

Government College (Autonomous) Rajahmundry

(Estd: 1853, Affiliated to Adikavi Nannaya University)

An Autonomous Institution since 2000

Accredited by NAAC (RAF-2017) with "A+" Grade (CGPA: 3.38/4.00)

College with Potential for Excellence (2016-21)

East Godavari District, Andhra Pradesh, India 533 105

Website: www.gcrjy.ac.in email: gcrjy1853@gcrjy.ac.in Office: 0883-2475732

Program Code : 245



Department of Biotechnology

(Biotechnology & Agrobiotechnology) Syllabus : 2023-24

Approved by Board Of Studies

Introducing Single Major Program in Biotechnology (in 2023)

Index / Check list

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1	General Agenda (Common to college).		Enclosed
2	Guidelines for Design and Development of Curriculum under single major system (Common to college).		Enclosed
3	Proceedings of the Vice Chancellor , regarding nomination of University Subject Expert.		Enclosed
4	a . Proceedings of the Principal regarding constitution of BoS members.		Enclosed
5	b. Composition of BoS		Enclosed
6	c. Resolutions adopted in the BoS meeting.		Enclosed
7	n. All the certificate courses proposed for the Calendar year 2024, Seminars/ workshops, field visits, department-specific activities, special days related to the subject and study tours for 2023-24 should be placed before the respective Board and get them approved.		Agenda : 15 Agenda :16
8	o. Tentative budget proposal for activities mentioned in the above point should be approved by the respective Board of Studies.		
9	p. The topics for CSP should be placed before the respective Board and get them approved.		Agenda 18
7	d. Table showing Members present with signatures		Enclosed
8	e. List of Examiners & Paper Setters		Agenda 13
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11a	h. Table showing the list of courses offered in the program with Credits for both theory and lab courses For Single Major program.		Agenda 11
11b	Table showing the list of courses offered in the program with Credits for both theory and lab courses. For 3 Core Program		Agenda 11
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12	i. Table showing the list of other minor courses if any offered by the department.		
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17	14. Syllabus of All the certificate courses proposed for the calendar year 2024		Agenda 16
20	q. Try to incorporate SWAYAM / NPTEL MOOCs in the curriculum wherever it suits the curriculum for the benefit of the students.		Agenda 11
22	Internship Guidelines for the Community Service Project (Given by APSCHE, CCE) Assessment methodology for Internships		Agenda 5
23	Model Program book for CSP		
24	SOP issued by CCE on CSP		
25	r. 2 hard copies & 2 soft copies of the BoS document should be submitted along with the original bills to the Academic Cell within 2 weeks after completion of BoS for settlement of the bills and also for getting them approved in Academic Council meeting		Submitted

General Agenda

As we are aware that landmark reforms are happening in Higher Education System in Andhra Pradesh. One of the major reforms is the conversion into single major system from 3 major system also the GCRJY always strives to enhance the quality of education and academic standards for the benefit of the students.

In this context, we have decided to conduct Board of Studies (BoS) meeting in order to review and revamp the curriculum for our academic program (UG) offered by the department. This BoS meeting will serve as an opportunity for Board of Studies of our department comprising of experts in the subject concerned from university, other academic institutions and industry to collaborate and exchange ideas resulting in the development of a more comprehensive and effective curriculum.

Further To ensure uniformity and consistency across all departments of college , it is suggested to adopt a standardized approach to curriculum design. Therefore, we are to utilize Bloom's Taxonomy as a framework for designing the curriculum which provides a structured method for developing educational objectives and aligning them with appropriate teaching strategies and assessment methods.

Further, we are to prepare a model question paper that aligns with the revised curriculum which follows the principles of Bloom's Taxonomy. This will help the students to develop higher-order thinking skills and encourage critical analysis and application of knowledge. It is also required to identify the potential paper setters and examiners for our subject to ensure fair and unbiased evaluation mechanism.

The scheduled date for the BoS meeting is 30 Aug 2023, at 10:00 AM onwards in department of Biotechnology

The Board of studies is requested to do the needful

Your active involvement and valuable contributions to this meeting will undoubtedly play a crucial role in the continuous improvement of our academic programs. Kindly note that, together we can create an environment that fosters excellence and prepares our students for future challenges.

Guidelines for Design & Development of Curriculum under single major system 2023-24

The Government of Andhra Pradesh has introduced 4-year honours degree programme in a single major from the academic year 2023-24.

The existing CBCS in 3 major system is redesigned and a 4-year UG honours programme from the year 2020-21 has been rolled out in consonance with the National Education Policy (NEP)-2020. As per the UGC guidelines released during December 2022, for a new student-centric 'Curriculum and Credit Framework and Undergraduate Programmes' (CCFUP), it had to redesign the curricular framework for the 4-year honours programmes with a single major and one minor to incorporate a flexible choice-based credit system, multi-disciplinary approach and multi entry and exit options for facilitating students to pursue their career path by choosing the subject / field of their interest.

The honours degree in a single major would give the students an opportunity to pursue an in-depth study of a particular subject or discipline, and equip them with the knowledge required to pursue a Ph.D that needs independent learning and research.

Along with the single major, the students will also study one minor course, which can be done either online (such as Swayam, NPTEL, UGC, or any other Edu Tech company) or offline mode. The minor courses are introduced to enhance the employability skills of students and are offered as an open vertical.

Students will be eligible to pursue a postgraduate (PG) course in the minor selected too, as the minor courses are assigned with 24 credits required for admission into PG programme in a particular subject.

Multidisciplinary courses

All the UG students are needed to undergo multidisciplinary courses, intended to broaden their intellectual experience and form part of liberal arts and science education.

The three multidisciplinary courses in five disciplines include natural and physical sciences; mathematics, statistics and computer applications, library, information and media sciences; commerce and management; and humanities and social sciences.

To enhance students' skills, a pool of skill enhancement courses would be designed by incorporating business skills, technology skills, data science and digital and human skills.



OFFICE OF THE DEAN, ACADEMIC AFFAIRS
ADIKAVI NANNAYA UNIVERSITY
RAJAMAHENDRAVARAM

No.ANUR Government College (A) Rajahmundry BOS/2023

Dt.01-06-2023

PROCEEDINGS OF THE VICE-CHANCELLOR

Sub: ANUR-DAA-Nominated University Subject Experts for BoS - Government
College (A), Rajahmundry – Orders – Issued.

Ref : Re.No.GCRJY/Acad.Cell/BoS Nominees(UG)/2023, Dt. 27.03.2023.

Read: - Note orders of the Vice-Chancellor dated 30.05.2023.

ORDER:

With reference to above, the Vice-Chancellor is pleased to order that the following member be nominated as University Subject Expert for constitution of Board of Studies of **Government College (A) Rajahmundry**, for a period of two years from the date of orders issued as detailed against each subject.

