
- **Second Internship (After 2nd Year Examinations):** Apprenticeship / Internship / on the job training / In-house Project / Off-site Project. To make the students employable, this shall be undertaken by the students in the intervening summer vacation between the 2nd and 3rd years (the detailed guidelines are enclosed).
- **Credit For Course: 04**
- **Third internship/Project work (6th Semester Period):**
  During the entire 6th Semester, the student shall 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 (the detailed guidelines are enclosed).
- **Credit For Course:12**

P.R.GOVT.COLLEGE (AUTONOMOUS)
2025-26, XXIV BOARD OF STUDIES MEETING
DEPARTMENT OF MICROBIOLOGY

The members present have discussed the syllabi and model question papers (Theory and Practical) related to I to VI semesters in Microbiology and made the following Resolutions.

Resolution I: Resolved to implement the Four-year honours degree programme in microbiology from the academic year 2025-26.

Resolution II: Resolved to implement the single major system prescribed by APSCHE in the four years honours degree programme.

Resolution III: Resolved to follow three major CBCS system for the third-year students.

Resolution IV: Resolve to offer Microbiology minor from the academic year 2025-26

Resolution V: Resolved to continue 50% external and 50% internal marks for theory for all semesters from the academic year 2025-26. 50 marks are allotted for practicals.

Resolution VI: For the 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.

Resolution VII: Resolved to conduct I mid examination in offline mode at college level and II mid examination is conducted in online mode at department level.

Resolution VIII: Resolved to follow the question paper pattern and CIA as per the structure given in the proceedings

Resolution IX: Resolved to implicate CSP (Community service project) by the end of I Year, second internship after second year and OJT in the sixth semester as prescribed by APSCHE.

Resolution X: It is mandatory that each student has to complete one MOOCS course from SWAYAM per year.

Resolution XI: Resolved to follow the benchmark of 75% attendance to appear in the Examinations without the payment of fine.

Resolution XII: Resolve to adapt skill enhancement course – Elective papers 6A/7A or 6B/7B or 6C/7C in the V semester.

Resolution XIII: Resolved to continue the same paper setters and examiners for all the semesters.

New Courses Introduced For all the Programs offered By Department of Microbiology During the year 2025-2026

S. No.	Title of the New course Introduced	Program in which it is Introduced	Introduced in I/II/III YR
1.	Eukaryotic microorganisms	Microbiology Major	II
2.	Biomolecules & Enzymology	Microbiology Major	II
3.	Microbial and Analytical Techniques	Microbiology Major	II
4.	Cell Biology and Genetics	Microbiology Major	II
5.	Molecular Biology and Microbial Genetics	Microbiology Major	II
6.	Microbial Physiology and Metabolism	Microbiology Major	II
7.	r DNA technology, Biostatistics& Bioinformatics	Microbiology Major	II
8.	Immunology & Medical Microbiology	Microbiology Major	III
9.	Pharmaceutical Microbiology	Microbiology Major	III
10.	Applied Microbiology	Microbiology Major	III
11.	Diagnostic Microbiology	Microbiology Major	III

12.	Industrial Microbiology	Microbiology Major	III
13.	Agricultural Microbiology	Microbiology Major	III
14.	Food and Dairy Microbiology	Microbiology Major	III
15.	Environmental Biotechnology	Microbiology Major	III

Chairperson
Board of Studies

P.R. GOVERNMENT COLLEGE (AUTONOMOUS)
KAKINADA
DEPARTMENT OF MICROBIOLOGY

PROGRAM OUTCOMES

Aim and objectives of UG program BSc Microbiology

POI: Graduates will acquire adequate knowledge and leadership skills for a successful career

PO2: Graduates will be able to analyze and solve biology-based problems.

PO3: Graduates will cooperate with each other to solve problems with creative thinking.

PO4: Graduates will acquire practical skills- plan & execute experimental techniques independently as well as to analyze & interpret data.

POS: Graduates will effectively be able to manage resources & time.

PO6: Graduates will be able to learn independently and develop critical thinking.

PO7: Graduates will accomplish ability to communicate effectively and able to understand ethical responsibility.

PO8: Graduates will get adequate knowledge to use information & communication technology.

PO9: Graduates will carry on to learn and to adapt in a world of constantly evolving technology.

P.R. GOVERNMENT COLLEGE (AUTONOMOUS)

KAKINADA

DEPARTMENT OF MICROBIOLOGY

PROGRAM SPECIFIC OUTCOMES

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

PSO1: Acquire knowledge on fundamentals of Microbiology

PSO2: Understand details of bacterial, fungal, algal and viral morphology and physiology.

PSO3: Competently be able to cultivate and characterize bacterial and fungal forms.

PSO4: Grasp the fundamental concepts of immunity and the contribution of organs and cellsin the development of immune response.

PSO5: Gain insight into the various aspects of microbial genetics.

PSO6: Be proficient on cloning vectors and rDNA technology.

PSO7: Assimilate technical skills on microbial genetics and molecular biology.

PSO8: Realize the application-oriented aspects of Microbiology.

PSO9: Understand the concepts and development of microbial diseases in animals & plants.

PSO10: Realize the principles of prevention and treatment of microbial diseases.

P.R.GOVERNMENT COLLEGE(A)

KAKINADA.

DEPARTMNENT OF MICROBIOLOGY

BUDGET ESTIMATION FOR THE ACADEMIC YEAR-2025-26

S.NO	NAME OF THE DEPARTMENT	BUDGET ESTIMATION	TOTAL AMOUNT
1.	MICROBIOLOGY	Guest Faculty – 14,400X 10 months	1,44,000
2.		Lab Equipment	
3.		Consumable	30,000.00
4.		Non-consumable	2,00,000.00
5.		Seminar	1,00,000.00
6.		Guest Lecture	10,000.00
7.		Field Trip/ Tour	50,000.00
8.		AMC for Lab	50,000.00
9.		Certificate Course	30,000.00
10.		Seed money	1,00,000.00
11.		Furniture	1,00,000.00
12.		Stationary	10,000.00
13.		Computers and peripherals	65,000.00
14.		Books	30,000.00

Dr. D. Aruna
University Nominee

G.P.Chakravathi
Head of Department

P.R. GOVERNMENT COLLEGE(A) KAKINADA.
DEPARTMNENT OF MICROBIOLOGY

Name of the department	S.NO	Semester program	Paper Number & Paper Title	Title of Topics to be added during BOS meeting august 2025	Percentage changes made in syllabus	Justification per each topic added	Justification per each topic deleted
MICROBIOLOGY	1	Sem V	12A	Unit III Removed Invasion, pathogen Removed Botulism Candidiasis Hepatitis -A Unit IV DNA probes	5%	Amebiasis dengue fever Cholera Hepatitis-B Agglutination	-
MICROBIOLOGY	2	Sem V	14A Industrial Microbiology (Major 3)	CRISPR-Cas technology: A Brief overview (Unit II: Strain Improvement)	5%	CRISPR-Cas Is an advanced microbial genome editing tool; Highly relevant to strain improvement and synthetic biology synthetic biology strengthens employability in biotech and pharma R&D.	-

BOS CHANGES-AY 2025-2026

Pithapur Rajah's College (A), Kakinada
Department of Microbiology
BOS 2025-26 Minutes

The BOS meeting of Microbiology course is held on 07-08-2025 at Department of Microbiology, 11:00 am onwards. The BOS committee members have actively participated in the discussion and following points were focused

- The third and fourth semester syllabus of Microbiology major course is discussed and the university nominee Dr. A. Aruna suggested to remove some repeated topics in course 4 of second semester.

- She also suggested to teach the common topics of first semester at the basic level to all the life science students.

P.R.GOVERNMENT COLLEGE(A)

KAKINADA.

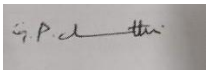
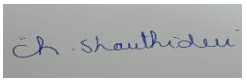
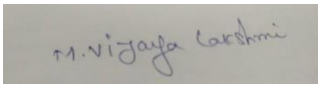
DEPARTMNENT OF MICROBIOLOGY

BOARD OF STUDIES MEETING 2025-2026
CHOICE BASED CREDIT SYSTEM

Time: 11AM Date 07-08-2025

Venue: Department of MICROBIOLOGY

The board on studies meeting of the department of microbiology took place at 11am 07-08-2025 in the Department of microbiology P.R govt college, (A) Kakinada for the year 2025-26 the following members attended.

SI.NO	Name and affiliation	Designation	Signature
1	G.P. Chakravarthi Head of Department of Microbiology P R college (A) Kakinada	Chairperson	
2	Dr. A. Aruna Asst. professor Dept. of microbiology SRR & CVR college Vijayawada	University Nominee	
3	Shanthi devi CH Dr VSK degree college Visakhapatnam	Subject Expert	
4	Dr. Vijay Lakshmi Industrial Nominee Staya scans	Industrial Nominee/Research Expert	

5	Dr. Ch.S Sudhakar	Member	
7	Sri Lakshmi	Student Alumni	
8	P Mahendra	Student member	
9	V Nagendra	Student Member	

P.R. GOVERNMENT COLLEGE (A), KAKINADA
BOS Meeting 2025-2026
Microbiology
List of Paper Setters& Examiners

S.NO	Name of the Lecturer	Papers	College
1	Dr.Ch. Shanthi Devi Lecturer in Microbiology 9052177822	ALL	Asst. professor Department of Microbiology Dr.V.S.Krishna Govt College Visakhapatnam
2	Smt. P.Sudha Rani Lecturer in Microbiology 6301096643	ALL	Head. Department of Microbiology Govt Degree College Male (A) Srikakulam Dr.B.R.Ambedkar University
3	B. Preethi chandrakala Lecturer in Microbiology	ALL	Rajeev Gandhi Institute of Sciences Kakinada
4	Smt. T. Sony 8328032673	ALL	Head of the Department of Microbiology, Govt. college (A) Rajamahendravaram
5	Dr.Ch.Lalitha Lecturer in Microbiology 9491331865	ALL	Asst. Professor department of Microbiology Govt Degree College Women(A), Srikakulam Dr.B.R.Ambedkar University
6	Dr. D. Aruna Lecturer in Microbiology	ALL	SRR & CVR Government college Vijayawada 9490040657
7	Dr. T. Varalakshmi Lecturer in Microbiology	ALL	Visakha Government degree college for women Visakhapatnam
8	Dr. A.Jyothi Lecturer in Microbiology 8179393442	ALL	Head of the Department of Microbiology Govt Degree College(W) Visakhapatnam Andhra University
9	Dr Ch. Madhavi Lecturer in Microbiology	ALL	CDC Anantapur 9908658952

SEMESTER-I

COURSE 1: INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY

Theory **Credits: 3** **3 hrs/week**

I. Course Objectives:

1. To understand the historical development of microbiology, major contributions of key scientists, microbial classification systems, and the scope of microbiology.
2. To learn the general characteristics of bacteria, Archaea, Actinomycetes, and Viruses including the replication of Bacteriophage T2 and HIV.
3. To comprehend the general characteristics of microalgae, focusing on key genera like *Chlorella*, *Dunaliella*, and *Spirulina*.
4. To gain knowledge on general characteristics of fungi, with special emphasis on *Saccharomyces* and *Aspergillus*.
5. To understand the general characters and importance of protozoa, with focus on representative genera like *Amoeba* and slime molds.

II. Course Outcomes: On completion of this course students will be able to

1. Explain the important historical milestones, describe classification systems, differentiate prokaryotic and eukaryotic microorganisms, and list applications of microbiology.
2. Explain the general characters and significance of prokaryotic microorganisms and viruses, and describe the replication mechanisms of Bacteriophage T2 and HIV.
3. Describe the general characters and applications of microalgae and explain their economic importance.
4. Describe morphology of fungi, reproductive mechanisms and explain the economic importance of fungi.
5. Explain the general characters of protozoa and their significance in ecosystems, medicine, and scientific research.

III. Syllabus of Theory:

Unit 1: History and classification of Microbiology

10hrs

1.1 Development of microbiology as a discipline, Spontaneous generation vs. biogenesis, Contributions of Anton von Leeuwenhoek, Louis Pasteur, Robert Koch, Alexander Fleming, Ivanowsky.

1.2 Systems of classification: Binomial Nomenclature; Whittaker's five kingdom Classification; Carl Woese's three kingdom classification systems, Concept of Species, Taxa, and Strain;

1.3 Brief note on Bergey's Manual of Systematic Bacteriology; Difference between prokaryotic and eukaryotic microorganisms; Definition and scope of Microbiology: Applications of Microbiology.

Unit 2: Prokaryotic microorganisms and Viruses

10hrs

2.1 General characteristics of bacteria and archaea: distribution, occurrence, morphology, reproduction and economic importance.
2.2 General characteristics of Viruses with emphasis on discovery of viruses, Nature and definition of viruses, morphology, reproduction and a brief note on Cultivation of Viruses
2.3. General features of Viral Replication; Structure and multiplication of Bacteriophage T2 and HIV

Unit 3: Microalgae

8hrs

3.1 General characteristics of algae: occurrence, morphology, habitat, ecological distribution, photosynthetic pigments, food reserves, reproduction and role in aquatic ecosystems
3.2 Morphology, reproduction, ecological significance and applications of a) **Chlorella** (Chlorophyceae) and b) **Spirulina** (Cyanophyceae).
3.3 Economic Importance of Microalgae: Biofertilizers, Biofuels, Pharmaceuticals, Food supplements, Wastewater treatment, Carbon dioxide sequestration, algal polysaccharides.

Unit 4: Fungi

9hrs

4.1 Habitat, distribution, nutritional requirements, fungal cell ultra- structure, fungal wall, Outline classification of Fungi
4.2 Important Microfungi: Morphology and structure, reproduction and applications of a) Saccharomyces (Ascomycota – Yeast) and b) Aspergillus (Ascomycota)
4.3 Economic importance of fungi: in agriculture, food, industry, medicine.

Unit 5: Protozoa

8 hrs

5.1 General Characteristics of Protozoa: Morphology, Nutrition, reproduction, Habitat and ecological role
5.2 Important Protozoa: Morphology, locomotion, nutrition, reproduction, Ecological role of a)Amoeba and b) Slime Molds
5.3 Economic Importance of Protozoa (in ecosystems, waste management, soil fertility, research and Protozoa as pathogens).

SEMESTER-I

COURSE 1: INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY

Practical **Credits: 1** **2 hrs/week**

I. Course objectives:

1. To learn preparation of culture media and techniques for isolation, identification, and preservation of fungi and algae.
2. To observe vegetative and reproductive structures of key fungal genera through slide preparations.
3. To study host-pathogen interaction and slime mold structures.

II. Laboratory/Field exercises:

1. Study of viruses (Bacteriophage, TMV and HIV) using micrographs
2. Preparation of Potato Dextrose Medium.
3. Isolation and identification of pathogenic and non-pathogenic fungi.
4. Study of host-pathogen interaction.
5. Study of the vegetative and reproductive structures of following genera through temporary and permanent slides: *Mucor, Saccharomyces, Penicillium, Agaricus* and *Alternaria*
6. Purification and preservation of pure cultures of common algae and fungi.
7. Observe prepared slides of slime mold structures.

COMMON QUESTION PAPERPATTERN TO BE FOLLOWED FOR 2021-22AB, 2022-23AB AND 2023-24AB (FOR CORE SUBJECTS)

SEMESTER -I

Course: 1 **Introduction to Microbiology and Microbial Diversity**

Time: 2 Hours **Max Marks: 50M**

Section -I

Answer any three of the following questions. Must attempt atleast one question from each part.

Each question carries 10 Marks. **3 X 10 = 30M**

Part – A

1. Essay question from UNIT- I
2. Essay question from UNIT- II
3. Essay question from UNIT- III

Part - B

4. Essay question from UNIT- IV
5. Essay question from UNIT- V
6. Essay question from any one of the five Units based on its weightage in the Syllabus.

Section II

Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M

7. Short Answer Question from UNIT-I
8. Short Answer Question from UNIT- II
9. Short Answer Question from UNIT- III
10. Short Answer Question from UNIT- IV
11. Short Answer Question from UNIT- V
12. Short answer question from any one of the five Units based on its weightage in the Syllabus.
13. Short answer question from any one of the five Units based on its weightage in the Syllabus

CIA structure for Single Major system

- Out of 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- I mid examination is to be conducted in offline mode at college level and II mid examination is to be conducted in online mode at department level.
    - I mid examination to be conducted in offline mode in which the student should attempt **one essay** question for ten marks out of two questions, **two short** answer questions with five marks each out of four questions and five objective questions to be given for each paper.
    - Question paper is to be given as per the following structure for the courses with **4 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question(5 M)	Objective Questions(1M)
1	I	1	0	1
2	II	1	0	1
3	III	0	2	1
4	IV	0	2	1+ one question from anyunit with more syllabus weightage

- For I mid examination to be conducted in offline mode, Question paper is to begiven as per the following structure for the courses with **5 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question(5 M)	Objective Questions(1 M)
1	I	1	0	1
2	II	1	0	1
3	III	0	1	1
4	IV	0	1	1
5	V	0	1+ one question from any unit(III or IV or V) with more syllabus weightage	1

- The remaining 25 marks for CIA are allocated as per the following structure.

Project-10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M

P R GOVERNMENT DEGREE COLLEGE (A); KAKINADA

I B.sc -Microbiology/I Semester End (W.E.F.2025-2026)

COURSE 1 :- INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY

BLUE PRINT

PART-I

Answer any three questions by attempting at least one question form each section

SECTION–A **3X10=30Marks**

1. Write a short note on contributions of Scientists to the field of Microbiology given below.
   a) Antony Van Leeuwenhoek.
   b) Louis Pasteur.
2. Explain Reproduction in viruses.
3. Write a short note on given below important Algae.
   a) Chlorella
   b) Spirulina.

SECTION–B

4. Explain Outline classification of Fungi.
5. Discuss General Characteristics of Protozoa.
6. Write a brief note on Cultivation of viruses.

PART–II

Answer any Four Questions from the following **4X5=20Marks**

7. Difference between Prokaryotic and Eukaryotic Microorganisms.
8. Discuss General characteristics of Bacteria and Archeae.
9. Discuss economic importance of microalgae.
10. Explain fungal cell ultra structure.
11. Write a brief note on Amoeba.
12. Explain concept of Binomial nomenclature.

SEMESTER-I

COURSE 2: PRINCIPLES OF BACTERIOLOGY & MICROBIAL TECHNIQUES

Theory **Credits: 3** **3 hrs/week**

I. Course objectives:

1. To understand the structure and function of prokaryotic cell components and their response to antibiotics.
2. To learn the key characteristics and ecological significance of Photosynthetic bacteria, Gliding bacteria, Mycoplasma, Fermentative bacteria, and Extremophiles.
3. To equip students with an understanding of microscopy principles, techniques, and staining methods used in microbiology.
4. To gain the knowledge of sterilization, disinfection, and various physical and chemical methods for microbial control.
5. To impart practical knowledge of pure culture techniques, maintenance, preservation methods in microbiology.

II. Course Outcomes: On completion of this course students will be able to:

1. Describe bacterial cell structure and explain effects of antibiotics on the cell wall.
2. Identify and describe the important features of Photosynthetic bacteria, Myxobacteria, Mycoplasma, Fermentative bacteria, Methanogens, and Halobacteria.
3. Gain insights into various microscopy techniques and apply simple and differential staining in bacterial observation.
4. Comprehend the principles, methods, and applications of sterilization and disinfection.
5. Comprehend methods for isolating and preserving pure cultures, and techniques for cultivating anaerobic and viable non-culturable bacteria.

III. Syllabus of Theory:

Unit 1 Cell organization **9 hrs**

1.1 Cell size, shape and arrangement, glycocalyx, capsule, flagella, fimbriae and pili. Cell wall: Composition and detailed structure of Gram-positive and Gram-negative cell walls.

1.2 Cell Membrane: Structure, function and chemical composition of bacterial cell membranes; Differences between eubacteria and archaebacteria;

1.3 Cytoplasm: Ribosomes, mesosomes, inclusion bodies, nucleoid, chromosome and plasmids, Endospore; Effect of antibiotics and enzymes on the cell wall: sphaeroplasts, protoplasts, and L-forms.

Unit 2 Type studies of Bacteria and Archaea **9 hrs**

2.1 Salient features of: a) Photosynthetic bacteria - Purple bacteria, Green bacteria and Anabaena b) Gliding bacteria - Myxobacteria

2.2 Salient features of a) Miscellaneous bacteria: Mycoplasma; b) Salient features of Fermentative bacteria

2.3 Salient features of Extremophiles- a) Methanogens and Halobacteria.

Unit 3 Basics of Microscopy

9hrs

3.1 Light Microscopy: Bright-Field Microscope- Principle, Components, Operation, resolution and Applications; Principle of Dark-field, Phase contrast and fluorescent microscopes.

3.2 Electron microscope: Principle, Components, resolution and Applications of Scanning and Transmission Electron Microscopes.

3.3 Staining Techniques – Types and properties of dyes; Simple and negative staining; Differential staining techniques- Gram staining, spore staining,

Unit 4 **Sterilization and disinfection techniques** **9hrs**

4.1 Definitions of Sterilization, Disinfection, Antiseptic, Germicide, Sanitizer, Fungicide, Virucide, Bacteriostatic and Bactericidal agent.

4.2 Physical methods of microbial control: Dry heat-Incineration, Hot air oven; Moist heat- Pressure cooker, autoclave; Filter sterilization- laminar air flow, Membrane filter; Radiation methods – UV rays, Gamma rays.

4.3 Chemical methods of microbial control: disinfectants, types and mode of action- alcohols, aldehydes, fumigants, phenols, halogens and heavy metals.

Unit 5 **Microbiological techniques** **9hrs**

5.1 Pure culture isolation: Serial dilution, enrichment culturing technique, plating methods, micromanipulator;

5.2 Maintenance and preservation/stocking of pure cultures: sub culturing, overlaying cultures with mineral oils, lyophilization, sand cultures, storage at low temperature, Culture collection Centers (MTCC, ATCC, DSMZ).

5.3 Cultivation of anaerobic bacteria; Accessing Viable non-culturable bacteria (VNBC).

IV. Reference Books:

1. Alcomo, I. E. (2001). *Fundamentals of Microbiology* (6th ed.). Jones and Bartlett Publishers.

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SEMESTER-I

COURSE 2: PRINCIPLES OF BACTERIOLOGY & MICROBIAL TECHNIQUES

Practical **Credits: 1** **2 hrs/week**

I. Course objectives:

1. To gain practical skills in bacterial isolation, pure culture techniques, and visualization using different microscopy methods.
2. To comprehend and perform basic staining techniques, including Gram, simple, and negative staining, and observe bacterial structures such as motility and capsules.
3. To learn sterilization methods for media and glassware and apply aseptic techniques in microbiological experiments.

II. Laboratory/Field exercises:

1. Isolation of bacteria using Winogradsky column and observation
2. Study of bright field, dark field and phase contrast, Electron microscope micrographs to visualize
3. microbial cells.
4. Simple staining & Negative staining.
5. Gram's staining.
6. Observation of motility and capsule in bacteria
7. Determination of bacterial cell size by the technique Micrometry.
8. Sterilization of medium using Autoclave, Sterilization of glassware using Hot Air Oven.
9. Isolation of pure cultures of bacteria by streaking method.
10. Isolation of bacteria from natural habitat by spread and pour plate method (using serial dilution method)

COMMON QUESTION PAPERPATTERN TO BE FOLLOWED FOR 2021-22AB, 2022-23AB AND 2023-24AB (FOR CORE SUBJECTS)

SEMESTER -I

Course: 2 **Principles of Bacteriology and Microbial Techniques**

Time: 2 Hours **Max Marks: 50M**

Section -I

Answer any three of the following questions. Must attempt atleast one question from each part.

Each question carries 10 Marks. **3 X 10 = 30M**

Part – A

1. Essay question from UNIT- I
2. Essay question from UNIT- II
3. Essay question from UNIT- III

Part - B

4. Essay question from UNIT- IV
5. Essay question from UNIT- V
6. Essay question from any one of the five Units based on its weightage in the Syllabus.

Section II

Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M

7. Short Answer Question from UNIT-I
8. Short Answer Question from UNIT- II
9. Short Answer Question from UNIT- III
10. Short Answer Question from UNIT- IV
11. Short Answer Question from UNIT- V
12. Short answer question from any one of the five Units based on its weightage in the Syllabus.
13. Short answer question from any one of the five Units based on its weightage in the Syllabus.

CIA structure for Single Major system

- Out of 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- I mid examination is to be conducted in offline mode at college level and II mid examination is to be conducted in online mode at department level.
    - I mid examination to be conducted in offline mode in which the student should attempt **one essay** question for ten marks out of two questions, **two short** answer questions with five marks each out of four questions and five objective questions to be given for each paper.
    - Question paper is to be given as per the following structure for the courses with **4 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question(5 M)	Objective Questions(1M)
1	I	1	0	1
2	II	1	0	1
3	III	0	2	1
4	IV	0	2	1+ one question from anyunit with more syllabus weightage

- For I mid examination to be conducted in offline mode, Question paper is to begiven as per the following structure for the courses with **5 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question(5 M)	Objective Questions(1 M)
1	I	1	0	1
2	II	1	0	1
3	III	0	1	1
4	IV	0	1	1
5	V	0	1+ one question from any unit(III or IV or V) with more syllabus weightage	1

- The remaining 25 marks for CIA are allocated as per the following structure.

Project-10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M

PR GOVERNMENT DEGREE COLLEGE (A); KAKINADA

I B.sc -Microbiology/I Semester End (W.E.F.2025-2026)

COURSE 2 :- INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY

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SECTION–A

PART-I

Answer any three questions by attempting at least one question form each section 3X10=30Marks

1. Explain about cell membrane and its structure, function in chemical composition
2. Silent features of extremophiles
    a) Methanogens.
    b) Halobacteria.
3. Write about bright field microscope and its principles.

PART–II

4. Explain about physical sterilization.
5. Write a Brief note on pure culture isolation.
6. Explain the process of simple staining and negative staining.

SECTION–B

Answer any Four Questions from the following 4X5=20Marks

7. Write a short note on mesosomes?
8. Give a note on gliding bacteria.
9. Explain differential staining.
10. Write about autoclave.
11. Write a short note on lyophilization.
12. Differences between eubacteria and archaebacteria .

II SEMESTER

COURSE 3: - INTRODUCTION TO MICROBIOLOGY

Credits 3

Course Outcomes:

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

1. Understand the historical significance of microbiology and the contributions of key scientists.
2. Recognize the classification of microorganisms and their place in the living world.
3. Comprehend the scope and applications of microbiology, including the origin of microbial life and the distinction between eukaryotic and prokaryotic cells.
4. Describe the characteristics of bacteria, archaea, fungi, algae, and protozoa.
5. Describe viruses, including their nature, composition, and diversity in structure.
6. Develop practical skills in aseptic techniques, growth media preparation, isolation methods, and the identification of bacteria and fungi.

Unit - 1: History of Microbiology **No. of Hours: 10**

1. Discovery of Microscope and microbial world by Anton von Leeuwenhoek; Aseptic techniques with reference to Charak Samhita, Sushruta Samhita and Ignaz Philipp Semmelweis

2. Golden era of Microbiology- Refutation of abiogenesis; Germ theory of Disease; Discovery of vaccination; Discovery of penicillin

3. Major contributions of Scientists: Ivanowsky, Martinus Beijerinck and Sergei Winogradsky

Unit - 2: Place of Microorganisms in the living world **No. of Hrs:10**

1. Haeckel's three Kingdom concept, Whittaker's five kingdom concept, three domain concept of Carl Woese

2. Definition and scope of Microbiology; Applications of Microbiology; Diverse groups of Microorganisms

3. Origin of microbial life on earth- Timeline, Miller's Experiment, endosymbiosis (cyanobacteria), distinguishing features of eukaryotic and prokaryotic cell

Unit - 3: Prokaryotic microorganisms and Viruses No. of Hrs:10

3.1. General characteristics of Bacteria (Morphology, metabolic diversity and reproduction).
3.2. General characteristics of Archaea differentiating them from Bacteria
3.3. General characteristics of viruses (Nature, composition, size, host specificity, diversity in structure)

Unit - 4: Eukaryotic microorganismsNo. of Hours: 10

1.1. Fungi - Habitat, nutrition, vegetative structure and modes of reproduction;
1.2. Algae- Habitat, thallus organization, photosynthetic pigments, storage forms of food, reproduction.
1.3. Protozoa–Habitat, cell structure, nutrition, locomotion, excretion, reproduction, encystment.

Unit - 5: Growing Microbes in Lab: Five I'sNo. of Hours:05

5.1. Inoculation-Aseptic methods of introducing inoculum to growth media;Composition of basic growth media, solid and liquid

5.2. Incubation and Isolation- Ambient temperature for growth of microorganisms;Concept of Pure culture, mixed culture and contaminated culture

5.3. Inspection and Identification - Observation of colour, size and shape of colonies;Wet mount and simple staining of bacteria and fungi

References:

1. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993). Microbiology. 5thEdition, Tata McGraw Hill Publishing Co., Ltd., New Delhi.
2. Dube, R.C. and Maheswari, D.K. (2000) General Microbiology. S Chand,New Delhi. Edition), Himalaya Publishing House, Mumbai.
3. Prescott, M.J., Harley, J.P. and Klein, D.A. (2012). Microbiology. 5thEdition, WCB McGraw Hill, New York.
4. Reddy, S.M. and Reddy, S.R. (1998). Microbiology Practical Manual, 3 rd Edition, Sri Padmavathi Publications, Hyderabad.
5. Singh, R.P. (2007). General Microbiology. Kalyani Publishers, New Delhi.
6. Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). General Microbiology,5th Ed.,Prentice Hall of India Pvt. Ltd., New Delhi.
7. Jaya Babu (2006). Practical Manual on Microbial Metabolisms and General Microbiology. Kalyani Publishers, New Delhi.
8. Gopal Reddy et al., Laboratory Experiments in Microbiology

II SEMESTER

COURSE 3: - INTRODUCTION TO MICROBIOLOGY

credits -_1

1. Good Laboratory Practices and Biosafety
2. Compound Light microscope -Parts and its handling
3. Microscopic observation of bacteria, Algae and Fungi and protozoa
4. Observation of electron micrographs of viruses (Lambda, T4, TMV, HIV, SARS CoV-2, Polio)
5. Laboratory equipment -Working principles of Autoclave, Hot air oven, Laminar airflow chamber

Co-Curricular Activities:

1. Establish a Microbiology Club where students can come together to discuss andexplore various topics related to microbiology.
2. Organizing microbiology-themed events like microbiologyday
3. Poster presentations, oral presentations, and Q&A sessions.
4. Field Trips to Microbiology-related Sites
5. Establish a Microbiology Journal Club where students can review and discussscientific articles related to microbiology.

COMMON QUESTION PAPERPATTERN TO BE FOLLOWED FOR 2021-22AB, 2022-23AB AND 2023-24AB (FOR CORE SUBJECTS)

SEMESTER -II

Course: 3 INTRODUCTION TO MICROBIOLOGY

Time: 2 Hours **Max Marks: 50M**

Section -I

Answer any three of the following questions. Must attempt atleast one question from each part.

Each question carries 10 Marks. **3 X 10 = 30M**

Part – A

1. Essay question from UNIT- I
2. Essay question from UNIT- II
3. Essay question from UNIT- III

Part - B

4. Essay question from UNIT- IV
5. Essay question from UNIT- V
6. Essay question from any one of the five Units based on its weightage in the Syllabus.

Section II

Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M

7. Short Answer Question from UNIT-I
8. Short Answer Question from UNIT- II
9. Short Answer Question from UNIT- III
10. Short Answer Question from UNIT- IV
11. Short Answer Question from UNIT- V
12. Short answer question from any one of the five Units based on its weightage in the Syllabus.
13. Short answer question from any one of the five Units based on its weightage in the Syllabus.

SEMESTER -II
Course: 3 INTRODUCTION TO MICROBIOLOGY

Time: 2 Hours **Max Marks: 50M**

Section -I

Answer any three of the following questions. Must attempt atleast one question from each part.

Each question carries 10 Marks. **3 X 10 = 30M**

Part – A

1. Describe about Golden era of Microbiology.
2. Write an essay on scope and applications of Microbiology.
3. Distinguish general characteristics of Archae from Bacteria.

Part - B

4. Explain general characteristics of Viruses.
5. Define Growth media. Explain different types and composition of growth media.
6. Explain general characteristics of Fungi.

Section II

Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M

7. Louis Pasteur
8. Carl Woese classification
9. Archae
10. Thallus organization
11. Wet mount technique
12. Simple staining
13. Winogradsky

CIA structure for Single Major system

- Out of 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- I mid examination is to be conducted in offline mode at college level and II mid examination is to be conducted in online mode at department level.
    - I mid examination to be conducted in offline mode in which the student should attempt **one essay** question for ten marks out of two questions, **two short** answer questions with five marks each out of four questions and five objective questions to be given for each paper.
    - Question paper is to be given as per the following structure for the courses with **4 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1M)
1	I	1	0	1
2	II	1	0	1
3	III	0	2	1
4	IV	0	2	1+ one question from anyunit with more syllabus weightage

- For I mid examination to be conducted in offline mode, Question paper is to begiven as per the following structure for the courses with **5 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1 M)
1	I	1	0	1
2	II	1	0	1
3	III	0	1	1
4	IV	0	1	1
5	V	0	1+ one question from any unit(III or IV or V) with more syllabus weightage	1

- The remaining 25 marks for CIA are allocated as per the following structure.

Project-10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M

II SEMESTER

COURSE 4: - BACTERIOLOGY AND VIROLOGY

Credits -_3

I. Learning Outcomes:

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

1. Understand the concept of prokaryotic diversity and taxonomy.
2. Identify and describe the salient features of various bacterial groups
3. Comprehend the discovery, nature, and definition of viruses.
4. Describe the replication processes of specific viruses
5. Comprehend the concept of oncogenic viruses, and role of viruses in the ecosystem.

Unit -1: Bacterial Taxonomy and Ultrastructure No. of Hrs: 9

1. Introduction to prokaryotic diversity and taxonomy. Types of classification-Numerical and Phylogenetic
2. Introduction to Bergy's manual of Systematic Bacteriology
3. Non-Culturables and Metagenomics
4. Ultrastructure of a Bacterial Cell-Invariable components -cell wall, Structure and /Functions of cell membrane, cytoplasm, nucleoid; Variable components- plasmid, inclusion bodies, flagella (structure and arrangement), pili, capsule, endospore.

Unit - 2: Type studies of Bacteria and Archae No. of Hours:9

1. Salient features of:

a) Photosynthetic bacteria - Purple bacteria, Green bacteria and *Anabaena*

b) Gliding bacteria - Myxobacteria and Cytophaga group

c) Filamentous -Actinomycetes

d) Spore forming bacteria - Bacillus and Clostridia

e) Miscellaneous - Mycoplasma, Rickettsia, Chlamydia

2. Salient features of Fermentative bacteria, Sulphur bacteria, Nitrogen fixing bacteria
3. Salient features of Extremophiles- Methanogens and halobacteria.

Unit - 3: General Properties and Classification of Viruses No. of Hrs:9

1. Discovery of viruses, Nature and definition of viruses, general properties
2. Hierarchy of ICTV nomenclature

3. Outline of Baltimore system of classification.
4. Cultivation of Viruses, Virus Purification and Assay.

Unit - 4: Replication of Viruses No. of Hours:9

1. General features of Viral Replication
2. Replication of T4, lambda, TMV, HIV
3. Replication of Polio, Influenza, Adeno Viruses

Unit - 5: Pathogenic and other Viruses No. of Hours:9

1. Defective Viruses- viroids, virusoids, satellite viruses and Prions.
2. Emergence of Viral Pathogens, Introduction to Oncogenic viruses, Concept of Oncogenes and Protooncogenes
3. Role of viruses in Ecosystems; Applications in Biotechnology

COURSE 4: - BACTERIOLOGY AND VIROLOGY credits -1

1. Study of bacteria by colony observation and staining-simple, gram
2. Observation of motility and capsule
3. Isolation of bacteria using Winogradsky column and observation
4. Study of viruses (Bacteriophage, TMV and HIV) using micrographs
5. Isolation and enumeration of bacteriophages (PFU) from water/sewage sample using double agar layer technique.
6. Studying isolation and propagation of animal viruses by chick embryo technique.
7. Study of cytopathic effects of viruses using photographs.
8. Perform local lesion technique for assaying plant viruses.

Co-Curricular Activities:

1. Invite guest speakers, to provide insights into the latest advancements and emerging trends in bacteriology and virology.

2. Conduct laboratory workshops that allow students to gain hands-on experience in bacterial culture techniques

3. Case Study Competitions: Organize case study competitions where students can work in teams to analyze and solve hypothetical cases related to bacteriology and virology

4. Arrange field trips to microbiology research facilities, such as government labs, industrial settings, or healthcare institutions

References:

1. Prescott, M.J.,Harley,J.P.andKlein,D.A.Microbiology. 5th Edition WCB Mc GrawHill, New York, (2002).
2. Tortora, G.J., Funke ,B.R. and Case, C.L. Microbiology : An Introduction. Pearson Education, Singapore, (2004).
3. Alcomo,I.E.FundamentalsofMicrobiology.VIEdition, JonesandBartlettPublishers.Sudbury.Massachusetts, (2001).
4. BlackJ.G.Microbiology-Principlesand Explorations.JohnWiley&SonsInc.NewYork, (2002).
5. Tom Besty,D.C Jim Koegh.Microbiology Demystified McGRAW-HILL.
6. Christopher Burrell Colin Howard Frederick Murphy. Fenner and White's MedicalVirology 5th Edition.Academic Press

COMMON QUESTION PAPERPATTERN TO BE FOLLOWED FOR 2021-22AB, 2022-23AB AND 2023-24AB (FOR CORE SUBJECTS)

SEMESTER -II

Course: 4 BACTERIOLOGY AND VIROLOGY

Time: 2 Hours **Max Marks: 50M**

Section -I

Answer any three of the following questions. Must attempt at least one question from each part.