Sl. No	Departments	Name of the Nominee for BOS
1	Aquaculture	Dr.M.Matta Reddy AKNU RJY
2	Biotechnology	Dr.K.Sarala Principal Scientist CTRI RJY
3	Botany	K.Usha Shree ASD Govt.Womens College KKD
4	Chemistry	Dr.K.Deepti AKNU RJY
5	Commerce	Dr.J.Pandu Ranga Rao PRGDC KKD
6	Computer Science & Applications	Dr.V.Persis AKNU RJY
7	Economics	Dr.P.Lakshmi Narayana AKNU RJY
8	English	P.R.Krishna Rao P.R.Govt.DC KKD
9	Geography	K.C.S.V Ramana, Y.N College Narsapur
10	Geology	Dr.K.Nukarathnam AKNU RJY
11	Hindi	Dr.K.Neeraja SKR GDC RJY
12	History	Dr.V.Narasimha Swamy GDC Alampur
13	Horticulture	Dr.M.Bhupati Rayalu GDC Kovvur
14	Journalism and Mass Communication	Dr.Karanam Narender OU, HYD.
15	Mathematics	Dr.P.Subhashini GDC Pithapuram
16	Microbiology	Dr.B.Lakshmi PR GDC KKD
17	Physics	P.V.L. Narayana GDC Nidadavole
18	Political science	Ch.Satyanarayana GDC Razolu
19	Sanskrit	Dr.K.Varalakshmi YN College Narsapur
20	Social Work	Prof.P.Arjun AU Visakhapatnam
21	Statistics	Dr.B.Muniswamy AU Visakhapatnam
22	Telugu	Dr.P.V.B Sanjeev Rao SKVT GDC RJY
23	Zoology	Dr.P.Vijaynirmala AKNU RJY

(BY ORDER)

(P. SURESH VARMA)
Dean, Academic Affairs

To
The Principal, Government College (A) Rajahmundry
The Above Members
The Principals concerned
PS to VC, PA to R, OOF

Proceedings of the Principal, Government College (Autonomous), Rajahmundry
Present: Dr. C. Krishna, M.Sc.Tech, NET., Ph.D.

Rc. No: Spl./Acad.Cell-GCRJY/BOS/2023-24, Dated: 28 June 2023

Sub:- Government College (Autonomous), Rajahmundry– **Boards of Studies (BoS) –2023-24** Nomination of Members - Orders Issued.

Ref:- 1. UGC Guidelines for Autonomous Colleges - 2018.
2. Proceedings of the Vice-Chancellor, ANUR No. ANUR Government College (A) Rajahmundry, dated 01-06-2023.
3. UGC, Curriculum and Credit Framework for undergraduate programs dated 7 December 2022.

ORDER:

The Principal, Government College (Autonomous), Rajahmundry is pleased to constitute the **Board of Studies in Biotechnology** for framing the syllabi in Biotechnology subject for all semesters under **single major system** duly following the norms of the UGC Autonomous guidelines 2018 and curriculum framework issued by UGC for single major system vide Ref.3 above.

S. No	Name	Designation
1	Dr. B. NAGESHWARI	Chairman
2	All Faculty members in the department	Member
3	Sri. K. Suresh Babu, Lecturer in Biotechnology , ABN College, Kovvur W. G. District.	Subject Expert
4	Sri. G. Sam Babu, Lecturer in Biotechnology , Sri. Y. N. College (A) , Margaret. W. G. Distrit.	Subject Expert
5	Dr. D. Sarala, Principal Scientist, CTRI, Rjy.	University Nominee
6	Dr. K. Ravindra Kumar Senior scientist (Horticulture) Dr. YSR Horticultural University Horticultural research Station Kovvur East Godavari dist Andhra pradesh 534350 Ph. 9491838982 9990112403 ravikhorti@gmail.com	Expert from Industry/Corporate Sector
7		Student Nominees

The above members are requested to attend the BOS meetings and share their valuable views, and suggestions on the following functionaries:

- (a) Prepare syllabi for the subject keeping in view the objectives of the college, the interest of the stakeholders and national requirements for consideration and approval of the Academic Council
- (b) Suggest methodologies for innovative teaching and evaluation techniques
- (c) Suggest a panel of names to the Academic Council for the appointment of examiners
- (d) Coordinate research, teaching, extension, and other activities in the department of the college.

The term of the members will be Two years from the date of issue of this proceedings. The Chairman of the BoS (HoD/lecturer In-Charge of the department) is directed to coordinate with the Principal of the College and conduct BoS meetings as and when necessary, but at least twice a year.

Note: For further information, please go through the guidelines provided by the Academic Cell of the College.



C. KRISHNA
PRINCIPAL
GOVERNMENT COLLEGE [A]
RAJAHMUNDRY

Copy to:

1. The above individuals
2. File

Government (Autonomous) College, Rajamahendravaram
Department of Biotechnology
Composition of Board of Studies Committee 2023-2024

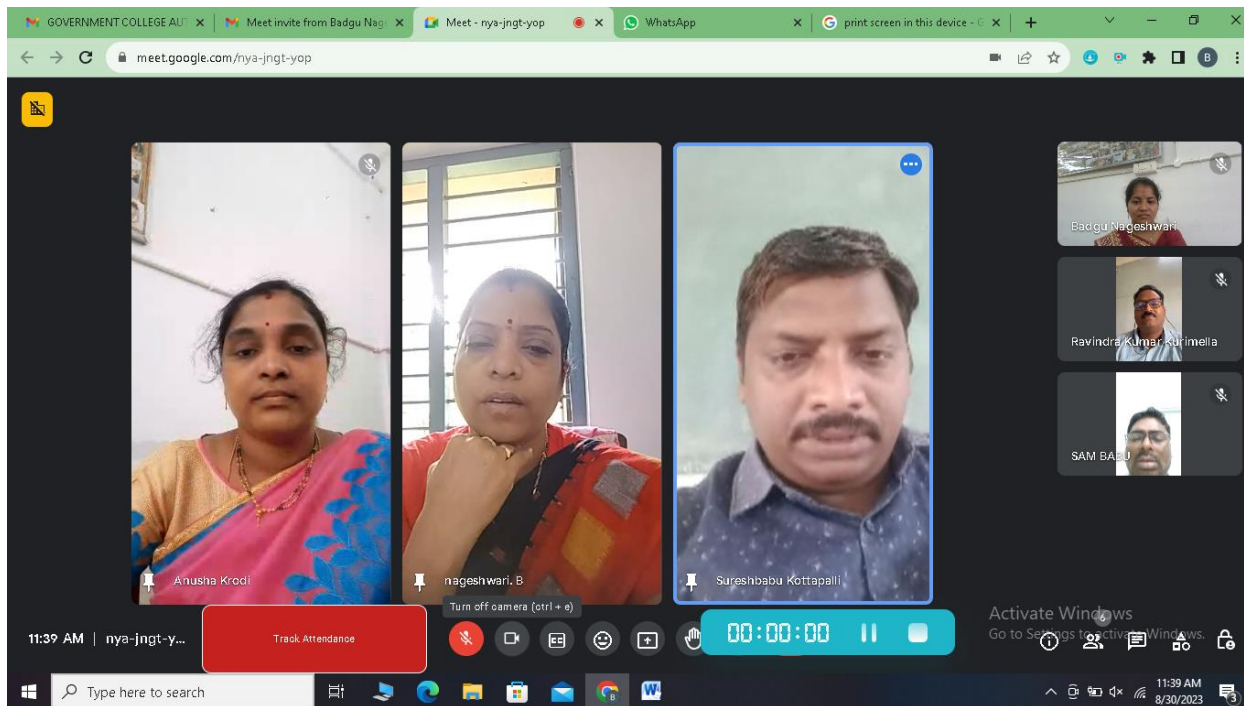
S.No	Nominee	Name and Designation
1	Chairman	Dr.B.Nageshwari, Lecturer in Charge , Department of Biotechnology, Govt (A) College, Rjy Phone : 9866219559, email Id: b.nageshwari@gcrjy.ac.in
2	Member	Mrs. K.Anusha, Lecturer , Department of Biotechnology, Govt (A) College, Rjy Phone : 7981940019, email Id: lekhaanu79@gcrjy.ac.in
3	Member	Ms. I.Parnika Sai Lecturer , Department of Biotechnology, Govt (A) College, Rjy Phone : 9493366602 parnikasaiilla@gmail.com
4	Subject Expert	Sri. K. Suresh Babu, ABN College, Kovvuru, WG Dist. Phone :9966845824, email Id: sureshbiozeal@gmail.com
5	Subject Expert	Sri.G.Sam Babu Sri Y.N. College (A), Narsapur. Phone: 9866611379, email Id: biotechsyamsir@gmail.com
6	University Nominee	Dr.K.Sarala Principal Scientist,Crop Improvement Division,CTRI, Rjy. Phone: 9849726890, email Id:
7	Industrial Nominee	Dr.K.Ravindra Kumar, Senior scientist (Horticulture) Dr.YSR Horticultural University. Horticultural Reseach Station, Kovvur. West Godavari Dist, A.P. 534350. Ph.9491838982, 9990112403., ravikhorti@gmail.com
8	Student Nominee	Name: B.Thiruvalli Present job / study : M.Sc, Biotechnology (AKNU-RJY) Phone: 8247260790, email Id: thiruvalli2723@gmail.com
9	Student Nominee	Name: B. Lakshmi Sahitya Present job / study : M.Sc., Biotechnology (AKNU-RJY) Phone:9494434719, email Id: b1sahitya459@gmail.com98

Government College (Autonomous), Rajamahendravaram
Department of Biotechnology
Board Of Studies – Committee Members : (2023-24)

Date : 30 -08 -2023

Time :10:00 : A.M.