Each question carries 10 Marks. **3 X 10 = 30M**

Part – A

1. Essay question from UNIT- I
2. Essay question from UNIT- II
3. Essay question from UNIT- III

Part - B

4. Essay question from UNIT- IV
5. Essay question from UNIT- V
6. Essay question from any one of the five Units based on its weightage in the Syllabus.

Section II

Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M

7. Short Answer Question from UNIT-I
8. Short Answer Question from UNIT- II
9. Short Answer Question from UNIT- III
10. Short Answer Question from UNIT- IV
11. Short Answer Question from UNIT- V
12. Short answer question from any one of the five Units based on its weightage in the Syllabus.
13. Short answer question from any one of the five Units based on its weightage in the Syllabus

SEMESTER -II

Course: 4 BACTERIOLOGY AND VIROLOGY

Time: 2 Hours **Max Marks: 50M**

Section -I

Answer any three of the following questions. Must attempt atleast one question from each part.

Each question carries 10 Marks. **3 X 10 = 30M**

Part – A

1. Describe Ultrastructure of Bacterial cell.
2. Describe the Salient features of Spore forming bacteria.
3. Explain the Baltimore system of classification.

Part - B

4. Give a detailed account of replication of HIV.
5. Explain the role of viruses in Ecosystem and Biotechnology.
6. Give a detailed account of replication of Poliovirus.

Section II

Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M

7. Non culturables
8. Actinomycetes
9. Cultivation of Viruses
10. TMV
11. Oncogenes and Protooncogenes
12. Nitrogen fixing bacteria.
13. Viroids, Satellite virus, Prions

CIA structure for Single Major system

- Out of 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- I mid examination is to be conducted in offline mode at college level and II mid examination is to be conducted in online mode at department level.
    - I mid examination to be conducted in offline mode in which the student should attempt **one essay** question for ten marks out of two questions, **two short** answer questions with five marks each out of four questions and five objective questions to be given for each paper.
    - Question paper is to be given as per the following structure for the courses with **4 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1M)
1	I	1	0	1
2	II	1	0	1
3	III	0	2	1
4	IV	0	2	1+ one question from anyunit with more syllabus weightage

- For I mid examination to be conducted in offline mode, Question paper is to begiven as per the following structure for the courses with **5 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1 M)
1	I	1	0	1
2	II	1	0	1
3	III	0	1	1
4	IV	0	1	1
5	V	0	1+ one question from any unit(III or IV or V) with more syllabus weightage	1

- The remaining 25 marks for CIA are allocated as per the following structure.

Project-10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M

MICROBIOLOGY: MINOR

w.e.f 2024-25 AY

COURSE STRUCTURE

Year	Semester	Course	Title	Hr/ week	credits
I	II	1	Introduction to Microbiology	3	3
			Introduction to Microbiology	2	1
II	III	2	Biomolecules & Enzymology	3	3
			Biomolecules & Enzymology	2	1
	IV	3	Molecular Biology and Microbial Genetics	3	3
			Molecular Biology and Microbial Genetics	2	1
		4	Microbial Physiology and Metabolism	3	3
			Microbial Physiology and Metabolism	2	1
III	V	5	Immunology & Medical Microbiology	3	3
			Immunology & Medical Microbiology	2	1
		6	Applied Microbiology	3	3
			Applied Microbiology	2	1

II SEMESTER

Minor

COURSE 1: - INTRODUCTION TO MICROBIOLOGY

credits -_3

I. Course Outcomes:

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

1. Understand the historical significance of microbiology and the contributions of key scientists.
2. Recognize the classification of microorganisms and their place in the living world.
3. Comprehend the scope and applications of microbiology, including the origin of microbial life and the distinction between eukaryotic and prokaryotic cells.
4. Describe the characteristics of bacteria, archaea, fungi, algae, and protozoa.
5. Describe viruses, including their nature, composition, and diversity in structure.
6. Develop practical skills in aseptic techniques, growth media preparation, isolation methods, and the identification of bacteria and fungi.

Unit - 1: History of Microbiology No. of Hours: 10

1. Discovery of Microscope and microbial world by Anton von Leeuwenhoek; Aseptic techniques with reference to Charak Samhita, Sushruta Samhita and Ignaz Philipp Semmelweis

2. Golden era of Microbiology- Refutation of abiogenesis; Germ theory of Disease; Discovery of vaccination; Discovery of penicillin

3. Major contributions of Scientists: Edward Jenner, Louis Pasteur, Robert Koch, Joseph Lister, Ivanowsky, Martinus Beijerinck and Sergei Winogradsky

Unit - 2: Place of Microorganisms in the living world No. of Hours:10

1. Haeckel's three Kingdom concept, Whittaker's five kingdom concept, three domain concept of Carl Woese

2. Definition and scope of Microbiology; Applications of Microbiology; Diverse groups of Microorganisms

3. Origin of microbial life on earth- Timeline, Miller's Experiment, endosymbiosis (cyanobacteria), distinguishing features of eukaryotic and prokaryotic cell

Unit - 3: Prokaryotic microorganisms and Viruses No. of Hours:10

1. General characteristics of Bacteria (Morphology, metabolic diversity and reproduction)
2. General characteristics of Archaea differentiating them from Bacteria
3. General characteristics of viruses (Nature, composition, size, host specificity, diversity in structure)

Unit - 4: Eukaryotic microorganisms No. of Hours: 10

1. Fungi - Habitat, nutrition, vegetative structure and modes of reproduction;
2. Algae- Habitat, thallus organization, photosynthetic pigments, storage forms of food, reproduction.
3. Protozoa–Habitat, cell structure, nutrition, locomotion, excretion, reproduction, encystment.

Unit - 5: Growing Microbes in Lab: Five I's No. of Hours:05

1. Inoculation-Aseptic methods of introducing inoculum to growth media; Composition of basic growth media, solid and liquid
2. Incubation and Isolation- Ambient temperature for growth of microorganisms; Concept of Pure culture, mixed culture and contaminated culture
3. Inspection and Identification - Observation of colour, size and shape of colonies; Wet mount and simple staining of bacteria and fungi

I. Skill Outcomes:

1. Implement safety protocols, handling hazardous materials, and practicing personal protective measures.
2. Identify microscope parts, adjusting focus and diaphragm, and accurately observing and documenting microscopic images.
3. Prepare smears, identifying different microorganisms, and interpreting microscopic characteristics.
4. Analyze electron micrographs, identifying virus types, and describing their morphology and size.
5. Operate Autoclave, Hot Air Oven, and Laminar Air Flow Chamber for sterilization and decontamination purposes.

SEMESTER- II

COURSE 1: - INTRODUCTION TO MICROBIOLOGY

credits -_1

1. Good Laboratory Practices and Biosafety
2. Compound Light microscope -Parts and its handling
3. Microscopic observation of bacteria, Algae and Fungi and protozoa
4. Observation of electron micrographs of viruses (Lambda, T4, TMV, HIV, SARSCoV-2, Polio)
5. Laboratory equipment -Working principles of Autoclave, Hot air oven, Laminarairflow chamber

II. References:

1. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993). Microbiology. 5thEdition, Tata McGraw Hill Publishing Co., Ltd., New Delhi.
2. ·Dube, R.C. and Maheswari, D.K. (2000) General Microbiology. S Chand,New Delhi. Edition), Himalaya Publishing House, Mumbai.
3. Prescott, M.J., Harley, J.P. and Klein, D.A. (2012). Microbiology. 5thEdition, WCB McGraw Hill, New York.
4. Reddy, S.M. and Reddy, S.R. (1998). Microbiology Practical Manual, 3 rdEdition, Sri Padmavathi Publications, Hyderabad.
5. Singh, R.P. (2007). General Microbiology. Kalyani Publishers, New Delhi.
6. Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). General Microbiology,5th Ed.,Prentice Hall of India Pvt. Ltd., New Delhi.
7. Jaya Babu (2006). Practical Manual on Microbial Metabolisms andGeneral Microbiology. Kalyani Publishers, New Delhi.
8. Gopal Reddy et al., Laboratory Experiments in Microbiology

III. Co-Curricular Activities:

1. Establish a Microbiology Club where students can come together to discuss andexplore various topics related to microbiology.

4. Organizing microbiology-themed events like microbiologyday 3 Poster presentations, oral presentations, and Q&A sessions. Field Trips to Microbiology-related Sites

5. Establish a Microbiology Journal Club where students can review and discussscientific articles related to microbiology.

SEMESTER -II (Minor)
Course: I INTRODUCTION TO MICROBIOLOGY

Time: 2 Hours **Max Marks: 50M**

Section -I

Answer any three of the following questions. Must attempt atleast one question from each part. Each question carries 10 Marks. 3 X 10 = 30M

Part – A

1. Essay question from UNIT- I
2. Essay question from UNIT- II
3. Essay question from UNIT- III

Part - B

4. Essay question from UNIT- IV
5. Essay question from UNIT- V
6. Essay question from any one of the five Units based on its weightage in the Syllabus.

Section II

Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M

7. Short Answer Question from UNIT-I
8. Short Answer Question from UNIT- II
9. Short Answer Question from UNIT- III
10. Short Answer Question from UNIT- IV
11. Short Answer Question from UNIT- V
12. Short answer question from any one of the five Units based on its weightage in the Syllabus.
13. Short answer question from any one of the five Units based on its weightage in the Syllabus

SEMESTER -II (Minor)
Course: I INTRODUCTION TO MICROBIOLOGY

Time: 2 Hours **Max Marks: 50M**

Section -I

Answer any three of the following questions. Must attempt atleast one question from each part. Each question carries 10 Marks. 3 X 10 = 30M

Part – A

1. Describe about Golden era of Microbiology.
2. Write an essay on scope and applications of Microbiology.
3. Distinguish general characteristics of Archae from Bacteria.

Part - B

4. Explain general characteristics of Viruses.
5. Define Growth media. Explain different types and composition of growth media.
6. Explain general characteristics of Fungi.

Section II

Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M

7. Louis Pasteur
8. Carl Woese classification
9. Archae
10. Thallus organization
11. Wet mount technique
12. Simple staining
13. Winogradsky

CIA structure for Single Major system

- Out of 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- I mid examination is to be conducted in offline mode at college level and II mid examination is to be conducted in online mode at department level.
  - I mid examination to be conducted in offline mode in which the student should attempt **one essay** question for ten marks out of two questions, **two short** answer questions with five marks each out of four questions and five objective questions to be given for each paper.
    - Question paper is to be given as per the following structure for the courses with **4 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1M)
1	I	1	0	1
2	II	1	0	1
3	III	0	2	1
4	IV	0	2	1+ one question from anyunit with more syllabus weightage

- For I mid examination to be conducted in offline mode, Question paper is to be given as per the following structure for the courses with **5 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1 M)
1	I	1	0	1
2	II	1	0	1
3	III	0	1	1
4	IV	0	1	1
5	V	0	1+ one question from any unit(III or IV or V) with more syllabus weightage	1

- The remaining 25 marks for CIA are allocated as per the following structure.

Project-10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M

Community Service Project

First internship (After 1st Year Examinations): Community Service Project. To inculcate social responsibility and compassionate commitment among the students, the summer vacation in the intervening 1st and 2nd years of study shall be for Community Service Project (the detailed guidelines are enclosed).

Credit For Course: 04

ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

Assessment methodology for Internships / On the Job Training / Apprenticeship under the revised CBCS (2020 – 21 onwards)

First internship (After 1st year examinations):Community Service Project

To inculcate social responsibility and compassionate commitment among thestudents, the summer vacation in the intervening 1st and 2nd years of study shall be for Community Service Project.

Learning outcomes:

- To facilitate an understanding of the issues that confronts the vulnerable /marginalized sections of the society.
- To initiate team processes with the student groups for societal change.
- To provide students an opportunity to familiarize themselves with urban / ruralcommunity they live in.
- To enable students to engage in the development of the community.
- To plan activities based on the focused groups.
- To know the ways of transforming the society through systematicprogramme implementation.

Assessment Model:

There will be only internal evaluation for this internship. Each faculty member is to be assigned with 10 t0 15 students depending upon availability of the faculty members. The faculty member will act as a faculty-mentor for the group and is in- charge for the learning activities of the students and also for the comprehensive andcontinuous assessment of the students.

The assessment is to be conducted for 100 marks. The number of credits assigned is 4. Later as per the present practice the marks are converted into grades and grade points to include finally in the SGPA and CGPA.

Each student is required to maintain an individual logbook, where he/she is supposed to record day to day activities. The project log is assessed on anindividual basis, thus allowing for individual members within groups to be assessed this way. The assessment will take into consideration the individual student's involvementin the assigned work.

While grading the student's performance, using the student's project log, the following should be taken into account -

a. The individual student's effort and commitment.
b. The originality and quality of the work produced by the individual student.
c. The student's integration and co-operation with the work assigned.
d. The completeness of the logbook.

The assessment for the ***Community Service Project implementation*** shall include the following components and based on the entries of Project Log and Project Report:

a. Orientation to the community development
b. Conducting a baseline assessment of development needs
c. Number and Quality of Awareness Programmes organised on beneficiaryprogrammes and improvement in quality of life, environment and social consciousness, motivation and leadership, personality development,etc.
d. Number Quality and Duration of Intervention/service Programmes (Prevention or promotion programs that aim to promote behavioural change in defined community contexts to address social problems) organised.
e. Followup Programmes suggested (Referral Services, Bringing Community Participation)
f. Developing short and mid-term action plans in consultation with local leadership and local government officers.

The **Project Report** should contain

a) Introduction, scope, objectives, and methodology
b) Project specifications (area / background of the work assigned).
c) Problems identified.
d) Analyses of the problems
e) Community awareness programmes conducted w.r.t the problems and their outcomes.
f) Intervention/service programmes taken up
g) Short-term and long term action plan for implementation
h) Recommendations and conclusions.
i) References

The **Project Presentation** is to be made by the student after he/she reports back to theCollege. The components for assessment are –

a. assessing the involvement in the project
b. presentation skills
c. final outcome of the project as evinced by the student.

For Example:

II MPC-EM

S.No.	Name of the Student	Class & Year of Study	Register Number	Project Log	Project Implementation	Project Report	Presentation	Total
				(20)	(30)	(25)	(25)	(100)

Signature of Nominated faculty **Signature of Project Mentor** **Signature of HOD/ In-Charge**

P R GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

III SEMESTER

COURSE 5: - EUKARYOTIC MICROORGANISMS

credits -_3

Learning outcomes of Course

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

1. Understand the characteristics, classification, andreproductive mechanisms of fungi, algae, and protozoa.
2. Recognize the importance of fungi in biotechnology, including theirroles in food production, medicine, and agriculture.
3. Comprehend the significance of algae in various industries,the environment, and as a source of food.
4. Identify pathogenic protozoa and understand their impact on humanhealth and the environment

UNIT- I: FUNGI **No. of hours: 9**

1. 1. Habitat, distribution, nutritional requirements, fungal cell ultra-structure, fungal wall, Outline classification of Fungi
2. Reproduction in different fungal groups- Phycomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes
3. Heterokaryosi s, heterothallism and parasexual mechanism.
4. Fungal dimorphism (Candida albicans)

UNIT- II : IMPORTANCE OF FUNGI **No. of hours: 9**

1. Role of fungi in biotechnology: food, medicine and pharmaceutical industry (baking, brewing, antibiotics, alcohols, enzymes, organic acids, and pharmaceuticals)
2. Beneficial Role of fungi in Agriculture: Biofertilizers, Myco toxins; Biologicalcontrol (Myco fungicides, Myco herbicides, Myco insecticides).
3. Mushrooms and its cultivation. (White button, Milky and Oyster)
4. Fungi as plant and animal pathogens (Cercospora, Puccinia, Candida,Aspergillus)

UNIT- III: ALGAE **No. of hours: 9**

1. Algae- occurrence, thallus organization, algae cell ultra-structure, pigments,flagella, eyespot food reserves, outline classification
2. Vegetative, asexual and sexual reproduction in Algae
3. Photosynthetic apparatus, and outline of Photosynthesis in Algae

UNIT- IV: Importance and cultivation of Algae **No. of hours: 9**

1. Importance of algae in agriculture, industry, environment and food withexamples.
2. Algal culture techniques- Indoor, Outdoor, Closed, Open, Batch, continuous,Fed batch
3. Culture media and growth parameters for algal cultivation (Spirulina)

UNIT- V: Protozoa **No. of hours: 9**

1. General characteristics with special reference to Amoeba, Paramecium
2. Pathogenic Protozoa- Plasmodium, Leishmania and Giardia
3. Importance of protozoa (in waste management, soil fertility, industry and scientific study)
4. Culturing protozoans from natural sources-Hay water, pond water, Chalkley's solution
5. Haplobiontic (Nemalion), Haplontic (Chlamydomonas), Diplontic (Cladophora), Diplobiontic (Polysiphonia) and Diplohaplontic (Cladophora) life cycles. deleted

Recommended Text Books &Reference books:

1. Alexopoulus, C.J., Mims,C.W. and Blackwel, M, Introductory Mycology.John Wiley,New York.
2. Mehrotra, R.S. and K.R.Aneja An Introduction to Mycology. New AgeInternational press, New Delhi
3. Webster, J. Introduction to fungi. Cambridge University Press. Cambridge, U.K. (1985).
4. Bessey E.A. Morphology and Taxonomy of fungi. Vikas Publishing House Pvt.Ltd.,New Delhi.
5. Jhon Webster and R W S Weber. Introduction to Fungi. Cambridge UniversityPress2007.

6. A. V. S. S. .Sambamurty. A Textbook of Algae. I.K. International PublishingHouse Pvt.Limited, 2010

7. H.D. Kumar and H.N. Singh.A Textbook on Algae (Macmillan international collegeedition)

P R GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

II year B.Sc., Program III Semester End Practical Syllabus

COURSE 5: - EUKARYOTIC MICROORGANISMS

CREDITS: 1

PRACTICAL SYLLABUS

a. Preparation of Potato Dextrose Medium.
b. Isolation and identification of pathogenic and non-pathogenic fungi
c. Study of host-pathogen interaction.
d. Study of the vegetative and reproductive structures of followinggenera through temporary and permanent slides: *Mucor*,*Saccharomyces*, *Penicillium*, *Agaricus* and *Alternaria*
e. Purification and preservation of pure cultures of common algae and fungi.

P.R. GOVERNMENT COLLEGE (A): KAKINADA

II B.Sc - Microbiology / III Semester End (W.E.F. 2021-2022)

COURSE 5: - EUKARYOTIC MICROORGANISMS

w.e.f. 2021-2022 ADMITTED BATCH

BLUE PRINT

PART-I

Answer any three questions by attempting at least one question form each section

SECTION - A **3 X 10 = 30 Marks**

1. Essay question from UNIT- I
2. Essay question from UNIT- II
3. Essay question from UNIT- III

SECTION - B

4. Essay question from UNIT- IV
5. Essay question from UNIT- V
6. Essay question from any one of the five Units based on its weightage in theSyllabus.