Deliberations - (BoS- Meeting)



Left to Right :

Member Faculty : **K.Anusha**, Lecturer , Department of Biotechnology, Govt (A) College, Rjy

Chairman : **Dr.B.Nageshwari**, Lecturer in Charge , Department of Biotechnology, Govt (A) College, Rjy

Subject expert : **Sri. K. Suresh Babu**, Lecturer Dept Of Biotechnology , ABN College, Kovvuru, WG Dist.

Member Faculty : **Parnika Sai**, Lecturer , Department of Biotechnology, Govt (A) College, Rjy

Industrial expert : **Dr.K.Ravindra Kumar**, Senior scientist (Horticulture), Dr.YSR Horticultural University.

Horticultural Reseach Station, Kovvur. East Godavari Dist, A.P. 534350.

Subject Expert : **Sub Lt. G. Sam Babu** , Lecturer Dept Of Biotechnology, Sri Y.N. College (A), Narsapur

Government College (Autonomous), Rajamahendravaram
Department of Biotechnology
Syllabus up gradation meeting 2023 -2024

DATE: 30/08/2023

TIME: 10:00 A.M.

Resolutions adopted in the Board of Studies meeting

A meeting was conducted in the Department Of Biotechnology, in hybrid mode (online & offline mode) on 30-08-2023 at 10:00 A.M. with the Biotechnology Board of Studies members to review and upgrade the syllabus for all semesters of the program offered for the academic year 2023-2024.

The members present discussed various aspects of the UG Biotechnology Syllabi, Courses offered, Model Question Papers of both Theory and Practical for B.Sc., degree program in Biotechnology that is to be implemented for the academic year 2023-2024.

The following resolutions were adopted after thorough discussion and approval by the Board of Studies committee members.

Agenda – 1: To introduce 3 year degree programme in a single major (Biotechnology) from the academic year 2023-24.

Discussion :

The A.P.State Council of Higher Education has initiated the process of revision of syllabus in respect of general UG programmes to be implemented from the academic year 2023-24 in accordance with NEP 2020 and revised curricular structure of UGC. The major change in the proposed curriculum is a shift from 3 majors to single major along with multiple entry and exit options

As per the UGC guidelines released during December 2022, for a new student-centric 'Curriculum and Credit Framework and Undergraduate Programmes' (CCFUP), a single major and one minor was incorporated along with a flexible choice-based credit system, multi-disciplinary approach and multi entry and exit options for facilitating students to pursue their career path by choosing the subject / field of their interest.

The honours degree in a single major would give the students an opportunity to pursue an in-depth study of a particular subject or discipline, and equip them with the knowledge required to pursue a Ph.D that need independent learning and research.

Along with the single major, the students will also study one minor course (non biotechnology courses), which can be done either online (such as Swayam, NPTEL, UGC, or any other Edu Tech company) or offline mode.

The minor courses are introduced to enhance the employability skills of students and are offered as an open vertical.

Students will be eligible to pursue a postgraduate (PG) course in the minor selected, as the minor courses are assigned with 24 credits required for admission into PG programme in a particular subject.

Hence an over all program with the following features is designed.

Credit-based courses with well-defined learning outcomes, ensuring outcome-based education.
Courses on Life Skills with flexibility of choice in choosing the courses.
Skill Development Courses (SDCs) to acquire multidisciplinary skills. Choice is given to the students to choose the courses in different domains, arts or commerce or science.
Skill Enhancement Courses (SECs) to ensure skills required for the future world of work in the specific domain areas of study. Flexibility in choosing the courses is given to the students by offering multiple courses.

Resolution 1 : The new student centric Curriculum and credit framework for the Undergraduate Programmes (as prescribed by UGC in December 2022) is accepted and offered with a single major and one minor (non biotechnology courses).

Further the syllabus for Sem 1 prescribed by The A.P.State Council of Higher Education in respect of general UG programmes is decided to be implemented from the academic year 2023-24(also in accordance with NEP 2020 and revised curricular structure of UGC) .

Agenda 2 : To Offer multi level entry and exit options

Discussion : National Education Policy 2020 envisages transformational initiatives like – Undergraduate degree programmes of either 3 or 4 - year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as
a UG certificate after completing 1-year (2 semesters) of study in the field.
a UG diploma after 2 years (4 semesters) of study.
a Bachelor’s degree after a 3-year (6 semesters) programme of study.

The 4- year multidisciplinary Bachelor's programme, however, shall be the preferred option since it allows the opportunity to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minors as per the choices of the student”.

Resolution 2 : It is resolved to offer multilevel entry and exit options for facilitating students to pursue their career path by choosing the subject / field of their interest.

Student is eligible for Exit Option – 1 with award of UG “Certificate” after completing 1-year (1 & 2 semesters) of study in respective discipline

Student is eligible for Exit Option-2 with the award of “Diploma” in respective major with minor after completing 1st & 2nd year (sem 1,2,3,&4).

Student is eligible for Exit Option-3 with the award of Degree in respective major. after completing 1st, 2nd & 3rd year (sem 1,2,3,4,5 & 6).

Agenda 3 : List Of Skill Enhancement Courses to be offered to the students by the college.

Discussion :

Tentative List of Skill Enhancement Courses

Semester – 1

A student has to choose any TWO of the following four courses

1. Entrepreneurship Development
2. Leadership Skills
3. Analytical Skills
4. Communication Skills

Semester – 2

A student has to choose any TWO of the following four courses

1. Business Writing
2. Marketing Skills
3. Investment Planning
4. Stock Market Operations
5. Digital Literacy

Semester – 3

A student has to choose any ONE of the following three courses

1. Business Forecasting
2. Project Management
3. Information and Communication Technology
4. Data Analysis

Semester – 4

A student has to choose any ONE of the following three courses

1. Cybersecurity
2. Digital Marketing
3. Tourism Guidance
4. Design thinking

Resolution 3: It is resolved to offer the above mentioned Skill Enhancement Courses and student shall be given liberty to choose courses of their choice.

Agenda 4: Multidisciplinary Courses to be offered to the students by the college .

Discussion 4 : Tentative List of Multidisciplinary Courses
Courses offered for B.Sc Majors

Semester – 1

A student has to choose any ONE of the following three courses

1. Introduction to Social Work
2. Principles of Psychology
3. Indian History

Semester – 2

No Multidisciplinary course is offered in Semester 2

Semester – 3

A student has to choose any ONE of the following three courses

1. Introduction to Public Administration
2. Principles of Management
3. Principles of Accounting

Semester – 4

A student has to choose any ONE of the following three courses

1. Fundamentals of Economics
2. Indian Philosophy
3. Performing Arts

Resolution 4: It is resolved to offer the above mentioned Multidisciplinary Courses and student shall be given liberty to choose courses of their choice.

**

Agenda-5: To discuss, consider, propose and approve basic frame work for syllabus for all the semesters and other components like carrying out of Internships in summers and in 5th or 6th semester, project work presentation, thesis Submission and facing viva voce.