PART - II

Answer any Four Questions from the following **4 X 5 = 20 Marks**

7. Short answer question from UNIT - I
8. Short answer question from UNIT - II
9. Short answer question from UNIT - III
10. Short answer question from UNIT - IV
11. Short answer question from UNIT - V
12. Short answer question from any one of the five Units based on its weightagein the Syllabus

SEMESTER - III

COURSE 5: - EUKARYOTIC MICROORGANISMS

Time: 2 Hours **Max Marks: 50M**

Section -I

Answer any three of the following questions. Must attempt atleast one question from each part. Each question carries 10 Marks. **3 X 10 = 30M**

Part – A

1. Outline classification of Fungi.

2. Role of fungi in biotechnology.

3. outline of Photosynthesis in Algae.

Part - B

4. Culture media and growth parameters for algal cultivation.

5. Diplontic life cycle.

6. General characteristics with special reference to Amoeba, Paramecium.

Section II

Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M

7. parasexual mechanism.

8. Biofertilizers.

9. outline classification of algae.

10. Importance of algae in agriculture.

11. Pathogenic Protozoa- Plasmodium.

12. Fungal dimorphism.

13. Diplobiontic lifecycle.

CIA structure for Single Major system

- Out of 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- I mid examination is to be conducted in offline mode at college level and II mid examination is to be conducted in online mode at department level.
- I mid examination to be conducted in offline mode in which the student should attempt **one essay** question for ten marks out of two questions, **two short** answer questions with five marks each out of four questions and five objective questions to be given for each paper.
- Question paper is to be given as per the following structure for the courses with **4 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1M)
1	I	1	0	1
2	II	1	0	1
3	III	0	2	1
4	IV	0	2	1+ one question from anyunit with more syllabus weightage

- For I mid examination to be conducted in offline mode, Question paper is to be given as per the following structure for the courses with **5 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1 M)
1	I	1	0	1
2	II	1	0	1
3	III	0	1	1
4	IV	0	1	1
5	V	0	1+ one question from any unit(III or IV or V) with more syllabus weightage	1

- The remaining 25 marks for CIA are allocated as per the following structure.

Project-10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M

P R GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

II B.Sc., Microbiology - Practical Examinations

Paper I Model at the end of III Semester (w.e.f. 2021-2022)

COURSE 5: - EUKARYOTIC MICROORGANISMS

Time: 3 Hrs. **Max. Marks: 50 M**

1. Major Experiment 20M
2. Minor Experiment 10M
3. Spotters 2 x 5 = 10M
   1) I
   2) II
   3) III
   4) IV
   5) V

4. Record 5M
5. Viva 5M

P R GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

III SEMESTER

COURSE 6: - BIOMOLECULES AND ENZYMOLOGY

credits -_3

I. Course Outcomes:

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

1. Understand the classification and properties of carbohydrates, including monosaccharides, disaccharides, polysaccharides, and sugar derivatives.
2. Gain knowledge of lipids and fatty acids, including their classification, structures, functions, and their role in cell signaling and metabolism.
3. Comprehend the structure and functions of amino acids and proteins, including their primary, secondary, tertiary, and quaternary structures.
4. Learn about the structure and functions of nucleic acids, including DNA and RNA, as well as the concept of base composition and nucleic acid- protein interactions. They will also be introduced to the role of vitamins in metabolism.
5. Understand the structure of enzymes, enzyme classification, and mechanismsof action. They will also learn about the factors influencing enzyme activity and various types of enzyme inhibition.

UNIT-I: Carbohydrates No. of hours: 9

1. General characters and outline classification of Carbohydrates
2. Monosaccharides- Glucose, fructose, ribose; Stereo isomerism of monosaccharides, epimers, mutarotation and anomers of glucose
3. Disaccharides- concept of reducing and non-reducing sugars;Sucrose, Lactose
4. Polysaccharides- Storage -Starch, glycogen, Structural-Cellulose peptidoglycan and chitin
5. Sugar derivatives- glucosamine.

UNIT-II: Lipids and fatty acids No. of hours: 9

1. Definition and classification of lipids. Structure and properties of lipids. Importance of lipids in biological systems.

2. Introduction to fatty acids: definition, structure, and nomenclature. Saturated and unsaturated fatty acids.
3. Triglycerides: structure, function, and metabolism. Phospholipids: structure, function, and role in cell membranes. Steroids: structure, biosynthesis, and physiological roles.Waxes: structure, functions, andapplications.

UNIT-III: Amino acids and Proteins. No. of hours:9

1. Biochemical structure and notation of standard protein amino acids
2. General characteristics of amino acids and proteins.
3. Primary, secondary, tertiary and quaternary structures of Protein
4. Non protein amino acids: Gramicidin, beta-alanine, D-alanine andD- glutamic acid.

UNIT-IV: Nucleic acids and Vitamins No. of hours:9

1. Structure and functions of DNA and RNA.
2. Base composition. A+T and G+C rich genomes. Basic concept ofnucleic acids protein interactions.
3. Concept and types of vitamins and their role in metabolism.

UNIT-V: Enzymes No. of hours: 9

1. Structure of enzyme, Apoenzyme and cofactors, prosthetic group- TPP, coenzyme -NAD, metal cofactors; Definitions of terms – enzymeunit, specific activity and turnover number
2. Classification of enzymes, Mechanism of action of enzymes: active site, transition state complex and activation energy. Lock and key hypothesis, and Induced Fit hypothesis.
3. Effect of pH and temperature on enzyme activity.
4. Inhibition of enzyme activity- competitive, noncompetitive, uncompetitive and allosteric.

RECOMMENDED TEXT BOOKS:

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

2 Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). Principles ofBiochemistry, 2 nd

Edition, CBS Publishers and Distributors, New Delhi.
3. Sashidhara Rao, B. and Deshpande, V. (2007). ExperimentalBiochemistry: A student Companion. I.K. International Pvt. Ltd.
4. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A shortcourse, 2nd ed., W.H.Freeman
5. Voet,D. and Voet J.G (2004) Biochemistry 3rd edition, John Wileyand Sons
6. White, D. (1995). The Physiology and Biochemistry of Prokaryotes,Oxford University Press, New York

P. R. GOVERNMENT COLLEGE (A), KAKINADA

COURSE 6: - BIOMOLECULES AND ENZYMOLOGY

CREDITS: 1

PRACTICAL SYLLABUS

1. Qualitative tests for sugars
2. Qualitative Analysis of Aminoacids.
3. Colorimetric estimation DNA by diphenylamine method.
4. Colorimetric estimation of proteins by Biuret/Lowry method

P.R. GOVERNMENT COLLEGE (A): KAKINADA

COURSE 6: - BIOMOLECULES AND ENZYMOLOGY

BLUE PRINT

PART-I

Answer any three questions by attempting at least one question form each section

SECTION - A **3 X 10 = 30 Marks**

1. Essay question from UNIT- I
2. Essay question from UNIT- II
3. Essay question from UNIT- III

SECTION - B

4. Essay question from UNIT- IV
5. Essay question from UNIT- V
6. Essay question from any one of the five Units based on its weightage in theSyllabus.

PART - II

Answer any Four Questions from the following **4 X 5 = 20 Marks**

7. Short answer question from UNIT - I
8. Short answer question from UNIT - II
9. Short answer question from UNIT - III
10. Short answer question from UNIT - IV
11. Short answer question from UNIT - V
12. Short answer question from any one of the five Units based on its weightagein the Syllabus.

SEMESTER - III

COURSE 6: - BIOMOLECULES AND ENZYMOLOGY

Time: 2 Hours **Max Marks: 50M**

Section -I

Answer any three of the following questions. Must attempt atleast one question from each part. Each question carries 10 Marks. **3 X 10 = 30M**

Part – A

1. General characters and outline classification of carbohydrates.

2. Phospholipids: Structure, function, and role in cell membranes.

3. Primary, secondary, tertiary and quaternary structures of protein.

Part - B

4. Structure and functions of DNA and RNA.

5. Inhibition of enzyme activity- competitive noncompetitive, uncompetitive and allosteric.

6. Lock and key hypothesis, and induced fit hypothesis.

Section II

Answer any four of the following questions. Each question carries 5 marks. **4X 5 = 20M**

7. Disaccharides- sucrose.

8. Biosynthesis, and physiological roles.

9. General characteristics of amino acids and proteins.

10. types of vitamins and their role in metabolism.

11. Effect of pH and temperature on enzyme activity.

12. Explain the terms Holoenzyme, cofactors, prosthetic group and coenzyme.

13. classification of carbohydrates.

SEMESTER - III

COURSE 6: - BIOMOLECULES AND ENZYMOLOGY
MINOR

Time: 2 Hours **Max Marks: 50M**

Section -I

Answer any three of the following questions. Must attempt atleast one question from each part. Each question carries 10 Marks. **3 X 10 = 30M**

Part – A

1. General characters and outline classification of carbohydrates.

2. Phospholipids: Structure, function, and role in cell membranes.

3. Primary, secondary, tertiary and quaternary structures of protein.

Part - B

4. Structure and functions of DNA and RNA.

5. Inhibition of enzyme activity- competitive noncompetitive, uncompetitive and allosteric.

6. Lock and key hypothesis, and induced fit hypothesis.

Section II

Answer any four of the following questions. Each question carries 5 marks. **4X 5 = 20M**

7. Disaccharides- sucrose.

8. Biosynthesis, and physiological roles.

9. General characteristics of amino acids and proteins.

10. types of vitamins and their role in metabolism.

11. Effect of pH and temperature on enzyme activity.

12. Explain the terms Holoenzyme, cofactors, prosthetic group and coenzyme.

13. classification of carbohydrates.

CIA structure for Single Major system

- Out of 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- I mid examination is to be conducted in offline mode at college level and II mid examination is to be conducted in online mode at department level.
    - I mid examination to be conducted in offline mode in which the student should attempt **one essay** question for ten marks out of two questions, **two short** answer questions with five marks each out of four questions and five objective questions to be given for each paper.
        - Question paper is to be given as per the following structure for the courses with **4 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1M)
1	I	1	0	1
2	II	1	0	1
3	III	0	2	1
4	IV	0	2	1+ one question from anyunit with more syllabus weightage

- For I mid examination to be conducted in offline mode, Question paper is to be given as per the following structure for the courses with **5 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1 M)
1	I	1	0	1
2	II	1	0	1
3	III	0	1	1
4	IV	0	1	1
5	V	0	1+ one question from any unit(III or IV or V) with more syllabus weightage	1

- The remaining 25 marks for CIA are allocated as per the following structure.

Project-10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M

Project-10M	Viva on theory-3M	Assignment-5M	Seminar- 5M	Clean & green and Attendance- 2M

P R GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

COURSE 6: - BIOMOLECULES AND ENZYMOLOGY

Credits-1

Time: 3 Hrs. **Max. Marks: 50 M**

1. Major Experiment 20M
2. Minor Experiment 10M
3. Spotters 2 x 5 = 10M
    1) I
    2) II
    3) III
    4) IV
    5) V

4. Record 5M
5. Viva 5M

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III SEMESTER

COURSE 7: MICROBIAL AND ANALYTICAL TECHNIQUES

credits -_3

I . Course Outcomes:

On completion of the course, the students will be able to

1. Understand the principles and applications of microscopy techniques, including bright field microscopy and electron microscopy (SEM and TEM), as well as staining techniques.
2. Know various sterilization and disinfection techniques, including physical methods (dry heat, moist heat, filtration, radiation) and chemical methods (disinfectants, alcohols, aldehydes, fumigants, phenols, halogens, heavy metals).
3. Perform pure culture isolation, maintenance and preservation of cultures, cultivation of anaerobic bacteria, and accessing viable non-culturable bacteria (VNBC).
4. Understand the principles and applications of spectrophotometry and chromatography techniques, including UV-visible spectrophotometry, colorimetry, turbidometry, paper chromatography, and column chromatography.
5. Gain knowledge of centrifugation principles and applications, electrophoretic techniques (agarose and SDS polyacrylamide gel), and the principles and applications of radioisotopes.

Unit -1: Microscopy No. of Hours: 9hrs

1 Microscopy: Principle, mechanism and applications of Bright fieldmicroscope.

2 Principle, mechanism and applications of electron microscope (SEMand TEM). Micrometry.

3 Staining Techniques – Simple, negative and Differential stainingtechniques (Gram staining, spore staining, Acid fast staining).

Unit-2: Sterilization and disinfection techniques No. of Hours: 9hrs

1. Sterilization, Disinfection, Antiseptic, Germicide, Sanitizer, Fungicide, Virucide, Bacteriostatic and Bactericidal agent.

Physical methods of microbial control: Dry heat-Incineration, Hot air oven; Moistheat- Pressure cooker, autoclave; Filter sterilization- laminar air flow, Membrane filter;Radiation methods – UV rays, Gamma rays.

2 Chemical methods of microbial control: disinfectants, types and mode of action-alcohols, aldehydes, fumigants, phenols, halogens and heavy metals.

Unit -3: Microbiological techniques **No. of Hours:9hrs**

1 Pure culture isolation: Streaking, serial dilution and plating methods, micromanipulator; cultivation.

2 Maintenance and preservation/stocking of pure cultures: sub culturing, overlaying

cultures with mineral oils, lyophilization, sand cultures, storage at low temperature, Culture collection centers(MTCC, ATCC, DSMZ);

3 Cultivation of anaerobic bacteria; Accessing Viable non-culturable bacteria (VNBC). Buffers in culture medium. Cultivation of fungi, Actinomycetes, yeasts.

Unit-4: Spectrophotometry & Chromatography No. of Hours: 9

1 Spectroscopy – Principles, laws of light absorption, Instrumentation and applications of UV-visible spectrophotometer. Colorimetry and turbidometry.

2 Chromatography: Principles and applications of paper chromatography (Ascending, Descending and 2-D), Thin layer chromatography.

3 Principle and applications of column chromatography (Partition, adsorption, ionexchange, exclusion and affinity chromatography). Column packing and fraction collection.

Unit - 5: Centrifugation, Electrophoresis & Radio isotopes No. of Hours:9

1 Centrifugation-Principles, types and applications.

2 Electrophoretic technique (agarose and SDS polyacrylamide gel) its Components, working principle and applications

3 Radioisotopes– characters and applications of radioisotopes, principle ofautoradiography.

References:

1. Pelczar M., Chan E.C.S. and Krieg, N.R. Microbiology. Tata Mc Grew HillPublishing Co. Ltd., New Delhi.
2. Stainier R.V., Ingraham, J.L., Wheelis, M.L. and Painter P.R. The Microbial World.Printice-Hall of India (Pvt.) Ltd., New Delhi
3. Wilson& Walker. Principles and Techniques in Practical B i o c h e m i s t r y . 5th EditionCambridge University Press (2000).
4. Murphy D.B. Fundamental of Light Microscopy & Electron Imaging.1st Edition. Wiley Liss. (2001).
5. K L Ghatak. Techniques and Methods In Biology PHI Publication (2011)
6. Pranav Kumar. Fundamentals and Techniques of Biophysics and Molecular Biology(2016)
7. Aurora Blair. Laboratory Techniques & Experiments in Biology.Intelliz Press
8. D.T Plummer. An Introduction to Practical Biochemistry. McGraw Hill Publication1987
9. Beckner, W.M., Kleinsmith L.J and Hardin J. The world of cell. IV editionBenjamin /Cummings (2000)

III SEMESTER

COURSE 7: MICROBIAL AND ANALYTICAL TECHNIQUES

credits -_1

1. Study of bright field, dark field and phase contrast, Electron microscopemicrographs to visualize microbial cells.
2. Simple staining & Negative staining.
3. Gram's staining.
4. Sterilization of medium using Autoclave, Sterilization of glassware using Hot Air Oven.
5. Isolation of pure cultures of bacteria by streaking method.
6. Isolation of bacteria from natural habitat by spread and pour plate method (using serial dilution method)
7. Separation of monosaccharides/amino acids by paper/thinlayer chromatography.
8. Demonstration of column packing in gel filtration chromatography.
9. Determination of absorption max for an aromatic amino acid.
10. Separation of bacterial cells (cell pellet) from broth culture by using a laboratoryscale centrifuge.
11. Separation of DNA fragments by Agarose gel electrophoresis.

P.R. GOVERNMENT COLLEGE (A): KAKINADA
COURSE 7: MICROBIAL AND ANALYTICAL TECHNIQUES

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PART-I

Answer any three questions by attempting at least one question form each section

SECTION - A **3 X 10 = 30 Marks**

1) Essay question from UNIT- I
2) Essay question from UNIT- II
3) Essay question from UNIT- III

SECTION - B

4) Essay question from UNIT- IV
5) Essay question from UNIT- V
6) Essay question from any one of the five Units based on its weightage in theSyllabus.

PART - II

7) **Answer any Four Questions from the following** **4 X 5 = 20 Marks**
8) Short answer question from UNIT - I
9) Short answer question from UNIT - II
10) Short answer question from UNIT - III
11) Short answer question from UNIT - IV
12) Short answer question from UNIT - V
13) Short answer question from any one of the five Units based on its weightagein the Syllabus.

SEMESTER - III

COURSE 7: -MICROBIAL AND ANALYTICAL TECHNIQUES

Time: 2 Hours **Max Marks: 50M**

Section -I

Answer any three of the following questions. Must attempt atleast one question from each part. Each question carries 10 Marks. **3 X 10 = 30M**

Part – A

1. Principal mechanism and applications of electron microscope.

2. Physical and chemical methods of microbial control.

3. Pure culture isolation.

Part - B

4. Spectroscopy- Principles laws of light absorption instrumentation and applications.

5. Electrophoretic techniques; its components working principle an application.

6. Chromatography: principles and applications.

Section II

Answer any four of the following questions. Each question carries 5 marks. **4X 5 = 20M**

7. Staining techniques-simple negative and differential staining techniques.

8. Explain the terms- bacteriostatic and bactericidal agent.

9. Preservation of Pure cultures.

10. Principle and applications of column chromatography.

11. Centrifugation- principles, types and applications.

12. Principles of autoradiography.

13. SEM and TEM.

CIA structure for Single Major system

- Out of 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- I mid examination is to be conducted in offline mode at college level and II mid examination is to be conducted in online mode at department level.
    - I mid examination to be conducted in offline mode in which the student should attempt **one essay** question for ten marks out of two questions, **two short** answer questions with five marks each out of four questions and five objective questions to be given for each paper.
        - Question paper is to be given as per the following structure for the courses with **4 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1M)
1	I	1	0	1
2	II	1	0	1
3	III	0	2	1
4	IV	0	2	1+ one question from anyunit with more syllabus weightage

- For I mid examination to be conducted in offline mode, Question paper is to be given as per the following structure for the courses with **5 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1 M)
1	I	1	0	1
2	II	1	0	1
3	III	0	1	1
4	IV	0	1	1
5	V	0	1+ one question from any unit(III or IV or V) with more syllabus weightage	1

- The remaining 25 marks for CIA are allocated as per the following structure.