Discussion : The committee discussed and came to conclusion that keeping in view further education of students in the field, it is apt to adopt the basic frame work for syllabus which is prescribed by APSCHE and to modify the syllabus advantageously according to the needs of the student , department, college and local area and it also decided to follow CBCS pattern in offering courses for 2nd and 3rd years.

Curriculum for 5th and 6th semesters by APSCHE which has been adopted from the year 2022-23 will continued for 2023-24 also.

- ❖ 3 sets of electives (2 courses in each set) will be offered to the student , of which the student will have to choose 1 set only consisting of 2 courses for the 5th semester.

The committee members discussed the usefulness of the internships and gave suggestions about where to send the students for 3 phases of trainings i.e., Community Service project (at the end of 2nd semester) , Internship (at the end of 4th semester) , Apprenticeship / On job training (one full semester 5th or 6th) for period of 2 months , again 2 months and finally 6 months respectively.

10 months mandatory internship in 3 phases for 4 yr conventional Degree program						
S.No	Phase	Project / Inernship / Training	Duration	Time of Academic year	Evaluation / Marks	Credits
1	First phase	Community Service Project	2 months	At the end of Sem -2	Log Book (20M) Project Implemetation(30M) Project Report (25M) Project viva (25M) ----- TOTAL= 100 M -----	4
2	Second phase	Internship/ Apprenticeship/ On job training	2 months	At the end of Sem 4	Log Book (20M) Project Implemetation(30M) Project Report (25M) Project viva (25M) ----- TOTAL= 100 M -----	4
3	Third phase	Internship/ Apprenticeship/ On job training	6 months (One full semester)	5 th sem or 6 th sem	Internal External (viva) ----- TOTAL = 200M -----	12
At the end of 2nd and 3rd phases the student will have to present his project work, submit a project thesis, take viva .						

First phase : Community Service Project :

After 2nd semester exams (April-May) the students will take up Community Service Project for a period of 2 months.

- The following is the evaluation methodology for awarding marks/grades.
- There will be only internal evaluation for this internship.
- 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.

The weightings shall be:

- ❖ Project Log 20%
- ❖ Project Implementation 30%
- ❖ Project report 25%,
- ❖ Presentation 25%

Letter grade	Remarks	% of Marks	Grade Point	Credits	Credit Point
O	(outstanding)		10	2	20
A+	(Excellent)		9	2	18
A	(Very Good)		8	2	16
B+	(Good)	75	7	2	14
B	(Above average)		6	2	12
C	(Average)		5	2	10
D	(Pass)		4	2	8
F	(Fail)		0	2	0
Ab	(Absent)		0	0	0

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

The following is the recommended list of projects for B.Sc programmes. The lists is not exhaustive and open for additions, deletions and modifications. Dept is expected to focus on specific local issues for this kind of projects. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of projects. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting shall be ensured.

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional health care methods
15. Food habits
16. Air pollution
17. Water pollution
18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice

23. Health care awareness programmes and their impact
24. Use of chemicals on fruits and vegetables
25. Organic farming
26. Crop rotation
27. Floriculture
28. Access to safe drinking water
29. Geographical survey
30. Geological survey
31. Sericulture
32. Study of species
33. Food adulteration
34. Incidence of Diabetes and other chronic diseases
35. Human genetics
36. Blood groups and blood picture

Second phase : After 4th semester exams (April-May) the students will take up Internship/ Apprenticeship/ On job training for a period of 2 months.

Evaluation methodology : Same as for CSP of Phase -1

Third phase : In the 5th sem or 6th sem the students will take up Internship / Apprenticeship / On job training for 6 months (One full semester).

Evaluation methodology

Internal Assessment (50M)

▪ Project Log	10M
▪ Project Implementation	20M
▪ Project report	10M
▪ Presentation	10M

External Assessment (150 M)

▪ Monthly report	20M
▪ Final Project Report	50M
▪ Evaluation by internship offering company	30M
▪ Viva Voce	50M

TOTAL = 200M

Resolution - 5 : It is resolved to approve and send the students for community service project for a period of 2 months during summer vacation after Iyr , again the students will be sent to internships for a period of 2 months during summer vacation after II yr and to send to Biotechnology subject specific internships for a period of (2+6=) 8 months in the 5th or 6th Semester. Further the students shall fulfill the following : Submit a project thesis , present the project work through PPT and face viva voce at the end of each project for all the three projects.

Agenda 6 : To invite suggestions / recommendations by the statutory body pertaining to Research.

Discussion : The committee recommended that mandatorily the students need to come out with a publication of their project work, so that the student is serious about the project work and at the same time it is fetching to the students too in their future endeavors.

Resolution 6: It is resolved to make publications mandatory from project work and to present the project work during poster presentation at events like seminars / symposiums and conferences.

Agenda 7 : To design course objectives , course outcomes and to propose and approve topics to be introduced in to the syllabus which confer skill development , employability and entrepreneurship .

Discussion : All the committee members involved in designing course objectives , course outcomes and and came up with need based objectives and outcomes . Further the syllabi was designed to attain the objectives and outcomes for the courses. Apart from the Board of Studies committee members' feedback from stakeholders and ex-students (BoS Committee – Student members) now pursuing M.Sc., in Biotechnology at various universities was also considered in designing the syllabus. Finally a syllabus with content which confers skill development , employability and entrepreneurship to the students has been evolved. These skill development , employability and entrepreneurship development topics are highlighted in Red, Green and Yellow colours respectively.

The present syllabus and curriculum is designed to cater the following to the students :

- ✓ To improve employability rate,
- ✓ To enhance skill development
- ✓ To induce Entrepreneurship.
- ✓ To cater to local industry needs / local advantage
- ✓ To encourage research oriented thinking,

✓ To enable students to clear entrance exams for pursuing higher studies

Resolution 7 : It is resolved to mention the designed course objectives and course outcomes in the courses being offered and it is also resolved to introduce such topics in the syllabus which cater to wide variety of needs of the students as mentioned above in the discussion.

Agenda - 8 : Proposing courses and Framing syllabus for I, II and III yr B.Sc., Biotechnology and carrying out deletions and introduction of additional inputs .

Discussion : The committee decided to offer same syllabus for I yr which was prescribed by APSCHE for single major program. For Iyr, necessary deletions and introduction of additional inputs have been carried out, it has been decided by the committee to offer the same courses in the fifth semester in the academic year 2023-24 after necessary deletions and introduction of additional inputs in to the syllabus . Further 3 sets of electives (2 courses in each set) are offered to the students , of which the student will have to choose 1 set only consisting of 2 courses.

The titles of new courses introduced for single major program in Sem- 1 are as follows

Year	Sem	Paper	Title of course	Theory + Lab Hrs per week	Marks			Credits	Course code
					CIA	SEE	Total		
I-yr	Sem-1	P-1	Introduction to classical biology + Lab	3 +2	50 50	50	100	3+1 = 4	
I-yr	Sem -1	P-2	Introduction to Applied Biology + Lab	3 +2	50 50	50	100	3+1 = 4	
I-yr	Sem -2	P-3	Biomolecules And Analytical techniques + Lab	3 +2	50	50 50	100	3+1 = 4	
I-yr	Sem -2	P-4	Microbiology, Cell Biology + Lab	3 +2	50	50 50	100	3+1 = 4	

Further The committee discussed and decided that some¹⁵ advanced topics of the field may be introduced as additional inputs so that the students are up to date with knowledge in the field of their study. Further some of the topics which are repeated in the courses offered by Botany department and some outdated topics may be removed. A separate document with additions and deletions is enclosed in this syllabus document.

Resolution - 8 : It is resolved to introduce the syllabus prescribed by APSCHE for semesters 1&2 with out changes . While for Sem 3, 4, 5 and 6 some changes in syllabus will be carried out with introduction of advanced topics as additional inputs and removal of outdated and topics .