Project-10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M

Project- 10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M

P R GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

COURSE 7: MICROBIAL AND ANALYTICAL TECHNIQUES

Time: 3 Hrs. **Max. Marks: 50 M**

1. Major Experiment 20M
2. Minor Experiment 10M
3. Spotters 2 x 5 = 10M
    1) I
    2) II
    3) III
    4) IV
    5) V
4. Record 5M
5. Viva 5M

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COURSE 8: - CELL BIOLOGY AND GENETICS

credits -_3

I. Course Outcomes:

By the Completion of the course the learner should able to–

1. Understand cell theory, cell organelles, the cell cycle, and the role of thecytoskeleton.
2. Students will comprehend the structure and functions of the cell membrane, nuclear envelope, and nucleolus, as well as gain basic knowledge of cancer development.
3. Learn about protein sorting, intracellular signal transduction pathways, programmed cell death, stem cells, and specialized chromosomes.
4. Gain knowledge of Mendelian genetics, including mono-hybrid and dihybrid crosses, inheritance patterns, and allele frequencies.
5. Understand the concepts of linkage, crossing over, the Hardy-Weinberg Law, natural selection, genetic drift, and the mechanisms of sex determination and inheritance.

Unit 1 Hours : 09

1. Cell theory and cell organelles (Mitochondria, Chloroplasts,Lysosomes, Glyoxysomes and Peroxisomes, Golgi apparatus and ER).
2. Cell cycle and its regulation.
3. Cytoskeleton: Structure and organization of actin, myosin and intermediatefilaments, microtubules, and their role.

Unit 2 Hours : 09

1. Structure and functions Cell membrane, proton pumps associated (Na-K, Cacalmodulin etc. and their distribution), phagocytosis, pinocytosis, exocytosis.
2. Nuclear envelope, structure of nuclear pore complex, nuclear lamina, transportacross nuclear membrane, Nucleolus.
3. Elementary knowledge of development and causes of cancer; Oncogenes andsuppressor genes,

Unit 3 Hours : 09

1. Protein sorting and Transport Intracellular signal transduction pathways (GPCR ,ERK Pathway, mTOR Signaling)
2. Programmed Cell Death; Stem cells.
3. Specialized chromosomes (polytene, lampbrush)

UNIT 4 Hours : 09

1. Mendalien Genetics , Mono hybrid and Dihybrid cross , Law of dominancesegregation

and Independent assortment.

2. Chromosome theory of inheritance, Pedigree analysis, Incomplete dominanceand co-dominance,
3. Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Allele frequencies, Genotypefrequencies.

Unit – 5 Hours : 09

1. Linkage and Crossing over, Molecular mechanism of crossing over. Recombinationfrequency as a measure of linkage intensity,
2. Hardy-Weinberg Law, role of natural selection, Genetic drift. Speciation

   Sex determination – Sex linked inheritance, extra chromosomal Inheritance

III. References:

1. A.J.F Griffiths, S. R Wessler, S. B Carroll & J. Doebley, An Introduction to Genetic Analysis,. 10th Ed., W.H. Freeman & Company (New York) 2010

   Geoffrey M. Cooper and Robert E. Hausman - The cell a molecular approach
2. Bruce Alberts , Rebecca Heald, et al. Molecular Biology Of The Cell
3. Arnold Berk (Author), Chris A. Kaiser (Author), Harvey Lodish (Author), Angelika Amon (Author), Molecular Cell Biology.
4. Benjamin Lewin Genes
5. Eldon John Gardner, Michael J. Simmons, D. Peter Snustad Principles of Genetics
6. Karp G, John Wiley Cell Biology
7. Jane B. Reece (Author), Martha R. Taylor (Author), Eric J. Simon (Author),Jean L. Dickey , Campbell Biology: Concepts and Connections
8. Veer Bala Rastogi, Genetics B D Singh, Genetics

III SEMESTER

COURSE 8: - CELL BIOLOGY AND GENETICS

credits -_1

1. Cell counting and Viability
2. Mitosis from onion root tips
3. Meiosis of onion root tips
4. Study of ultrastructure of cell (Plasma membrane, Nucleus, Nuclear Pore Complex,Chloroplast, Mitochondrion, Golgi bodies, Lysosomes, SER and RER)
5. Identification and study of types of cancer, cancer cells by permanent slides/photographs.
6. Study of Linkage, recombination, gene mapping using marker-based data fromDrosophila.
7. Demonstration of DNA fingerprinting.
8. Pedigree chart analysis.

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COURSE 8: - CELL BIOLOGY AND GENETICS

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PART-I

Answer any three questions by attempting at least one question form each section

SECTION - A **3 X 10 = 30 Marks**

1) Essay question from UNIT- I
2) Essay question from UNIT- II
3) Essay question from UNIT- III

SECTION - B

4) Essay question from UNIT- IV
5) Essay question from UNIT- V
6) Essay question from any one of the five Units based on its weightage in theSyllabus.

PART - II

7) **Answer any Four Questions from the following** **4 X 5 = 20 Marks**
8) Short answer question from UNIT - I
9) Short answer question from UNIT - II
10) Short answer question from UNIT - III
11) Short answer question from UNIT - IV
12) Short answer question from UNIT - V
13) Short answer question from any one of the five Units based on its weightagein the Syllabus.

SEMESTER - III

COURSE 8: - CELL BIOLOGY AND GENETICS
Microbiology (Major)

Time: 2 Hours **Max Marks: 50M**

Section -I

Answer any three of the following questions. Must attempt atleast one question from each part. Each question carries 10 Marks. 3 X 10 = 30M

Part – A

1. Cell cycle and its regulation.

2. Structure and functions Cell membrane.

3. Programmed Cell Death

Part - B

4. Mono hybrid and Di hybrid cross

5. Molecular mechanism of crossing over.

6. Chromosome theory of inheritance.

Section II

Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M

7. Cytoskeleton.

8. Oncogenes

9. Specialized chromosomes

10 law of Independent assortment.

11. Hardy-Weinberg Law

12. co-dominance

13. Multiple alleles.

SEMESTER - III

COURSE 8: - CELL BIOLOGY AND GENETICS
Microbiology (Minor)

Time: 2 Hours **Max Marks: 50M**

Section -I

Answer any three of the following questions. Must attempt atleast one question from each part. Each question carries 10 Marks. 3 X 10 = 30M

Part – A

1. Cell cycle and its regulation.

2. Structure and functions Cell membrane.

3. Programmed Cell Death

Part - B

4. Mono hybrid and Di hybrid cross

5. Molecular mechanism of crossing over.

6. Chromosome theory of inheritance.

Section II

Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M

7. Cytoskeleton.

8. Oncogenes

9. Specialized chromosomes

10 law of Independent assortment.

11. Hardy-Weinberg Law

12. co-dominance

13. Multiple alleles.

CIA structure for Single Major system

- Out of 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- I mid examination is to be conducted in offline mode at college level and II mid examination is to be conducted in online mode at department level.
  - I mid examination to be conducted in offline mode in which the student should attempt **one essay** question for ten marks out of two questions, **two short** answer questions with five marks each out of four questions and five objective questions to be given for each paper.
  - Question paper is to be given as per the following structure for the courses with **4 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1M)
1	I	1	0	1
2	II	1	0	1
3	III	0	2	1
4	IV	0	2	1+ one question from anyunit with more syllabus weightage

- For I mid examination to be conducted in offline mode, Question paper is to be given as per the following structure for the courses with **5 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1 M)
1	I	1	0	1
2	II	1	0	1
3	III	0	1	1
4	IV	0	1	1
5	V	0	1+ one question from any unit(III or IV or V) with more syllabus weightage	1

  - The remaining 25 marks for CIA are allocated as per the following structure.

Project-10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M

Project- 10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M

P R GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

COURSE 8: - CELL BIOLOGY AND GENETICS

Time: 3 Hrs. **Max. Marks: 50 M**

4. Major Experiment 20M
5. Minor Experiment 10M
6. Spotters 2 x 5 = 10M
    1) I
    2) II
    3) III
    4) IV
    5) V

4. Record 5M
5. Viva 5M

P R GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

III SEMESTER

COURSE II: - BIOMOLECULES AND ENZYMOLOGY(MINOR)

credits -_3

II. Course Outcomes:

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

1. Understand the classification and properties of carbohydrates, including monosaccharides, disaccharides, polysaccharides, and sugar derivatives.
2. Gain knowledge of lipids and fatty acids, including their classification, structures, functions, and their role in cell signaling and metabolism.
3. Comprehend the structure and functions of amino acids and proteins, including their primary, secondary, tertiary, and quaternary structures.
4. Learn about the structure and functions of nucleic acids, including DNA and RNA, as well as the concept of base composition and nucleic acid- protein interactions. They will also be introduced to the role of vitamins in metabolism.
5. Understand the structure of enzymes, enzyme classification, and mechanismsof action. They will also learn about the factors influencing enzyme activity and various types of enzyme inhibition.

UNIT-I: Carbohydrates No. of hours: 9

1. General characters and outline classification of Carbohydrates
2. Monosaccharides- Glucose, fructose, ribose; Stereoisomerism ofmonosaccharides, epimers, mutarotation and anomers of glucose
3. Disaccharides- concept of reducing and non-reducing sugars;Sucrose, Lactose
4. Polysaccharides- Storage -Starch, glycogen, Structural-Cellulose peptidoglycan and chitin
5. Sugar derivatives- glucosamine.

UNIT-II: Lipids and fatty acids No.ofhours: 9

1. Definition and classification of lipids. Structure and properties of lipids. Importance of lipids in biological systems.
2. Introduction to fatty acids: definition, structure, and nomenclature. Saturated and unsaturated fatty acids.
3. Triglycerides: structure, function, and metabolism. Phospholipids: structure, function, and role in cell membranes. Steroids: structure, biosynthesis, and physiological roles.Waxes: structure, functions, andapplications.

UNIT-III: Amino acids and Proteins. **No. of hours:9**

1. Biochemical structure and notation of standard protein amino acids
2. General characteristics of amino acids and proteins.
3. Primary, secondary, tertiary and quaternary structures of Protein
4. Non protein amino acids: Gramicidin, beta-alanine, D-alanine andD- glutamic acid.

UNIT-IV: **Nucleic acids and Vitamins** **No. of hours:9**

1. Structure and functions of DNA and RNA.
2. Base composition. A+T and G+C rich genomes. Basic concept ofnucleic acids protein interactions.
3. Concept and types of vitamins and their role in metabolism.

UNIT-V: Enzymes **No. of hours: 9**

1. Structure of enzyme, Apoenzyme and cofactors, prosthetic group- TPP, coenzyme - NAD, metal cofactors; Definitions of terms – enzymeunit, specific activity and turnover number
2. Classification of enzymes, Mechanism of action of enzymes: active site, transition state complex and activation energy. Lock and key hypothesis, and Induced Fit hypothesis.
3. Effect of pH and temperature on enzyme activity.
4. Inhibition of enzyme activity- competitive, noncompetitive, uncompetitive and allosteric.

RECOMMENDED TEXT BOOKS:

1. 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.
2. Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). Principles ofBiochemistry, 2 nd Edition, CBS Publishers and Distributors, New Delhi.
3. Sashidhara Rao, B. and Deshpande, V. (2007). ExperimentalBiochemistry: A student Companion. I.K. International Pvt. Ltd.
4. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A shortcourse, 2nd ed., W.H.Freeman
5. Voet,D. and Voet J.G (2004) Biochemistry 3rd edition, John Wileyand Sons
6. White, D. (1995). The Physiology and Biochemistry of Prokaryotes,Oxford University Press, New York

P. R. GOVERNMENT COLLEGE (A), KAKINADA

COURSE 3: - BIOMOLECULES AND ENZYMOLOGY

CREDITS: 1

PRACTICAL SYLLABUS

1. Qualitative tests for sugars
2. Qualitative Analysis of Aminoacids.
3. Colorimetric estimation DNA by diphenylamine method.
4. Colorimetric estimation of proteins by Biuret/Lowry method

P.R. GOVERNMENT COLLEGE (A): KAKINADA
COURSE 6: - BIOMOLECULES AND ENZYMOLOGY

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PART-I

Answer any three questions by attempting at least one question form each section

SECTION - A

3 X 10 = 30 Marks

1. Essay question from UNIT- I
2. Essay question from UNIT- II
3. Essay question from UNIT- III

SECTION - B

4. Essay question from UNIT- IV
5. Essay question from UNIT- V
6. Essay question from any one of the five Units based on its weightage in theSyllabus.

PART - II

7. **Answer any Four Questions from the following** **4 X 5 = 20 Marks**
8. Short answer question from UNIT - I
9. Short answer question from UNIT - II
10. Short answer question from UNIT - III
11. Short answer question from UNIT - IV
12. Short answer question from UNIT - V
13. Short answer question from any one of the five Units based on its weightagein the Syllabus.

CIA structure for Single Major system

- Out of 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- I mid examination is to be conducted in offline mode at college level and II mid examination is to be conducted in online mode at department level.
    - I mid examination to be conducted in offline mode in which the student should attempt **one essay** question for ten marks out of two questions, **two short** answer questions with five marks each out of four questions and five objective questions to be given for each paper.
        - Question paper is to be given as per the following structure for the courses with **4 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1M)
1	I	1	0	1
2	II	1	0	1
3	III	0	2	1
4	IV	0	2	1+ one question from anyunit with more syllabus weightage

- For I mid examination to be conducted in offline mode, Question paper is to be given as per the following structure for the courses with **5 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1 M)
1	I	1	0	1
2	II	1	0	1
3	III	0	1	1
4	IV	0	1	1
5	V	0	1+ one question from any unit(III or IV or V) with more syllabus weightage	1

- The remaining 25 marks for CIA are allocated as per the following structure.

Project-10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M

Project- 10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M

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COURSE 6: - BIOMOLECULES AND ENZYMOLOGY

Time: 3 Hrs. **Max. Marks: 50 M**

1. Major Experiment 20M
2. Minor Experiment 10M
3. Spotters 2 x 5 = 10M

a. I

b. II

c. III

d. IV

e. V

4. 4. Record 5M
5. 5. Viva 5M

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IV SEMESTER

COURSE 9: - MOLECULAR BIOLOGY AND MICROBIAL GENETICS

credits -_3

I. Course Outcomes:

By the Completion of the course the learner should able to–

1. Understand the nature of genetic material, its organization in prokaryotes and eukaryotes,and the role of DNA and RNA.
2. Explain the process of DNA replication in prokaryotes and the involvement of enzymes andfactors.
3. Recognize the characteristics, types, and applications of extra chromosomal geneticelements such as plasmids and transposons.
4. Differentiate between classical and modern concepts of genes, understand gene structure,and the process of transcription.
5. Comprehend the genetic code, translation process, and regulation of gene expression inbacteria.

Unit - 1: DNA/RNA as genetic material, Replication of DNA No. ofHours:9

1.1 Experimental evidences that established DNA and RNA as genetic material.Genome organization in prokaryotes and eukaryotes.

1.2 Replication of DNA in prokaryotes.: Bidirectional and unidirectional replication, Semiconservative replication, Proof of Semiconservative replication (Messelson – Stahl Experiment). Mechanism of DNA Replication in Prokaryotes: step by step process, Enzymes and factors involved in replication- Primase, Helicase, Gyrase, DNA polymerases, DNA ligase, SSB proteins.

1.3 Extra chromosomal genetic elements: General characters, types and applicationsof Plasmids and transposons.

Unit - 2: Concept of gene, Transcription No. of Hours:9

2.1 Classical Concept of gene: Muton, Recon and Cistron; One gene-one enzyme andone gene - one polypeptide and One gene – One Product hypotheses.

2.2 Modern concept of gene: Definition of gene; Open reading frame; structural, constitutive and regulatory genes; uninterrupted genes, Split genes- concept of introns and exons.

2,3 Protein synthesis in Prokaryotes: Transcription- Definition, difference from replication,

promoter, RNA Polymerase, mechanism of transcription. RNA splicing in eukaryotes;

Unit - 3: Translation and regulation of gene expression No. of Hours:9Protein synthesis

in Prokaryotes

3.1 Genetic code: Salient features, Wobble hypothesis.

3.2 Translation- Charging of tRNA, aminoacyl tRNA synthetases, Mechanisms of initiation, elongation and termination of polypeptides. Inhibitors of protein synthesis.

Regulation of gene expression in bacteria – lac operon

Unit - 4: Mutations and DNA repair No. of Hours:9

4.1 Mutations: Definition and types of Mutations (Spontaneous and induced, Somaticand germline); Physical and chemical mutagens;

4.2 Molecular basis of mutations (base pair changes, frame shifts, deletions, inversions, tandem duplications, insertions); Functional mutants (loss and gain of functionmutants); Uses of mutations.

4.3 Outlines of DNA repair mechanisms: Direct repair, Excision repair, MismatchRepair, Recombination Repair, SOS Repair.

Unit - 5: Genetic recombination in bacteria No. of Hours:9

5.1 Conjugation - discovery, F-factor, F+ & Hfr, mechanism of conjugation,applications of conjugation;

5.2 Transformation- Discovery, mechanism of transformation, Competence Factorsaffecting transformation and application of transformation.

5.3 Transduction- discovery, mechanism and types of transduction.

III. References

Text books:

1. James D. Watson Tania A. Baker, Stephen P. Bell Alexander Gann, Michael Levine, Richard Losick, 2013, Molecular Biology of the Gene, 5th Edition, PearsonEdu Publishers.
2. Roger Y. Stanier, Edward A. Adelberg, John L. Ingraham, 1977, General Microbiology 5th edition, London Macmillan.
3. David Freifelder1986 Molecular Biology 3rd edition, Jones & Bartlett Publishers
4. T.A. Brown, Gene cloning and DNA analysis- An Introduction, 4thedition
5. Bernard R. Glick and Jack. J. Pasternak, Molecular Biotechnology. 3rd edition
6. David Freifelder.Essentials of molecular biology.Jones and Bartlett Publishers,1998

IV SEMESTER

COURSE 9: - MOLECULAR BIOLOGY AND MICROBIAL GENETICS

credits -1

1. Isolation of genomic DNA from E. coli
2. Estimation of DNA using UV spectrophotometer (A260measurement).
3. Problems related to DNA and RNA characteristics, Transcription and Translation.
4. Resolution and visualization of DNA by Agarose Gel Electrophoresis.
5. Problems related to DNA and RNA characteristics, Transcription and Translation.
6. Induction of mutations in bacteria by UV light.
7. Study of different conformations of plasmid DNA through agarose gel electrophoresis.
8. Demonstration of bacterial transformation
9. Instrumentation in molecular biology – Ultra centrifuge, Transilluminator, PCR
10. Study of different types of DNA and RNA using micrographs and model / schematic
11. representations
12. Study of semi-conservative replication of DNA through micrographs / schematic
13. Representations

P.R. GOVERNMENT COLLEGE (A): KAKINADA
COURSE 9: - MOLECULAR BIOLOGY AND MICROBIAL GENETICS

w.e.f. 2021-2022 ADMITTED BATCH

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PART-I

Answer any three questions by attempting at least one question form each section

SECTION - A **3 X 10 = 30 Marks**

1. Essay question from UNIT- I
2. Essay question from UNIT- II
3. Essay question from UNIT- III

i. SECTION - B

4. Essay question from UNIT- IV
5. Essay question from UNIT- V
6. Essay question from any one of the five Units based on its weightage in theSyllabus.

i. PART - II

7. **Answer any Four Questions from the following** **4 X 5 = 20 Marks**
8. Short answer question from UNIT - I
9. Short answer question from UNIT - II
10. Short answer question from UNIT - III
11. Short answer question from UNIT - IV
12. Short answer question from UNIT - V
13. Short answer question from any one of the five Units based on its weightagein the Syllabus.