Agenda - 9 : To review the practical syllabus for all the courses.

Discussion: The members of the committee discussed and came to conclusion that instead of having high end practical in the syllabus which are not possible to carry out with “hands on” by every student, the practical which are feasible to carry in and around the department / college may be introduced

Resolution - 9 : It is resolved to introduce such practical in to the syllabus which are feasible to carry out in the department / college.

Agenda 10: Identification and approval of unit wise assignment questions.

Discussion : Keeping in view the addictive nature of students to the phone, it is decided by the committee to give internet based assignments to the students to inculcate the habit of using the gadget in a resourceful manner. Further the topics which enhance skills , employability and entrepreneurship have been decided upon to be assigned to the students.

Resolution - 10: it is resolved to give internet based assignments to the students and such topics which enhance skills , employability and entrepreneurship.

Agenda - 11 : To propose and approve the allocation of marks for internal and external components.

➤ **Discussion :** The committee members discussed and recommended that the college specific allocation of Internal component (CIA : SEE as 50:50) prepared by IQAC, GDC (A) RJY as recommended by Autonomous, may be adopted. Further parts of components were chosen from the internal choices offered by the college specific allocation and finally department specific allocation was evolved, which is shown below. Further the following approved pedagogy techniques for internal assessment are also mentioned below.

Department of Biotechnology
Department Specific : Allocation of Internal component
Common for all the semesters.

S.No.	Component				Distribution of Marks
1 CIE I	Q No		Learning Objective		Marks
	1	Memory based (Remember)		2	
	2	Understand (Comprehension)		2	
	3	Application		3	
	4	Analysis		3	
	5	Evaluation		5	
	6	Creativity		5	
	TOTAL			20 marks	
					20
2	CIE II (Online Exam)				10
3	ATTENDANCE		Above 95%	5	5
			91% to 95%	4	
			86% to 90%	3	
			81% to 85%	2	
			75% to 80%	1	
			Below 75%	0	
Pedagogical Strategies					
4	ASSIGNMENT				5
5	Participation or Paper Presentation in Student Seminars/Workshops/Group Discussions/ Quiz/ Student Study Project/Field Visit/Survey				5
		Participation	Second Prize	First Prize / Best Paper	
	Workshop/Seminar/ Technical Symposium	2	3	5	
	National / International Conference	3	4	5	
6	Viva-voce/ chart preparation with diagrams				5
TOTAL					50

7. The assessment component is designed as follows:

For all I, II & III year students (CBCS pattern) Theory examination:

Internal exam (CIA)	- 50 marks	Assessment through new pedagogical methods
SEE exam	- 50marks	
Total	-100 M	

8. Practical exam would be conducted at the end of each semester for BSc I, II, III year.

- Internal practical exam at the end of 1st, 3rd and 5th each for - 50marks.
- External practical exam at the end of 2th, 4th, and 6th semester each for - 50marks.

The scheme of Model question papers for each course is framed at the end of the syllabus.

- ✓ A minimum of 120 credits should be earned to complete an under graduate course.

*Extra credits can be earned through Extension activities for better future opportunities

*It is mandatory to pursue a **certificate course in** semester-3 (for a complete Calendar year)

Internal assessment: **50 marks**

External assessment: **50 marks**

Total: 100 marks / (02 credits)

*Enrolment and completion of Course in SWAYAM “MOOCs” will be entitled to earn an additional 1 credit.

Two Day Workshop for Govt colleges of East Godavari District on strengthening of District Resource Centers and Enhancement of Quality of Teaching Learning Practices On 25th and 26th at Govt College (A), Rajahmundry.

Additional inputs : additional to the syllabus, latest developments or aspects useful to the students.

Learning objectives: What knowledge, skills and values the students are expected to gain after teaching of the topic.

Activity Chart		
CURRICULAR	CO-CURRICULAR (Subject related)	EXTRA CURRICULAR (College Level)
<p>Post assessment, Class room teaching, Bridge courses, Models ,using teaching Aids like maps, charts, graphs, paper clippings, photographs, audio visuals, OHP, LCD, internet based or learning packages prepared by teacher, examples that relate the theory to the practice / evidence, brain storming, Spl. class using ICT, Revision, Tutorial, Remedial class, Unit test, Discussion on valued scripts, academic counselling etc</p>	<p>Student activities like Seminars, Assignments, Field work, Project work, Quiz, Debate, Group discussion, Guest lectures, role play, building models, extension work, Feedback, Review, problem solving etc.</p>	<p>Seminars, Field work, project work, Quiz, Career guidance, Celebrating relevant days, just a minute program, Extension lectures, Linkages, Guest lectures, Panel Discussions etc.,</p>

Learner - Oriented Activities (Co-curricular)

Seminars Elocution/Debate Quiz/Group Discussion Project Work / Study Projects
Field study - Brief Research Project (Outside the class/ Internet) Games / Activities
Invited Lecturers/ Extension Lectures (Community involved) Linkages / Collaborations
Preparation of Models
Power point show - Videos - TV channel (Mana TV / Discovery, National Geographic /
History/ National / BBC Documentary - Internet - Downloads etc) - ICT bases
Extra-Curricular Activities (the above Subject related activities at the College-
level)

Evaluation (Learner)

Post Admission Assessment - Pre Teaching assessment - Module/Unit wise
While teaching assessment - Post Teaching Assessment - Weekly Tests/ Units Tests
Pre-Final - Tutorial - Remedial Programmes - Group Discussions
Subject Related Essay competitions / Elocution / Debate/ Quiz etc.

REVISED Bloom's Taxonomy Action Verbs

Definitions	I. Remembering	II. Understanding	III. Applying	IV. Analyzing	V. Evaluating	VI. Creating
Bloom's Definition	Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers.	Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas.	Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.	Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations.	Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria.	Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.
Verbs	<ul style="list-style-type: none"> • Choose • Define • Find • How • Label • List • Match • Name • Omit • Recall • Relate • Select • Show • Spell • Tell • What • When • Where • Which • Who • Why 	<ul style="list-style-type: none"> • Classify • Compare • Contrast • Demonstrate • Explain • Extend • Illustrate • Infer • Interpret • Outline • Relate • Rephrase • Show • Summarize • Translate 	<ul style="list-style-type: none"> • Apply • Build • Choose • Construct • Develop • Experiment with • Identify • Interview • Make use of • Model • Organize • Plan • Select • Solve • Utilize 	<ul style="list-style-type: none"> • Analyze • Assume • Categorize • Classify • Compare • Conclusion • Contrast • Discover • Dissect • Distinguish • Divide • Examine • Function • Inference • Inspect • List • Motive • Relationships • Simplify • Survey • Take part in • Test for • Theme 	<ul style="list-style-type: none"> • Agree • Appraise • Assess • Award • Choose • Compare • Conclude • Criteria • Criticize • Decide • Deduct • Defend • Determine • Disprove • Estimate • Evaluate • Explain • Importance • Influence • Interpret • Judge • Justify • Mark • Measure • Opinion • Perceive • Prioritize • Prove • Rate • Recommend • Rule on • Select • Support • Value 	<ul style="list-style-type: none"> • Adapt • Build • Change • Choose • Combine • Compile • Compose • Construct • Create • Delete • Design • Develop • Discuss • Elaborate • Estimate • Formulate • Happen • Imagine • Improve • Invent • Make up • Maximize • Minimize • Modify • Original • Originate • Plan • Predict • Propose • Solution • Solve • Suppose • Test • Theory

Anderson, L. W., & Krathwohl, D. R. (2001). A taxonomy for learning, teaching, and assessing, Abridged Edition. Boston, MA: Allyn and Bacon.