SEMESTER -IV

Course:9 MOLECULAR BIOLOGY AND MICROBIAL GENETICS

MICROBIOLOGY MAJOR

Time: 2 Hours **Max Marks: 50M**

Section -I

Answer any three of the following questions. Must attempt atleast one question from each part. Each question carries 10 Marks. **3 X 10 = 30M**

Part – A

1. Explain mechanism of DNA replication in prokaryotes and write enzyme and proteins involved in replication.
2. Explain prokaryotic transcription Initiation, Elongation, Termination, RNA polymerase structure and functions Out come of transcription in bacteria.
3. Discuss salient features of genetic code.

Part - B

4. Write various types of mutations spontaneous induced: physical and chemical mutations.
5. Discuss mechanism and types of transductions in bacteria generalized transduction specialized transduction.
6. Explain DNA repair mechanism with examples.

Section II

Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M

7. Discuss transposes in bacteria.
8. Define plasmid and write functions of plasmid.
9. Explain constitutive genes.
10. Conjugation.
11. SOS repair
12. Explain RNA splicing.
13. Explain lac operon.

SEMESTER -IV

Course:9 MOLECULAR BIOLOGY AND MICROBIAL GENETICS

MICROBIOLOGY MINOR

Time: 2 Hours **Max Marks: 50M**

Section -I

Answer any three of the following questions. Must attempt atleast one question from each part. Each question carries 10 Marks. **3 X 10 = 30M**

Part – A

1. Explain mechanism of DNA replication in prokaryotes and write enzyme and proteins involved in replication.
2. Explain prokaryotic transcription Initiation, Elongation, Termination, RNA polymerase structure and functions Out come of transcription in bacteria.
3. Discuss salient features of genetic code.

Part - B

4. Write various types of mutations spontaneous induced: physical and chemical mutations.
5. Discuss mechanism and types of transductions in bacteria generalized transduction specialized transduction.
6. Explain DNA repair mechanism with examples.

Section II

Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M

7. Discuss transposes in bacteria.
8. Define plasmid and write functions of plasmid.
9. Explain constitutive genes.
10. Conjugation.
11. SOS repair
12. Explain RNA splicing.
13. Explain lac operon.

CIA structure for Single Major system

- Out of 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- I mid examination is to be conducted in offline mode at college level and II mid examination is to be conducted in online mode at department level.
    - I mid examination to be conducted in offline mode in which the student should attempt **one essay** question for ten marks out of two questions, **two short** answer questions with five marks each out of four questions and five objective questions to be given for each paper.
        - Question paper is to be given as per the following structure for the courses with **4 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1M)
1	I	1	0	1
2	II	1	0	1
3	III	0	2	1
4	IV	0	2	1+ one question from anyunit with more syllabus weightage

- For I mid examination to be conducted in offline mode, Question paper is to be given as per the following structure for the courses with **5 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1 M)
1	I	1	0	1
2	II	1	0	1
3	III	0	1	1
4	IV	0	1	1

5	V	0	1+ one question from any unit(III or IV or V) with more syllabus weightage	1

- The remaining 25 marks for CIA are allocated as per the following structure.

Project-10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M

Project-10M	Viva on theory-3M	Assignment-5M	Seminar- 5M	Clean & green and Attendance- 2M

P R GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

COURSE 9: - MOLECULAR BIOLOGY AND MICROBIAL GENETICS

Time: 3 Hrs. **Max. Marks: 50 M**

1. Major Experiment 20M
2. Minor Experiment 10M
3. Spotters 2 x 5 = 10M

1) I
2) II
3) III
4) IV
5) V

4. 4. Record 5M
5. 5. Viva 5M

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IV SEMESTER

COURSE 10: - MICROBIAL PHYSIOLOGY AND METABOLISM

credits - 3

I. Course Outcomes:

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

1. Understand the nutritional requirements of microorganisms and the different methods of nutrient uptake. They will also gain knowledge of different nutritional groups and types of growth media used for microbial cultivation.
2. Comprehend microbial growth, including the definition of growth, generation time, and the different phases of growth. They will also learn about factors influencing microbial growth and methods for measuring it.
3. Gain knowledge of thermodynamics in biological systems, including concepts offree energy, enthalpy, and entropy. They will also learn about ATP structure and properties, oxidation-reduction reactions, and carbohydrate breakdown pathways.
4. Understand microbial respiration, including aerobic and anaerobic respiration, chemoautotrophy, and fermentative modes.
5. Differentiate the processes of oxygenic and anoxygenic photosynthesis.

UNIT I: Microbial Nutrition - No. of hours: 9

1. Nutritional requirements of Microorganisms
2. Methods of uptake of nutrients by cells- Primary and secondary active transport,concept of uniport, symport and antiport Group translocation; Iron uptake
3. Nutritional groups of microorganisms-based on C, energy and electron. sources
4. Growth media - synthetic, nonsynthetic, selective, enrichment and differentialmedia.

UNIT II: Microbial Growth - No. of hours:9

1. Microbial Growth- Definitions of growth, generation time and specific growth rate;different phases of growth in batch cultures;
2. Synchronous, continuous, biphasic growth.
3. Factors influencing microbial growth

Methods for measuring microbial growth - Direct microscopy, viable countestimates, turbidometry and biomass.

UNIT IV: Thermodynamics; Breakdown of Carbohydrates No.of hours: 9

1. Thermodynamics in biological systems - Concept of free energy, Enthalpy, Standard FreeEnergy change of reaction, Entropy. First and Second law of Thermodynamics. Open andClosed system.
2. Structure and properties of ATP, Standard Free energy change of hydrolysis of ATP andother high energy compounds. Biological oxidation-reduction reactions. Structure and Function of NAD and FAD.
3. Breakdown of carbohydrates· Glycolytic pathways- EMP, HMP shunt/pentose phosphatepathway and ED; TCA cycle.

UNIT V: Microbial Respiration and Fermentation No. of hours: 9

1. Aerobic respiration - ETS and oxidative phosphorylation
2. Anaerobic respiration, chemoautotrophy - oxidation of inorganic compounds - N, S,Fe and H.
3. Fermentative modes in microorganisms with special reference to alcoholic, Lacticacid fermentations

UNIT V: Bacterial Photosynthesis No. of hours:9

1. Photosynthetic pigments, Photosynthetic apparatus in prokaryotes
2. Outline of oxygenic photosynthesis in bacteria
3. Outline of anoxygenic photosynthesis in bacteria

IV References:

1. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company Caldwell, D.R. (1995). Microbial Physiology and Metabolism, W.C. BrownPublications,Iowa, USA.
2. Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). Principles of Biochemistry, 2nd Edition, CBS Publishers and Distributors, New Delhi.
3. Sashidhara Rao, B. and Deshpande, V. (2007). Experimental Biochemistry: A student Companion. I.K. International Pvt. Ltd.
4. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H.Freeman
5. Voet,D. and Voet J.G (2004) Biochemistry 3rd edition, John Wiley and Sons
6. White, D. (1995). The Physiology and Biochemistry of Prokaryotes, OxfordUniversity Press, New York.

IV SEMESTER

COURSE 10: - MICROBIAL PHYSIOLOGY AND METABOLISM

credits -1

1. Effect of Temperature on bacterial growth 2.Effect of pH on bacterial growth
2. Colony count in Plates
3. Study and plot the growth curve of E. coli by turbidometric and standard plate countmethods
4. Observation and identification of permanent slides of cyanobacteria

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COURSE 10: - MICROBIAL PHYSIOLOGY AND METABOLISM
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PART-I

Answer any three questions by attempting at least one question form each section

SECTION - A **3 X 10 = 30 Marks**

1. Essay question from UNIT- I
2. Essay question from UNIT- II
3. Essay question from UNIT- III

SECTION - B

4. Essay question from UNIT- IV
5. Essay question from UNIT- V
6. Essay question from any one of the five Units based on its weightage in theSyllabus.

PART - II

7. **Answer any Four Questions from the following** **4 X 5 = 20 Marks**
8. Short answer question from UNIT - I
9. Short answer question from UNIT - II
10. Short answer question from UNIT - III
11. Short answer question from UNIT - IV
12. Short answer question from UNIT - V
13. Short answer question from any one of the five Units based on its weightagein the Syllabus.

SEMESTER -IV
COURSE 10: - MICROBIAL PHYSIOLOGY AND METABOLISM

Time: 2 Hours **Max Marks: 50M**

Section -I

Answer any three of the following questions. Must attempt atleast one question from each part. Each question carries 10 Marks. **3 X 10 = 30M**

Part – A

1. Explain nutritional groups of microorganisms.
2. Discuss various factors influencing bacterial growth.
3. Explain TCA Cycle with enzymatic reactions and net ATP generated.

Part - B

4. Explain lactic acid fermentation with example.
5. Discuss about oxygenic photosynthesis in bacteria.
6. Write EMP pathway and its significance with net ATP generated.

Section II

Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M

7. Define Enrichment media with two examples.
8. Explain oxidative phosphorylation with two examples.
9. Define bacterial growth and discuss phases of bacterial growth and generation time.
10. Structure and functions of NAD.
11. Photosynthetic pigments in bacteria
12. Chemo lithotrophs.
13. Discuss structure of ATP.

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CIA structure for Single Major system

- Out of 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- I mid examination is to be conducted in offline mode at college level and II mid examination is to be conducted in online mode at department level.
    - I mid examination to be conducted in offline mode in which the student should attempt **one essay** question for ten marks out of two questions, **two short** answer questions with five marks each out of four questions and five objective questions to be given for each paper.
        - Question paper is to be given as per the following structure for the courses with **4 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1M)
1	I	1	0	1
2	II	1	0	1
3	III	0	2	1
4	IV	0	2	1+ one question from anyunit with more syllabus weightage

- For I mid examination to be conducted in offline mode, Question paper is to be given as per the following structure for the courses with **5 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1 M)
1	I	1	0	1
2	II	1	0	1
3	III	0	1	1
4	IV	0	1	1
5	V	0	1+ one question from any unit(III or IV or V) with more syllabus weightage	1

- The remaining 25 marks for CIA are allocated as per the following structure.

Project-10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M

Project- 10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M

P R GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

COURSE 10: - MICROBIAL PHYSIOLOGY AND METABOLISM

Time: 3 Hrs. **Max. Marks: 50 M**

1. Major Experiment 20M
2. Minor Experiment 10M
3. Spotters 2 x 5 = 10M

1) I
2) II
3) III
4) IV
5) V

4. 4. Record 5M
5. 5. Viva 5M

6. P R GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

IV SEMESTER

COURSE 11: r DNA TECHNOLOGY, BIOINFORMATICS AND BIOSTATISTICS

credits - 3

I. Course Outcomes:

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

1. Learn the principles and techniques of genetic engineering, including g restrictionendonucleases, and DNA transformation.
2. Understand the use of vectors and the basics of polymerase chain reacti also explore theapplications of genetic engineering in industry, agr medicine.
3. Gain knowledge of blotting techniques, DNA labeling, DNA sequenc basics of intellectualproperty rights.
4. Learn about bioinformatic resources, sequence databases, sequence align use of biostatisticsin data analysis.
5. Develop skills in measuring central tendency and dispersion, understand types of data, andutilizing biostatistical software for analysis and data pr

UNIT- I: Recombinant DNA Technology No. of Hours: 9

1. Basic principles of genetic engineering. Steps in gene cloning.
2. Restriction endonucleases- applications of Type II restriction enzymes in geneticengineering; DNA polymerases and ligases;Use of linkers and adaptors
3. Vectors – Cosmid , Bacteriophages , BAC, YAC
4. Transformation of DNA by Chemical method, Electroporation.

UNIT- II: Applications of r-DNA technology No. of Hours: 9

1. Genomic and C-DNA Libraries, RFLP, RAPD,
2. Basics of Polymerase chain Reaction
3. Application of genetic engineering in industry, agriculture and medicine, HybirdomaTechnology.

UNIT- III: Techniques in genetic engineering and IPR No. of Hours: 9

1. Blotting Techniques.
2. Labeling of DNA, DNA foot printing.
3. DNA Sequencing-Sanger's method
4. Outlines of Intellectual property Rights (Patents,Trademark,Copyright)

UNIT- IV:Bioinformatics No. of Hours: 9

1. Bioinformatic resources : NCBI, EBI, DDBJ, PUBMED, BIOMED.
2. Sequence Databases – GENBANK, BLAST, FASTA, ExPasy, PDB, NDB, UNIPROT –SWISS PROT.

3. Sequence alignment – Sequence homology, pairwise sequence alignment, automatedDNA sequencing, ChIP.

UNIT- V:Biostatistics No. of Hours: 9

1. Measurement of central tendency : MEAN , MEDIAN, MODE.
2. Measurement of dispersion : RANGE, MEANDEVIATION ,STANDARD DEVIATION.
3. Use of Biostatistic softwares.
4. Sample and population ; Types of Data , methods of Data presentation.

References

1. Ghosh Z. and Bibekanand M. (2008) Bioinformatics: Principles and Applications.Oxford University Press.
2. Pevsner J. (2009) Bioinformatics and Functional Genomics. II Edition. Wiley- Blackwell. 3.Campbell A. M., Heyer L. J. (2006) Discovering Genomics, Proteomicsand Bioinformatics. II Edition. Benjamin Cummings. Crueger W, Crueger A (1990)

   Biotechnology: A text Book of Industrial Microbiology 2nd edition Sinauerassociates,Inc.
3. Demain, A. L and Davies, J. E. (1999). Manual of Industrial Microbiology andBiotechnology, 2nd Edition, ASM Press.
4. Glazer AN and Nikaido H (2007) Microbial Biotechnology, 2nd edition, CambridgeUniversity Press Glick BR, Pasternak JJ, and Patten CL (2010) Molecular Biotechnology 4th edition, ASM Press Gupta PK (2009) Elements of Biotechnology2nd edition, Rastogi Publications
5. Prescott, Harley and Klein's Microbiology by Willey JM, Sherwood LM, WoolvertonCJ (2014), 9th edition, Mc Graw Hill Publishers.
6. Ratledge, C and Kristiansen, B. (2001). Basic Biotechnology, 2nd Edition, CambridgeUniversity Press.
7. Stanbury PF, Whitaker A, Hall SJ (1995) Principles of Fermentation Technology 2ndedition., Elsevier Science
8. Swartz, J. R. (2001). Advances in Escherichia coli production of therapeutic proteins.Current Opinion in Biotechnology, 12, 195–201.

IV SEMESTER

COURSE 11: r DNA TECHNOLOGY, BIOINFORMATICS AND BIOSTATISTICS

credits -1

1. Isolation of plasmid DNA by Agarose gel Electrophoresis.
2. Preparation of Recombinant vector by using T4 DNA Ligase.
3. To Understand the concept of DNA fingerprinting by Random Ampilification ofPolymorphic DNA.
4. Nucleic acid and protein databases.
5. Sequence alignment
6. Sequence homology and Gene annotation.

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COURSE 11: r DNA TECHNOLOGY, BIOINFORMATICS AND BIOSTATISTICS

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PART-I

Answer any three questions by attempting at least one question form each section

SECTION - A **3 X 10 = 30 Marks**

13. Essay question from UNIT- I
14. Essay question from UNIT- II
15. Essay question from UNIT- III

SECTION - B

16. Essay question from UNIT- IV
17. Essay question from UNIT- V
18. Essay question from any one of the five Units based on its weightage in theSyllabus.

PART - II

Answer any Four Questions from the following **4 X 5 = 20 Marks**

19. Short answer question from UNIT - I
20. Short answer question from UNIT - II
21. Short answer question from UNIT - III
22. Short answer question from UNIT - IV
23. Short answer question from UNIT - V
24. Short answer question from any one of the five Units based on its weightagein the Syllabus.

SEMESTER -IV

COURSE 11: r DNA TECHNOLOGY, BIOINFORMATICS AND BIOSTATISTICS

MICROBIOLOGY MAJOR

Time: 2 Hours **Max Marks: 50M**

Section -I

Answer any three of the following questions. Must attempt atleast one question from each part. Each question carries 10 Marks. **3 X 10 = 30M**

Part – A

1. Explain principles of genetic engineering.
2. Discuss application of genetic engineering in medicine and agriculture.
3. Write sanger's method for DNA sequencing.

Part - B

4. Write and three DNA major DNA sequence databases.
5. Discuss the measurement of central tendency: MEAN, MEDLAN and MODE.
6. Give a note on protein data bases.

Section II

Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M

7. Restriction endo nucleases.
8. C-DNA libraries.
9. Patents.
10. NCBI.
11. BLAST.
12. Standard deviation.
13. Copy rights.

SEMESTER -IV

COURSE 11: r DNA TECHNOLOGY, BIOINFORMATICS AND BIOSTATISTICS

MICROBIOLOGY MINOR

Time: 2 Hours **Max Marks: 50M**

Section -I

Answer any three of the following questions. Must attempt atleast one question from each part. Each question carries 10 Marks.

3 X 10 = 30M

Part – A

1. Explain principles of genetic engineering.
2. Discuss application of genetic engineering in medicine and agriculture.
3. Write sanger's method for DNA sequencing.

Part - B

4. Write and three DNA major DNA sequence databases.
5. Discuss the measurement of central tendency: MEAN, MEDLAN and MODE.
6. Give a note on protein data bases.

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Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M

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8. C-DNA libraries.
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10. NCBI.
11. BLAST.
12. Standard deviation.
13. Copy rights.

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  - I mid examination to be conducted in offline mode in which the student should attempt **one essay** question for ten marks out of two questions, **two short** answer questions with five marks each out of four questions and five objective questions to be given for each paper.
    - Question paper is to be given as per the following structure for the courses with **4 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1M)
1	I	1	0	1
2	II	1	0	1
3	III	0	2	1
4	IV	0	2	1+ one question from anyunit with more syllabus weightage

- For I mid examination to be conducted in offline mode, Question paper is to be given as per the following structure for the courses with **5 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1 M)
1	I	1	0	1
2	II	1	0	1
3	III	0	1	1
4	IV	0	1	1
5	V	0	1+ one question from any unit(III or IV or V) with more syllabus weightage	1

- The remaining 25 marks for CIA are allocated as per the following structure.