Approved Pedagogical Techniques considered for Internal Assessment

- ✓ P1 – Lecture
- ✓ P2- Demonstration
- ✓ P3- Question & Answer
- ✓ P4- Discussion, Debate or Collaboration
- ✓ P5- Audio & Video
- ✓ P6- Virtual or Online learning
- ✓ P7- Assignment or Case Study
- ✓ P8- Study (Research) Project
- ✓ P9- Hands on Study
- ✓ P10-Class Seminar
- ✓ Px1- Quiz
- ✓ Px2- Brainstorming
- ✓ Px5- Peer review
- ✓ Px6- Games & Puzzles
- ✓ Px7- Tutorial
- ✓ Px8- Display of Newspaper clipping
- ✓ Px9- Invited lecture
- ✓ Px10 – Group learning Px11 -Bulletin board,
- ✓ Px12 -Open text book study
- ✓ Px13 - Student magazine,
- ✓ Px14 -Report/Review writing
- ✓ Px15 - Diagrams in text book
- ✓ Px16 -3-D Models,
- ✓ Px17 -Drawing (maps)/charts
- ✓ PT – Test,
- ✓ *Google classroom
- ✓ *Project based teaching

Resolution -11: It is resolved to follow the evolved Biotechnology Department specific Allocation of Internal component and external component (CIA : SEE as 50:50) .

Agenda - 12 : To propose and approve model question papers for Theory and Practical of external assessment.

Discussion : The committee members discussed and keeping in view the various activities in the curriculum, approved the model question paper with 50% choice in section –A (essays), and Section – B (short answers) , No choice in Section –C (short answer type questions) for theory. One essay and one short answer question is to be framed from each unit including additional input. Further it decided to continue the same pattern of question paper for practical exam. The model question of both theory and practical papers are enclosed in the BoS document 2023-24.

Resolution - 12: It is resolved to follow pattern of question paper with 50% choice in section –A essay, and Section – B short answers , No choice in Section –C (short answer type questions) for theory .It is resolved to continue the same pattern of question paper for Practical exam.

Agenda - 13 : Identifying / approving potential paper setters and examiners.

Discussion : The committee approved the list of colleges proposed for setting the question paper and for acting as evaluators of exam – answer scripts. State wide colleges which are offering Biotechnology have only been selected.

Resolution - 13 : It is resolved to approve the list of colleges proposed by the department of biotechnology for setting papers and for acting as examiners.

Agenda - 14: Propose and approve co- curricular activities .

Discussion : The committee members discussed and proposed that students should be taken on a field trip at least once in an year so that they can gain practical knowledge about various aspects in the field of their study. Further the committee proposed that once in every semester a guest lecture may organized . It is suggested that eminent personalities in the filed may be invited for delivering the talk. It was decided that the students may be made to learn the innovations and day to day importance of biotechnology and research development through Biotechnology news

Resolution - 14: It is resolved to take the students of I yr and II yr for “Educational tour” or “Field trip”, organize a “Guest lecture” every semester and to make the students subscribe to Biotechnology news.

Agenda - 15 : To propose and approve extra curricular activities for the department.

Discussion : The committee proposed that birth anniversaries of eminent scientists in the field may be celebrated to make the students aware of the contribution of scientists and also to motivate them to contribute to the field . It is decided to celebrate the birth anniversaries of Karl Ereky (Father Of Biotechnology) on 20th Oct , Kary B Mullis (Inventor of PCR technique) on 28th Dec , Alexander Fleming (Discoverer of antibiotic Penicillin) on 6th Aug. Further it is proposed that some useful activities like webinars / seminars

or

awareness campaigns and lab to school activities may be conducted on these days.

Resolution - 15: It is resolved to celebrate the birth anniversaries of of Karl Ereky on 20th Oct , Kary B Mullis on 28th Dec , Alexander Fleming on 6th Aug by the department of biotechnology by organizing some useful event like seminar, awareness campaigns and lab to school extension activities.

Agenda - 16: To propose and approve the certificate course offered by the department of biotechnology.

Discussion : After thorough discussion the committee proposed that for a certificate course with topics exclusively based on techniques may be offered. As the techniques are likely to increase the employability opportunities of the student. The certificate course with title “ Microbiological and Biophysical techniques” is

resolved to be offered by the department of biotechnology.

Resolution - 16: It is resolved to run the certificate course titled “ Biophysical and microbiological techniques”.

Agenda 17 : Discontinuation of the program Agrobiotechnology.

Discussion: The program agrobiotechnology was introduced as it was thought that it would cater to needs of the geographical region which is mainly agriculture based. But there seems to be no vertical mobility with respect to career or to pursue master’s degree in Agrobiotechnology. Hence it is decided to discontinue the program.

Resolution - 17: It is resolved to discontinue the Agro biotechnology based program, since there seems to be no vertical mobility with respect to career or to pursue master’s degree in Agrobiotechnology.

**

Agenda - 18 : Identification of events to be carried out by the department for the academic year 2023-2024 and to propose and approve the approximate amount to meet the expenses for carrying out approved activities.

Discussion : The committee members discussed and suggested that the department should plan for the following events 1. Filed trip, 2. Webinar / seminar 3. Observation of Birthdays of eminent Scientists in the field. 4.Awareness rallies, 5. Mounting informative posters on department notice board on daily/weekly basis. 6. Carrying out mini projects in the department. 7. Biotechnology Club Activities. 8. Celebration of Science day on 28th Feb of every year. The estimated budget was worked out and an amount of Rs 85,500 was approved. The estimate sheet with signnatures of committee members is enclosed in this BoS document for reference.

Resolution - 18 : It is resolved to observe the above mentioned activities proposed by the committee and to approve the budget estimate of Rs 1,00,500 -00 that is most likely to be incurred for carrying out the events. Activities not mentioned in any of the above discussion but which are found to be useful to the students shall be carried out by meeting the expenses from the approved budget estimate only after due permission from concerned authority (IQAC / Academic cell / Principal)

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GOVERNMENT COLLEGE (A), RAJAHMUNDRY
ACTION PLAN 2023-2024
DEPARTMENT OF BIOTECHNOLOGY

Sl.	MONTH/YEAR	ACTIVITY	Tentative Date	Remarks
01	August 2023	• Alexander Fleming birthday celebrations.	August 6th	
		• Admissions & commencement of class work.	From Aug 17 th	
		• Conducting induction programme for newly admitted students I year students on CBCS.	Aug 17 th to Sep 6 th	
		• Bridge course to Newly admitted first year students.	AUG 18 th to Sep 5 th	
		• Handmade and Ecofriendly Rakhi Making activity by students.	Aug 30 th and Aug 31 st	
02	September 2023	• National nutrition week celebrations.	Sep 1 st to Sep 6 th	
03	October 2023	• World Heart Day - Observation	Sep 29 th	
		• Guest lecture on Advancements in Bioanalytical techniques	Second week of October	
04	November 2023	• Karl Ereky birthday celebration	28 th October	
		• Field visit to Andhra Sugars, Tanuku, AP.	1 st Week of Nov	
		• Extension activity for junior college students on Awareness towards viral diseases	2 nd week of November	
05	December 2023	• National seminar by virtual mode. -	4 th week of Nov	
		• National pollution prevention day.	First week of Dec	
		• Louis Pasteur birthday celebrations.	Dec (27 th)	
		• Kary Mullis Birthday Celebrations.	28 th December	
06	January-2024	Extension activity - Lab to School.	Third week of Jan	
		National level Online quiz competition - Developments in Biotechnology.	Jan 30 th	
07	February 2024	• World cancer day	4 th Feb	
		• National science day celebrations	3 rd week of Feb	
08	March 2024	• Extension activity to ZP School, - peer teaching by UG Students	1 st week of March	
09	April 2024	• Bioquest intercollegiate competitions	3 rd Week of March 2024	
		One day Faculty Development Programme (FDP) for High school teachers	2 nd week of April	
		Field visits, Industrial visits	Fourth week of April	
		One day workshop for students in any relevant area	April	

1) Dr. B. Nageshwari

B. Nageshwari

2) Mrs. K. Anusha

K.A.

3) Ms. J. Parnika Sa: *J. Ni*

B. Nageshwari

Lecturer in charge
 Dept. of Biotechnology
 GOVERNMENT COLLEGE (Autonomous)
 RAJAHMUNDRY-533 105. (A.P.)

GOVERNMENT COLLEGE (A), RAJAHMUNDRY
ACTION PLAN 2023-2024
DEPARTMENT OF BIOTECHNOLOGY

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		• One day workshop for students in any relevant area	April	

- 1) Dr. B. Nageshwari *B. Nageshwari*
 2) Mrs. K. Anusha *KA*
 3) Ms. J. Parnika Sa: *J. Ni*



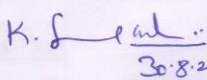
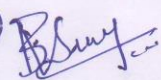
B. Nageshwari
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Government (Autonomous) College, Rajamahendravaram

Department of Biotechnology

Approval of resolutions taken during BoS meeting for the academic year 2023-24

Held on 30th Aug 2023 at 10:00 A.M, At Department Of Biotechnology, GDC (A) RJY.

S.No	Nominee	Name and Designation	Signatures
1	Chairman	Dr.B.Nageshwari, Lecturer in Charge , Department of Biotechnology, _ Govt (A) College, Rjy Phone : 9866219559 email Id: b.nageshwari@gcrjy.ac.in	
2	Member	Smt. K .Anusha, Lecturer , Department of Biotechnology, Govt (A) College, Rjy Phone : 7981940019 email Id: lekhaanu79@gcrjy.ac.in	
3	Subject Expert / Local nominee	Sri. K. Suresh Babu, ABN College, Kovvuru, WG Dist. Phone :9966845824 email Id: sureshbiozeal@gmail.com	 30.8.23
4	Subject Expert / Local Nominee	Sri.G.Sam Babu Sri Y.N. College (A), Narsapur. Phone: 9866611379 email Id: biotechsyamsir@gmail.com	Attended Online
5	University Nominee	Dr.K.Sarala Principal Scientist,Crop Improvement Division,CTRI, Rjy. Phone: 9849726890 email Id:	Absent
6	Expert from Industry / Corporate Sector	Dr.K.Ravindra Kumar, Senior scientist (Horticulture) Dr.Y.S.R. Horticultural University. Horticultural Research Station, Kovvur. East Godavari Dist, A.P. 534350. Ph.9491838982, 9990112403. ravikhorti@gmail.com	Attended Online
7	Student Nominee	B. Thinivalli M.Sc Biotechnology (AKNU, RJY) 824726070 thinivalli2723@gmail.com	B. Thinivalli
8	Student Nominee	B. Lakshmi Sahithya M.Sc, Biotechnology (AKNU, RJY) 9494434719 bvsahithya459@gmail.com	

Government College(A) , Rajamahendravaram Department Of Biotechnology

List of colleges for engaging Examiners/ Paper setters

S. No	Name of the college
1.	PR college(A),Kakinada
2.	Ideal Degree College(A),Kakinada
3.	ASD Govt.College for Women, Kakinada
4.	VSLakshmi College, Kakinada
5.	DNR college(A),Bhimavaram, W.G.Dist.A.P
6.	K.G.R.L College(A), Bhimavaram, W.G.Dist.A.P
7.	Sir CR Reddy College(A), Eluru, W.G.Dist.A.P
8.	Sri Y.N.College(A),Narsapur, W.G.Dist.A.P
9.	S.K.B.R college(A),Amalapuram
10.	VS Krishna Govt.College, Visakhapatnam
11.	Women'scollege, Visakhapatnam
12.	Andhra Loyola College, Vijayawada
13.	Govt. college for Men,Srikakulam
14.	Govt. college for Women, Srikakulam
15.	S.V.K.P. & Dr. K.S. Raju Arts & Science College, Penugonda, W.G.Dist.A.P
16.	ABNcollege, Kovuru, W.G.Dist.A.P

Program Specific Outcomes

B.Sc., Major -Biotechnology

The program **Biotechnology**, has been introduced to prepare the students for a career which finds application and provides solution to some of the major contemporary problems on the earth i.e., providing food for growing population, designing advanced medical treatment options for increasing–evolving diseases, to find solution to deteriorating environment caused due to over exploitation / misuse of natural resources etc.,

The subject biotechnology amalgamates the various disciplines of sciences and offers ethically acceptable knowledge to bring about sustainable solutions for a variety of problems related to agriculture, environment etc to improve quality of human life. These problems are solved with responsibility using appropriate tools while keeping in mind safety factor of environment and society.

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B.Sc., BIOTECHNOLOGY DEGREE WITH SINGLE MAJOR SYSTEM, PROGRAM CODE -245
Curricular frame work (Courses, Teaching hours, Credits, and Marks)

Year	Sem	Paper	Title of course	Theory + Lab Hrs per week Total 15 weeks (45+30)	Marks			Credits	Course code
					CIA	SEE	Total		
I-yr	Sem -1 2 Courses	P-1	Introduction to classical biology +Lab	3 +2	50 50	50 -	100 50	3 +1	124501
		P-2	Introduction to Applied Biology +Lab	3 +2	50 50	50 -	100 50	3 +1	124502
I-yr	Sem-2 2 Courses	P-3	Biomolecules and Analytical Techniques +Lab	3 +2	50 50	50 -	100 50	3 +1	124503
		P-4	Microbiology, Cell Biology +Lab	3 +2	50 50	50 -	100 50	3 +1	124504
Summer	2months	CSP	Community Service Project (Log Book (30M)); Project Implementation (20M) Project Report (25M) ; Project viva (25M)	180				4	
TOTAL CREDITS								=20	
Student is eligible for Exit Option – 1 with award of UG “Certificate” after completing 1-year (2 semesters) of study in respective discipline									
I-yr	Sem-3 4 Courses	P-5	Plant and Animal Biotechnology +Lab	3 +2	50 50	50 -	100 50	3 +1	124505
		P-6	Molecular Biology +Lab	3 +2	50 50	50 -	100 50	3 +1	124506
		P-7	Genetic Engineering +Lab	3 +2	50 50	50 -	100 50	3 +1	124507
		P-8	Metabolism +Lab	3 +2	50 50	50 -	100 50	3 +1	124508
I-yr	Sem-4 4 Courses	P-9	Immunology +Lab	3 +2	50 50	50 -	100 50	3 +1	124509
		P-10	Bioinformatics and Biostatistics – +Lab	3 +2	50 50	50 -	100 50	3 +1	124510
		P-11	Medical Biotechnology +Lab	3 +2	50 50	50 -	100 50	3 +1	124511
Summer	2 months	Internship	Short –Term Internship / Apprenticeship / UJT	180				4	
TOTAL CREDITS								=32	
Student is eligible for Exit Option-2 with the award of Diploma in respective major with minor									

IIIyr	Sem -5 4 courses	P-12	Industrial Biotechnology +Lab	3 +2	50 50	50 -	100 50	3 +1	124512
		P-13	Food & Nutritional Biotechnology +Lab	3 +2	50 50	50 -	100 50	3 +1	124513
		P-14	Gene Biotechnology (OR) Genomics & Proteomics +Lab	3 +2	50 50	50 -	100 50	3 +1	124514
		P-15	Nanotechnology & Pharmaceutical Biotechnology (OR) Applications of Biotechnology +Lab	3 +2	50 50	50 -	100 50	3 +1	124515
IIIyr	Sem-6	Project	Semester Internship / Apprenticeship / O J T (On Job Training)	6months				12	
			TOTAL CREDITS					=28	
Student is eligible for Exit Option-3 with the award of Degree in respective major									