Project-10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M

Project-10M	Viva on theory-3M	Assignment-5M	Seminar- 5M	Clean & green and Attendance- 2M

P R GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

COURSE 11: r DNA TECHNOLOGY, BIOINFORMATICS AND BIOSTATISTICS

Time: 3 Hrs. **Max. Marks: 50 M**

7. Major Experiment 20M
8. Minor Experiment 10M
9. Spotters 2 x 5 = 10M
    1) I
    2) II
    3) III
    4) IV
    5) V

4. Record 5M
5. Viva 5M

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IV SEMESTER

COURSE 3: - MOLECULAR BIOLOGY AND MICROBIAL GENETICS(MINOR)

credits -_3

II. Course Outcomes:

By the Completion of the course the learner should able to–

6. Understand the nature of genetic material, its organization in prokaryotes and eukaryotes, and the role of DNA and RNA.
7. Explain the process of DNA replication in prokaryotes and the involvement of enzymes andfactors.
8. Recognize the characteristics, types, and applications of extra chromosomal geneticelements such as plasmids and transposons.
9. Differentiate between classical and modern concepts of genes, understand gene structure,and the process of transcription.
10. Comprehend the genetic code, translation process, and regulation of gene expression inbacteria.

Unit - 1: DNA/RNA as genetic material, Replication of DNA No. ofHours:9

1.4 Experimental evidences that established DNA and RNA as genetic material.Genome organization in prokaryotes and eukaryotes.

1.5 Replication of DNA in prokaryotes.: Bidirectional and unidirectional replication, Semiconservative replication, Proof of Semiconservative replication (Messelson – Stahl Experiment). Mechanism of DNA Replication in Prokaryotes: step by step process, Enzymes and factors involved in replication- Primase, Helicase, Gyrase, DNA polymerases, DNA ligase, SSB proteins.

1.6 Extra chromosomal genetic elements: General characters, types and applicationsof Plasmids and transposons.

Unit - 2: Concept of gene, Transcription No. of Hours:9

2.3 Classical Concept of gene: Muton, Recon and Cistron; One gene-one enzyme andone gene - one polypeptide and One gene – One Product hypotheses.

2.4 Modern concept of gene: Definition of gene; Open reading frame; structural, constitutive and regulatory genes; uninterrupted genes, Split genes- concept of introns and exons.

2,3 Protein synthesis in Prokaryotes: Transcription- Definition, difference from replication, promoter, RNA Polymerase, mechanism of transcription. RNA splicing in eukaryotes;

Unit - 3: Translation and regulation of gene expression No. of Hours:9Protein synthesis

in Prokaryotes

3.3 Genetic code: Salient features, Wobble hypothesis.

3.4 Translation- Charging of tRNA, aminoacyl tRNA synthetases, Mechanisms of initiation, elongation and termination of polypeptides. Inhibitors of protein synthesis.

Regulation of gene expression in bacteria – lac operon

Unit - 4: Mutations and DNA repair No. of Hours:9

4.4 Mutations: Definition and types of Mutations (Spontaneous and induced, Somaticand germline); Physical and chemical mutagens;

4.5 Molecular basis of mutations (base pair changes, frame shifts, deletions, inversions, tandem duplications, insertions); Functional mutants (loss and gain of functionmutants); Uses of mutations.

4.6 Outlines of DNA repair mechanisms: Direct repair, Excision repair, MismatchRepair, Recombination Repair, SOS Repair.

Unit - 5: Genetic recombination in bacteria No. of Hours:9

5.4 Conjugation - discovery, F-factor, F+ & Hfr, mechanism ofconjugation,applications of conjugation;

5.5 Transformation- Discovery, mechanism of transformation, Competence Factorsaffecting transformation and application of transformation.

5.6 Transduction- discovery, mechanism and types of transduction.

IV. References

Text books:

1. James D. Watson Tania A. Baker, Stephen P. Bell Alexander Gann, Michael Levine, Richard Losick, 2013, Molecular Biology of the Gene, 5th Edition, PearsonEdu Publishers.
2. Roger Y. Stanier, Edward A. Adelberg, John L. Ingraham, 1977, General Microbiology 5th edition, London Macmillan.
3. David Freifelder1986 Molecular Biology 3rd edition, Jones & Bartlett Publishers
4. T.A. Brown, Gene cloning and DNA analysis- An Introduction, 4thedition
5. Bernard R. Glick and Jack. J. Pasternak, Molecular Biotechnology. 3rdedition
6. David Freifelder.Essentials of molecular biology.Jones and Bartlett Publishers,1998

IV SEMESTER

COURSE 9: - MOLECULAR BIOLOGY AND MICROBIAL GENETICS

credits -1

1. Isolation of genomic DNA from E. coli
2. Estimation of DNA using UV spectrophotometer (A260measurement).
3. Problems related to DNA and RNA characteristics, Transcription and Translation.
4. Resolution and visualization of DNA by Agarose Gel Electrophoresis.
5. Problems related to DNA and RNA characteristics, Transcription and Translation.
6. Induction of mutations in bacteria by UV light.
7. Study of different conformations of plasmid DNA through agarose gel electrophoresis.
8. Demonstration of bacterial transformation
9. Instrumentation in molecular biology – Ultra centrifuge, Transilluminator, PCR
10. Study of different types of DNA and RNA using micrographs and model / schematic
11. representations
12. Study of semi-conservative replication of DNA through micrographs / schematic
13. Representations

P.R. GOVERNMENT COLLEGE (A): KAKINADA
COURSE 9: - MOLECULAR BIOLOGY AND MICROBIAL GENETICS

w.e.f. 2021-2022 ADMITTED BATCH

BLUE PRINT

PART-I

Answer any three questions by attempting at least one question form each section

SECTION - A **3 X 10 = 30 Marks**

1. Essay question from UNIT- I
2. Essay question from UNIT- II
3. Essay question from UNIT- III

SECTION - B

4. Essay question from UNIT- IV
5. Essay question from UNIT- V
6. Essay question from any one of the five Units based on its weightage in theSyllabus.

PART - II

7. **Answer any Four Questions from the following** **4 X 5 = 20 Marks**
8. Short answer question from UNIT - I
9. Short answer question from UNIT - II
10. Short answer question from UNIT - III
11. Short answer question from UNIT - IV
12. Short answer question from UNIT - V
13. Short answer question from any one of the five Units based on its weightagein the Syllabus.

CIA structure for Single Major system

- Out of 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- I mid examination is to be conducted in offline mode at college level and II mid examination is to be conducted in online mode at department level.
    - I mid examination to be conducted in offline mode in which the student should attempt **one essay** question for ten marks out of two questions, **two short** answer questions with five marks each out of four questions and five objective questions to be given for each paper.
        - Question paper is to be given as per the following structure for the courses with **4 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1M)
1	I	1	0	1
2	II	1	0	1
3	III	0	2	1
4	IV	0	2	1+ one question from anyunit with more syllabus weightage

- For I mid examination to be conducted in offline mode, Question paper is to be given as per the following structure for the courses with **5 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question (5 M)	Objective Questions(1 M)
1	I	1	0	1
2	II	1	0	1
3	III	0	1	1
4	IV	0	1	1

5	V	0	1+ one question from any unit(III or IV or V) with more syllabus weightage	1

- The remaining 25 marks for CIA are allocated as per the following structure.

Project-10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M

Project-10M	Viva on theory-3M	Assignment-5M	Seminar- 5M	Clean & green and Attendance- 2M

P R GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
COURSE 9: - MOLECULAR BIOLOGY AND MICROBIAL GENETICS

Time: 3 Hrs. **Max. Marks: 50 M**

10. Major Experiment	20M
11. Minor Experiment	10M
12. Spotters	2 x 5 = 10M

1) I
2) II
3) III
4) IV
5) V

4. Record	5M
5. Viva	5M

Second Internship

Second Internship (After 2nd Year Examinations): Apprenticeship / Internship / on the job training / In-house Project / Off-site Project. To make the students employable, this shall be undertaken by the students in the intervening summer vacation between the 2nd and 3rd years (the detailed guidelines are enclosed).

Credit For Course: 04

ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

Assessment methodology for Internships / On the Job Training / Apprenticeship under the revised CBCS (2020 – 21 onwards)

Second Internship (After 2nd year examinations): Apprenticeship / Internship / On the job training / In-house Project / Off-site Project

To make the students employable, an Apprenticeship / Internship / On the job training / In-house Project / Off-site Project shall be undertaken by the students in the intervening summer vacation between the 2nd and 3rd years.

Learning outcomes

- Explore career alternatives prior to graduation.
- Integrate theory and practice.
- Assess interests and abilities in their field of study.
- Learn to appreciate work and its function towards future .
- Develop work habits and attitudes necessary for job success.
- Develop communication, interpersonal and other critical skills in the future job.
- Build a record of work experience.
- Acquire employment contacts leading directly to a full-time job followinggraduation from college.
- Acquire additional skills required for world of work.

Assessment Model

There will be only internal evaluation for this internship. Each faculty member is to be assigned with 10 t0 15 students depending upon availability of the faculty members. The faculty member will act as a faculty-mentor for the group and is in- charge for the learning activities of the students and also for the comprehensive and continuous assessment of the students.

The assessment is to be conducted for 100 marks and the credits assigned are 4. Later as per the present practice the marks are converted into grades and grade points to include finally in the SGPA and CGPA.

The weightings shall be:

Project Log	20%

Project Implementation	30%
Project report	25%,
Presentation	25%

Each student is required to maintain an individual logbook, where he/she is supposed to record day to day activities. The project log is assessed on an individual basis, thus allowing for individual members within groups to be assessed this way. The assessment will take into consideration the individual student's involvement in the assigned work.

While grading the student's performance, using the student's project log, the followingshould be taken into account -

a. The individual student's effort and commitment.
b. The originality and quality of the work produced by the individual student.
c. The student's integration and co-operation with the work assigned.
d. The completeness of the logbook.

The assessment for Project Implementation during ***second internship / Project Work / On the Job Training / Apprenticeship*** shall include the following components and based on the entries of Project Log and Project Report:

a. Involvement in the work assigned
b. Regularity in the work assigned
c. New knowledge acquired
d. New skill acquired

The Project Report should contain

a. Introduction.
b. Project specifications (area / background of the work assigned).
c. Problems taken up.
d. Analysis of the problem.
e. Recommendations and conclusions.

The Project Presentation is to be made by the student after he/she reports back to theCollege. The components for assessment are –

a. assessing the involvement in the project
b. presentation skills
c. final outcome of the project as evinced by the student.

For Example:

II MPC-EM

S.No.	Name of the Student	Class & Year of Study	Register Number	ProjectLog	Project Implementation	Project Report	Presentation	Total
				(20)	(30)	(25)	(25)	(100)

Signature of Project Mentor **Signature of Nominated faculty** **Signature of HOD/ In-Charge**

P R GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

V SEMESTER

COURSE 12 : IMMUNOLOGY AND MEDICAL MICROBIOLOGY

credits -3

I Course outcomes:

By the Completion of the course the learner should able to–

1. Describe the key concepts in Immunology and how the immune system is able to discriminate self vs. non-self
2. Explain how the innate and adaptive immune systems work together to generate an effective immune response against a specific pathogen.
3. Explain how the immune system is able to respond to so many diverse antigens.
4. To understand the importance of pathogenic microorganisms in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract etc
5. To understand and able to correlate disease symptoms with causative agent, isolate and identify pathogens.

Unit - 1: Immune System — No. of Hours:9

1. Concept of Innate and Adaptive immunity
2. Primary and secondary organs of immune system - thymus, bursa fabricius, bone marrow, spleen, lymph nodes and lymphoid tissues
3. Cells of immune system- Identification and function of B and T lymphocytes, null cells, monocytes, macrophages, neutrophils, basophils and eosinophils Components of innate immunity;Complement system (in brief)

Unit - 2: Immune response — No. of Hours 9

1. Characteristics of antigen (Foreignness, Molecular size, Heterogeneity and solubility) haptens.
2. Antibodies - basic structure and types.

3. Generation of Immune Response - Primary and Secondary Generation of Humoral Immune Response (Plasma and Memory cells), MHC Generation of Cell Mediated Immune Response

4. Immune complex formation and elimination -Agglutination, Precipitation, Neutralisation, Complement fixation, Phagocytosis
5. Hypersensitivity- definition and types (in brief)

Unit - 3: Microbes in Health and Disease — No. of Hours:9

1. Normal flora of human body.
2. General account of protozoan diseases: amebiasis, dengue fever
3. General account on microbial diseases - causal organism, pathogenesis, epidemiology, diagnosis, prevention and control of the following

   Bacterial diseases - Tuberculosis, Viral Diseases - Hepatitis- B and AIDS

Unit - 4: Principles of Diagnosis — No. of Hours:9

1. General principles of diagnostic microbiology- Collection, transport of clinical samples
2. Identification by culturing
3. Identification by biochemical/physiological properties
4. Agglutination based tests.
5. Identification by serological test ELISA,

Unit - 5: Prevention and Treatment — No. of Hours:9

1. Vaccines – Killed attenuated Toxoid recomdinated
2. Antimicrobial agents- General modes of action of antibacterial (Penicillin, Streptomycin), antifungal (Amphotericin and Griseofulvin), antiviral (Amantadine, Acyclovir)agents
3. Interferons
4. Antibiotic resistance -Tests for antimicrobial susceptibility (Disc diffusion)

II Skill Outcomes:

By the completion of the course the learner should able to– 1.Perform some of the ag-ab reactions

2. Carry out the biochemical tests useful for identification of of bacteria
3. Perform antibiotic sensitivity test
4. Identify some common symptoms and relate them to etiology
5. Prepare some differential media routinely used for identification of bacteria

P.R. GOVERNMENT COLLEGE (A), KAKINADA

III B.Sc., Microbiology – Practical Examinations Paper

Model at the end of V Semester

COURSE 12 : IMMUNOLOGY AND MEDICAL MICROBIOLOGY

Time: 2 Hrs. **Max. Marks: 50**

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1. Major Experiment 20M
2. Minor Experiment 10M
3. Spotters 2 x 5 = 10M
   1) I
   2) II
   3) III
   4) IV
   5) V

4. Record 5M
5. Viva 5M

P.R. GOVERNMENT COLLEGE (A): KAKINADA

II B.Sc - Microbiology / V Semester

COURSE 12 : IMMUNOLOGY AND MEDICAL MICROBIOLOGY

BLUE PRINT

PART-A

Answer any three questions by attempting at least one question form each section

SECTION - A **3 X 10 = 30 Marks**

1. Essay question from UNIT- I
2. Essay question from UNIT- II
3. Essay question from UNIT- III

SECTION - B

4. Essay question from UNIT- IV
5. Essay question from UNIT- V
6. Essay question from any one of the five Units based on its weightage in theSyllabus.

PART -B

Answer any Four Questions from the following **4 X 5 = 20 Marks**

7. Short answer question from UNIT - I
8. Short answer question from UNIT - II
9. Short answer question from UNIT - III
10. Short answer question from UNIT - IV
11. Short answer question from UNIT - V
12. Short answer question from any one of the five Units based on its weightagein the Syllabus.

P.R. GOVERNMENT COLLEGE (A): KAKINADA
COURSE 12 : IMMUNOLOGY AND MEDICAL MICROBIOLOGY

MICROBIOLOGY MAJOR

PART-I

Answer any three questions by attempting at least one question form each section

SECTION - A **3 X 10 = 30 Marks**

1. Primary and secondary organs of immune system?
2. Explain antigen and antibody reaction?
3. Explain Amebiases?

SECTION - B

4. Write about general principles of Diagnostics Microbiology Collection transport of clinical Samples?
5. Explain antimicrobial agent's antibacterial antifungal antiviral agents?
6. Write about hepatitis-B.

PART - II

Answer any Four Questions from the following **4 X 5 = 20 Marks**

7. Innate immunity?
8. Phagocytosis?
9. Dengue fever?
10. ELISA?
11. Vaccines?
12. AIDS?

P.R. GOVERNMENT COLLEGE (A): KAKINADA
COURSE 12 : IMMUNOLOGY AND MEDICAL MICROBIOLOGY

MICROBIOLOGY (MINOR)

PART-I

Answer any three questions by attempting at least one question form each section

SECTION - A **3 X 10 = 30 Marks**

1. Primary and secondary organs of immune system?
2. Explain antigen and antibody reaction?
3. Explain Amebiases?

SECTION - B

4. Write about general principles of Diagnostics Microbiology Collection transport of clinical Samples?
5. Explain antimicrobial agent's antibacterial antifungal antiviral agents?
6. Write about hepatitis-B.

PART - II

Answer any Four Questions from the following **4 X 5 = 20 Marks**

7. Innate immunity?
8. Phagocytosis?
9. Dengue fever?
10. ELISA?
11. Vaccines?
12. AIDS?

CIA structure for 3 Major system

- Out of 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- I mid examination is to be conducted in offline mode at college level and II mid examination is to be conducted in online mode at department level.
- I mid examination to be conducted in offline mode in which the student should attempt **one essay** question for ten marks out of two questions, two **short** answer questions with five marks each out of four questions and five objective questions with one mark each.

- The remaining 25 marks for CIA are allocated as per the following structure.

Project-10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M

V SEMESTER

COURSE 13 : APPLIED MICROBIOLOGY

credits -3

I. Course Outcomes:

By the completion of the course the learner should able to–

1. Identify the areas of entrepreneurship, and assess the scope for establishment.
2. Explain production of fermentation products and economics
3. Explain the production method of biofertilisers and mushrooms
4. Explain the process of baking and brewing
5. Prepare DPR and understand patenting

Unit–I: Entrepreneurial skill No of Hours: 9

Entrepreneurial skills–Institutes involved, Government support to entrepreneurs, Incubation centers, risk assessment. Scope for small, medium and Large scale industries in Microbiology

Unit–II: Fermentation Products No of Hours: 9

1. Microbial cells as fermentation products-
2. Bakers yeast, food and feed yeasts, SCP, Bacterial Insecticides, Legume Inoculants, Algae.
3. Enzymes as fermentation products–
4. Bacterial and Fungal Amylases, Proteolytic Enzymes, Pectinases, Invertases, and other enzymes
5. Fermentation Economics

Unit–III: Bio-fertilisers and Mushrooms No of Hours: 9

1. Mushroom cultivation–Cultivation of Agaricus campestris,Calocyba indica, Agaricus bisporus, and Volvariella volvaciae; Preparation of compost, filling tray beds, spawning, maintaing optimal temperature, casing, watering, harvesting, storage.
2. Biofertilizers –Chemical fertilizers versus biofertilizers, organic farming. Production of biofertilisers-Rhizobium sp, Azospirillumsp, Azotobactersp.
3. Microbial consortia for composting and as biofertilisers

Unit–IV: Baking and Brewing processes No of Hours: 9

Brewing–Media components, preparation of medium, Microorganisms involved, maturation,
carbonation, packaging, keeping quality, contamination, by products. Bread making- Yeast activation,

Unit–V:DPR and Patents No of Hours: 9

1. Preparation of DPR (Detailed Project Report)
2. Patents and secret processes –History of patenting, composition, subject matter and characteristics of a patent, Inventor, Infringement, cost of patent

Skill Outcomes:

By the completion of the course the learner should able to–

1. Prepare Microbial consortia for composting
2. Prepare a report on the working of production unit of mushrooms/biofertiliser
3. Prepare sample DPR

COURSE 13 : APPLIED MICROBIOLOGY
TOTAL HOURS: 40 Credits: 2

1. Collection transport and processing of clinical specimens (Blood, Urine, Stool and Sputum).Receipts, Labelling, 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, Salmonellaand Psedumonas.*
4. Demonstration of permanent slides of the following parasites:
    a) *Entamoeba histolytica*
    b) *Ascarisspps.*
    c) *Plasmodium spp.*
    d) Mycobacterium tuberculosis & Mycobacterium leprae
5. Estimation of haemoglobin (Acid haematin 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.

P.R. GOVERNMENT COLLEGE (A), KAKINADA

III B.Sc., Microbiology – Practical Examinations Paper

7A Model at the end of V Semester

COURSE 13 : APPLIED MICROBIOLOGY

Time: 2 Hrs. **Max. Marks: 50**

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1. Major Experiment 20M
2. Minor Experiment 10M
3. Spotters 2 x 5 = 10M
   1) I
   2) II
   3) III
   4) IV
   5) V

4. Record 5M
5. Viva 5M

P.R. GOVERNMENT COLLEGE (A): KAKINADA

II B.Sc - Microbiology / V Semester

COURSE 13 : APPLIED MICROBIOLOGY

BLUE PRINT

PART-A

Answer any three questions by attempting at least one question form each section

SECTION - A **3 X 10 = 30 Marks**

1) Essay question from UNIT- I
2) Essay question from UNIT- II
3) Essay question from UNIT- III

4) SECTION - B

5) Essay question from UNIT- IV
6) Essay question from UNIT- V
7) Essay question from any one of the five Units based on its weightage in theSyllabus.

1. PART -B

8) **Answer any Four Questions from the following** **4 X 5 = 20 Marks**
9) Short answer question from UNIT - I
10) Short answer question from UNIT - II
11) Short answer question from UNIT - III
12) Short answer question from UNIT - IV
13) Short answer question from UNIT - V
14) Short answer question from any one of the five Units based on its weightagein the Syllabus.

P.R. GOVERNMENT COLLEGE (A), KAKINADA

Microbiology Major

III B.Sc - Microbiology /V Semester End

COURSE 13 : APPLIED MICROBIOLOGY

Time: 2hrs **Max.Marks:50**

Section -I

Answer any three of the following questions. Must attempt atleast one question from each part. Each question carries 10 Marks. **3 X 10 = 30M**

Part – A

1. Scope for small, medium and large-scale industries in Microbiology.

2. Legume Inoculants.

3. Production of biofertilizers - Rhizobium sp

Part - B

4. Brewing process.

5. concept of Patent.

6. Cultivation of Agaricus bisporus.

Section II

Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M

7. Government support to entrepreneurs

8. Bacterial and Fungal Amylases.

9. Microbial consortia for composting and as biofertilizers.

10 Bread making.

11. Characteristics of a patent.

12. Baker's yeast

13. Bacterial Insecticides.

P.R. GOVERNMENT COLLEGE (A), KAKINADA

Microbiology Minor

III B.Sc - Microbiology /V Semester End

COURSE 13: APPLIED MICROBIOLOGY

Time: 2hrs **Max.Marks:50**

Section -I

Answer any three of the following questions. Must attempt atleast one question from each part. Each question carries 10 Marks. **3 X 10 = 30M**

Part – A

1. Scope for small, medium and large-scale industries in Microbiology.
2. Legume Inoculants.
3. Production of biofertilizers - Rhizobium sp

Part - B

4. Brewing process.
5. concept of Patent.
6. Cultivation of Agaricus bisporus.

Section II

Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M

7. Government support to entrepreneurs
8. Bacterial and Fungal Amylases.
9. Microbial consortia for composting and as biofertilizers.
10. Bread making.
11. Characteristics of a patent.
12. Baker's yeast
13. Bacterial Insecticides.

CIA structure for 3 Major system

- Out of 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- I mid examination is to be conducted in offline mode at college level and II mid examination is to be conducted in online mode at department level.
- I mid examination to be conducted in offline mode in which the student should attempt **one essay** question for ten marks out of two questions, two **short** answer questions with five marks each out of four questions and five objective questions with one mark each.

- The remaining 25 marks for CIA are allocated as per the following structure.

Project-10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M

V SEMESTER
COURSE 14: INDUSTRIAL MICROBIOLOGY
credits -3

Course Outcomes:

By the Completion of the course, the learner should able to–

1. Recognize various industrially important microorganisms
2. Identify the methods of screening of required microorganisms
3. Identify the appropriate methods of fermentation to be adapted for productions
4. Discuss the basic concepts in industrial microbiology, industrially important microbes and metabolites
5. Explain the components of upstream and downstream bioprocessing

UNIT I: Microorganisms of industrial importance No. of hours: 9

1. Brief history and developments in industrial microbiology.
2. Microorganisms of industrial importance -yeasts (Saccharomyces cerevisiae), molds (Aspergillus niger) bacteria (E.coli), actinomycetes (Streptomyces griseus).
3. Industrially important Primary and secondary microbial metabolites- Techniques involved in selection of industrially important metabolites from microbes.

UNIT II : Screening and Strain Improvement No. of hours: 9

1. Primary and secondary screening. Preservation and maintenance of industrial strains
2. Outlines of strain improvement. CRISPR-Cas TECHNOLOGY A Brief overview
3. Fermentation media (Crude and synthetic media; molasses, corn- steep liquor, sulphite waste liquor, whey, yeast extract and protein hydrolysates)

UNIT III: Bioreactors No. of hours: 9

1. Components of a typical continuously stirred tank bioreactor.
2. Types of fermenters – laboratory, pilot-scale and production fermenters.
3. Types of fermentation processes- solid state, liquid state; batch, fed- batch, continuous; aerobic, anaerobic; submerged, surface

UNIT IV: Fermentation and Downstream processes No. of hours: 9

1. Measurement and control of fermentation parameters - pH, temperature, dissolved oxygen, foaming and aeration
2. Downstream processing - filtration, centrifugation, cell disruption, solvent extraction. Overview of GMP And biosafety guidelines
3. Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes.

UNIT V: Microbial Productions No. of hours: 9

1. Production of citric acid, ethanol and penicillin.
2. Production of Glutamic acid and vitamin B12
3. Industrial production and uses of amylases, proteases, lipases and cellulases.

Skill Outcomes:

By the completion of the course the learner should able to–

1. Comprehend the significance of and demonstrate microbial diversity by isolating microorganisms from natural environments.
2. Microscopically demonstrate the microorganisms found in fermented food; prepare some of the fermented products(wine) in the laboratory to observe the associated physical and chemical changes.
3. Carry out microbial productions in small scale (citric acid) and estimate the product

P.R. GOVERNMENT COLLEGE (A), KAKINADA

III B.Sc., Microbiology – Practical Examinations Paper

7A Model at the end of V Semester

COURSE 14 : INDUSTRIAL MICROBIOLOGY

Time: 2 Hrs. **Max. Marks: 50**

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4. Major Experiment 20M
5. Minor Experiment 10M
6. Spotters 2 x 5 = 10M
   1) I
   2) II
   3) III
   4) IV
   5) V

4. Record 5M
5. Viva 5M

P.R. GOVERNMENT COLLEGE (A): KAKINADA

II B.Sc - Microbiology / V Semester

COURSE 14 : INDUSTRIAL MICROBIOLOGY

BLUE PRINT

PART-A

Answer any three questions by attempting at least one question form each section

SECTION - A **3 X 10 = 30 Marks**

1Essay question from UNIT- I

2Essay question from UNIT- II

3Essay question from UNIT- III

SECTION - B

5Essay question from UNIT- IV

6Essay question from UNIT- V

7Essay question from any one of the five Units based on its weightage in theSyllabus.

1. PART -B

Answer any Four Questions from the following **4 X 5 = 20 Marks**

8Short answer question from UNIT - I

9Short answer question from UNIT - II

10Short answer question from UNIT - III

11Short answer question from UNIT - IV

12Short answer question from UNIT - V

13Short answer question from any one of the five Units based on its weightagein the Syllabus.

P.R. GOVERNMENT COLLEGE (A), KAKINADA

III B.Sc - Microbiology /V Semester

MICROBIOLOGY (MAJOR)
COURSE 14 : INDUSTRIAL MICROBIOLOGY

Time: 2hrs **Max.Marks:50**

PART-A

Answer any Three questions by attempting at least one question each section

Section – A **3 x 10 = 30M**

1. Write an essay on the industrial importance of actinomycetes with examples of metabolites produced.
2. Explain the methods of primary and secondary screening of microorganisms used in industry.
3. Describe the components of a typical continuously stirred tank bioreactor (CSTR) with a neat diagram.

Section – B

4. Discuss the parameters affecting fermentation (pH, temperature, dissolved oxygen, aeration, foaming) and their control.
5. Explain the production of citric acid by Aspergillus niger. Add its industrial applications.
6. Write an essay on the industrial production and applications of proteases.

PART - B

Answer any **Four** of the following questions **4 x 5 = 20M**

7. Briefly outline the primary microbial metabolites and give two examples.
8. What are the main objectives of strain improvement?
9. Differentiate between batch, fed-batch, and continuous fermentation.
10. What is downstream processing? Mention any two methods used.
11. Write short notes on the production of vitamin B12.
12. Write a note on immobilized enzymes and their applications.

V SEMESTER

COURSE 15 A: FOOD AND DAIRY MICROBIOLOGY

credits -3

Course Outcomes: By the Completion of the course the learner should able to–

1. Understand the factors influencing microbial growth, contamination in foods, and sources of microbial contamination.
2. Gain knowledge of Microflora of milk, microbial contamination of raw milk and butter, and spoilage of various food types.
3. Use dairy starter cultures in fermented dairy products, other fermented foods, and probiotics.
4. Differentiate Foodborne diseases, intoxications, and infections
5. To adopt food sanitation, control measures, Follow HACCP; Carry out tests to detect pathogens in foods

Unit1: Microbes in Food and Dairy No. of Hours: 9

1. Intrinsic and extrinsic factors that affect growth and survival of microbes in foods, natural flora and source of contamination of foods in general.
2. Microflora associated with milk and milk products and their importance. Sources of microbial contamination of raw milk and butter
3. Sources of microbial contamination and spoilage of vegetables, fruits, meat, eggs, bread, canned Foods;

Unit 2: Food Preservation No. of Hours: 9

1. Principles of food preservation: temperature, canning, drying, irradiation, microwave processing and aseptic packaging, chemical methods of food preservation: salt, sugar, organic acids, SO2, citrates, benzoates,nitrite and nitrates etc.
2. Microbial and chemical changes in raw milk during chilling and refrigeration.
3. Naturally occurring preservative systems in milk like LP system, Immunoglobulins, Lysozyme, Lactoferrin. Food grade Biopreservatives (GRAS), Bacteriocins of lactic acid bacteria; Nisin and other antimicrobials produced by Lactic Acid Bacteria (LAB)

Unit 3: Fermented foods No. of Hours: 9

1. Dairy starter cultures, fermented dairy products: yogurt, acidophilus milk, kumiss, kefir, dahi and cheese
2. Other fermented foods: dosa, sauerkraut, soy sauce and tempeh, Probiotics: Health

benefits, types of microorganisms used, probiotic foods available in market.

3. Utilization and disposal of dairy by-products – whey.

Unit 4: Food borne diseases No. of Hours: 9

1. Food borne diseases (causative agents, foods involved, symptoms and preventive measures)
2. Food intoxications: Staphylococcus aureus, Clostridium botulinum and mycotoxins;
3. Food infections: Bacillus cereus, Vibrio parahaemolyticus, Escherichia coli, Salmonellosis,
4. Shigellosis, Yersinia enterocolitica, Listeria monocytogenes and Campylobacter jejuni

Unit 5: Food Sanitation No. of Hours: 9

1. Food sanitation and control; HACCP; National and International microbiological standards for dairy products (BIS, ICMSF, Codex Alimentarius Standards.
2. Cultural and rapid detection methods of food borne pathogens and introduction to predictive microbiology.
3. Genetically modified foods, Nutraceuticals, Biosensors in food, Applications of microbial enzymes in dairy industry [Protease, Lipases].

Skill Outcomes:

1. Mastering the MBRT method and standard plate count technique, interpreting MPN results, assessing milk quality based on microbial load, and understanding the significance of microbial analysis in ensuring milk safety.
2. Check the efficiency of pasteurization of milk include understanding the principle of the test, performing the enzymatic reaction, interpreting results, and assessing the effectiveness of milk pasteurization in ensuring food safety.
3. Mastering aseptic techniques, perform sample preparation and isolation techniques, identify potential pathogens and spoilage microorganisms, and understand the role of microorganisms in food safety and spoilage.
4. Follow yogurt fermentation protocols, controlling fermentation conditions, assessing yogurt quality, and understanding the role of microbial cultures in yogurt production.

P.R. GOVERNMENT COLLEGE (A): KAKINADA

II B.Sc - Microbiology / V Semester

COURSE 15 : FOOD AND DAIRY MICROBIOLOGY

BLUE PRINT

PART-A

Answer any three questions by attempting at least one question form each section

SECTION - A **3 X 10 = 30 Marks**

15) Essay question from UNIT- I

16) Essay question from UNIT- II

17) Essay question from UNIT- III

18) SECTION - B

19) Essay question from UNIT- IV

20) Essay question from UNIT- V

21) Essay question from any one of the five Units based on its weightage in theSyllabus.

1. PART -B

22) **Answer any Four Questions from the following** **4 X 5 = 20 Marks**

23) Short answer question from UNIT - I

24) Short answer question from UNIT - II

25) Short answer question from UNIT - III

26) Short answer question from UNIT - IV

27) Short answer question from UNIT - V

28) Short answer question from any one of the five Units based on its weightagein the Syllabus.

P.R. GOVERNMENT COLLEGE (A), KAKINADA

III B.Sc., Microbiology – Practical Examinations Paper

7A Model at the end of V Semester

COURSE 15 : FOOD AND DAIRY MICROBIOLOGY

Time: 2 Hrs. **Max. Marks: 50**

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1. Major Experiment 20M
2. Minor Experiment 10M
3. Spotters 2 x 5 = 10M
   1) I
   2) II
   3) III
   4) IV
   5) V

4. Record 5M
5. Viva 5M

P.R. GOVERNMENT COLLEGE (A), KAKINADA

III B.Sc - Microbiology /V Semester

MICROBIOLOGY (MAJOR)

COURSE 15 : FOOD AND DAIRY MICROBIOLOGY

Time: 2hrs **Max.Marks:50**

PART-A

Answer any Three questions by attempting at least one question each section

Section – A **3 x 10 = 30M**

1. Discuss the intrinsic and extrinsic factors influencing microbial growth in foods with examples.
2. Explain the principles of food preservation by physical and chemical methods.
3. Describe the role of dairy starter cultures in fermented dairy products.

Section – B

4. Write an essay on food intoxications caused by Staphylococcus aureus and Clostridium botulinum.
5. Explain the importance of food sanitation and HACCP in the dairy industry.
6. Write an essay on genetically modified foods, nutraceuticals, and biosensors in food microbiology.

PART - B

Answer any **Four** of the following questions **4 x 5 = 20M**

7. Microflora of milk and milk products.
8. Natural antimicrobial systems in milk (LP system, lysozyme, bacteriocins).
9. List the health benefits of probiotics.
10. Name the causative agents of Shigellosis and Listeriosis.
11. Outline the rapid detection methods of foodborne pathogens.
12. Write short notes on applications of microbial enzymes (proteases, lipases) in the dairy industry.

CIA structure for 3 Major system

- Out of 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- I mid examination is to be conducted in offline mode at college level and II mid examination is to be conducted in online mode at department level.
- I mid examination to be conducted in offline mode in which the student should attempt **one essay** question for ten marks out of two questions, two **short** answer questions with five marks each out of four questions and five objective questions with one mark each.

- The remaining 25 marks for CIA are allocated as per the following structure.

Project-10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M

Apprenticeship/ On the Job Training

Third internship/Project work (6th Semester Period):

During the entire 6th Semester, the student shall 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 (the detailed guidelines are enclosed).

Credit For Course:12

ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

Assessment methodology for Internships / On the Job Training /Apprenticeship under the revised CBCS (2020 – 21 onwards)

Third internship/Apprenticeship (5th/6th Semester period):

During the entire 5th /6th Semester, the student shall 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.

Learning outcomes

- Explore career alternatives prior to graduation.
- Integrate theory and practice.
- Assess interests and abilities in their field of study.
- Learn to appreciate work and its function towards future .
- Develop work habits and attitudes necessary for job success.
- Develop communication, interpersonal and other critical skills in the future job.
- Build a record of work experience.
- Acquire employment contacts leading directly to a full-time job followinggraduation from college.
- Acquire additional skills required for world of work.

Assessment model for the semester long apprenticeship / on the job training /internships during the V/VI Semester:

The assessment for the V / VI Semester long apprenticeship is for 200 marks and credits assigned are 12.

A monthly report is to be submitted to the teacher guide online within 15 days after thecompletion of the every month upto four months. The last two months of internship period shall be used for preparation of final project report simultaneously undergoing on the job training / internship / apprenticeship.

The assessment for this internship / on the job training will be both internal and external assessment. The internal assessment will be for 25% of marks which will be continuous and the assessment by the industry / enterprise / organization where the student does his/her internship will be indicated in grades. This assessment is to be conducted by a responsible person (General Manager / HR Manager / Head of the Division) in consultation with the supervisor under whom the internship was done.

The components of internal assessment during *this* ***third internship / Project Work / On the Job Training / Apprenticeship*** shall include the following components and based on the entries of Project Log and Project Report:

a. Involvement in the work assigned
b. Regularity in the work assigned
c. New knowledge acquired
d. New skill acquired

The Project Report should contain

a. Introduction.
b. Project specifications (area / background of the work assigned).
c. Problems taken up.
d. Analysis of the problem.
e. Recommendations and conclusions.

The Project Presentation is to be made by the student after he/she reports back tothe College. The components for assessment are –

a. assessing the involvement in the project
b. presentation skills
c. final outcome of the project as evinced by the student.

There shall be a final evaluation committee comprising of Principal, Teacher Guide, Internal Expert and External Expert nominated by the affiliating University. The final evaluation committee shall consider the following for evaluation –

A. Monthly Reports submitted by the student

B. Final Project Report

C. Grading given by the Company / Business unit / Enterprise where the student has undergone the training. The grades shall be converted into marks on the scale followed by the University

To evaluate and award marks, the Committee conducts viva voce examination at the college.

Example:

Name of the Student:	
Class & Year of Study	
Registered Number	
Internal Assessment Component	**Max. Marks**
1. Project Log	10
2. Project Implementation	20
3. Project Report	10
4. Presentation	10
TOTAL	**50**
External Assessment Component	**Max. Marks**
Performance Assessment by the Evaluation Committee, converting the grades awarded by the industry, enterprise, etc.	**100**
External Viva Voce	**50**
GRAND TOTAL	**200**