Semester wise subjects for students of Single Major Program

Semester- 1 (2023-26)				
S.No.	Course	Core / Paper	Hours	Credits
1	Introduction to classical biology	Biotech	3+2	4
2	Introduction to Applied Biology	Biotech	3+2	4
*	Minor	-	-	-
3	AECC	English	4	3
4	AECC	II-Language	4	3
5	Multidisciplinary	Any 1 4. Introduction to Social Work 5. <u>Principles of Psychology</u> 6. Indian History	2	2
6	Skill Enhancement Course	(Any 2 out of 4) 5. <u>Entrepreneurship Development</u> 6. Leadership Skills 7. Analytical Skills	2	2
7	Skill Enhancement Course 2	8. Communication Skills	2	2
*	OOTC	-	-	-
*	Environmental Education.	-	-	-
TOTAL	7 courses	-	24	20

Semester – 2 (2023-26)				
S.No.	Course	Core / Paper	Hours	Credits
1	Major-Biotechnology	Biotech	3+2	4
2	Major -Biotechnology	Biotech	3+2	4
3	Minor		3+2	4
4	AECC	English	4	3
5	AECC	II-Language	4	3
*	Multidisciplinary	-	-	-
6	Skill Enhancement Course 1	Any 2 1.Business Writing 2.Marketing Skills	2	2
7	Skill Enhancement Course 2	3.Investment Planning 4.Stock Market Operations 5.Digital Literacy	2	2
*	OOTC	-	-	-
*	Environmental Education.	-	-	-
TOTAL	7 courses	-	27	22



Government College (Autonomous) Rajahmundry
Department Of Biotechnology

B.Sc. –Minor
Subject : Biotechnology .

w.e.f. AY 2023-24

COURSE STRUCTURE

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
I	II	1	Biomolecules and Analytical Techniques – (T)	3	3
			Biomolecules and Analytical Techniques – (P)	2	1
II	III	2	Plant and Animal Biotechnology -(T)	3	3
			Plant and Animal Biotechnology – (P)	2	1
	IV	3	Immunology – (T)	3	3
			Immunology – (P)	2	1
		4	Bioinformatics and Biostatistics – (T)	3	3
			Bioinformatics and Biostatistics – (P)	2	1
III	V	5	Industrial Biotechnology – (T)	3	3
			Industrial Biotechnology – (P)	2	1
		6	Food & Nutritional Biotechnology – (T)	3	3
			Food & Nutritional Biotechnology – (P)	2	1



Government College (Autonomous) Rajahmundry

Department Of Biotechnology

Theory Syllabus Course - 1	Major : Biotechnology	Program : B.Sc			
	Title of the Course “ Introduction to Classical Biology ”	Year -1			
	Course Code: 124501	Semester : 1			
	Total Hours Allocated- 45 ; Per Week –5hrs	L Lecture	T Tutorial	P Practical	C Credits
Pre-requisites:	Basic knowledge about , ➤ Common names of plants, different types of living organisms, food cycle, Types of pollution. ➤ Exchanges of gases in plants and animals, agriculture, parts of living organism, structure of generalized cell, Structure of DNA, RNA, Protein, Structure of atom, molecule, Elements in periodic table.	3		2	3+1=4

Course / Learning Objectives:

The student will be able to learn the diversity and classification of living organisms and understand their chemical, cytological, evolutionary and genetic principles.

Learning Outcomes :	
CO1	Learn the principles of classification and preservation of biodiversity
CO2	Understand the plant anatomical, physiological and reproductive processes
CO3	Knowledge on animal classification, physiology, embryonic development and their economic importance
CO4	Outline the cell components, cell processes like cell division, heredity and molecular processes.
CO5	Comprehend the chemical principles in shaping and driving the macromolecules and life processes

Course with focus on employability / entrepreneurship / Skill Development modules

<p>Skill Development</p>	<p>Nomenclature – ICBN and ICZN, Binomial and trinomial nomenclature. Ecology – Concept of ecosystem, Biodiversity and conservation.</p>	<p>Employability</p>	<p>Mushroom cultivation, floriculture and landscaping – Sericulture, Apiculture, Aquaculture In vitro fertilisation Green chemistry</p>	<p>Entrepreneurship</p>	<p>Mushroom cultivation, floriculture and landscaping – Sericulture, Apiculture, Aquaculture</p>
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Government College (Autonomous) Rajahmundry
Department Of Biotechnology
B.Sc. Iyr , Sem-1, –Major : Biotechnology .

Title of the Course 1 : Introduction to Classical Biology ; Course code : 124501

Syllabus

Unit 1: Introduction to systematics, taxonomy and ecology.

- 1.1. Systematics – Definition and concept, Taxonomy – Definition and hierarchy.
- 1.2. Nomenclature – ICBN and ICZN, Binomial and trinomial nomenclature.
- 1.3. Ecology – Concept of ecosystem, Biodiversity and conservation.
- 1.4. Pollution and climate change.

Unit 2: Essentials of Botany.

- 2.1. The classification of plant kingdom.
- 2.2. Plant physiological processes (Photosynthesis, Respiration, Transpiration, phytohormones).
- 2.3. Structure of flower – Micro and macro sporogenesis, pollination, fertilization and structure of mono and dicot embryos.
- 2.4. Mushroom cultivation, floriculture and landscaping.

Unit 3: Essentials of Zoology

- 3.1. The classification of Kingdom Animalia and Chordata.
- 3.2. Animal Physiology – Basics of Organ Systems & their functions, Hormones and Disorders
- 3.3. Developmental Biology – Basic process of development (Gametogenesis, Fertilization, Cleavage and Organogenesis)
- 3.4. Economic Zoology – Sericulture, Apiculture, Aquaculture

Unit 4: Cell biology, Genetics and Evolution

- 4.1. Cell theory, Ultrastructure of prokaryotic and eukaryotic cell, cell cycle.
- 4.2. Chromosomes and heredity – Structure of chromosomes, concept of gene.
- 4.3. Central Dogma of Molecular Biology.
- 4.4. Origin of life

Unit 5: Essentials of chemistry

- 5.1. Definition and scope of chemistry, applications of chemistry in daily life.
- 5.2. Branches of chemistry
- 5.3. Chemical bonds – ionic, covalent, noncovalent – Vander Waals, hydrophobic, hydrogen bonds.
- 5.4. Green chemistry

References

1. Sharma O.P., 1993. Plant taxonomy. 2nd Edition. McGraw Hill publishers.
2. Pandey B.P., 2001. The textbook of botany Angiosperms. 4th edition. S. Chandpublishers, New Delhi, India.
3. Jordan E.L., Verma P.S., 2018. Chordate Zoology. S. Chand publishers, New Delhi, India.
4. Rastogi, S.C., 2019. Essentials of animal physiology. 4th Edition. New Age International Publishers.
5. Verma P.S., Agarwal V.K., 2006. Cell biology, genetics, Molecular Biology, Evolution and Ecology. S. Chand publishers, New Delhi, India.
6. Satyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers.
7. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chandpublishers, New Delhi, India.
8. Karen Timberlake, William Timberlake, 2019. Basic chemistry. 5th Edition. Pearson publishers.
9. Subrata Sen Gupta, 2014. Organic chemistry. 1st Edition. Oxford publishers.


WebLinks:

1. <https://en.wikipedia.org/wiki/Carbohydrate>
2. <http://biomodel.uah.es/en/model3/ac-gr.htm>
3. <http://biomodel.uah.es/en/model3/aa.htm>
4. <http://biomodel.uah.es/en/model3/vits.htm>
5. <http://biomodel.uah.es/en/model4/dna/>

CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS O1	PS O2	PS O3
CO1													
CO2													
CO3													
CO4													
CO5													

	Government College (Autonomous) Rajahmundry Department Of Biotechnology Major : Biotechnology	
B.Sc.-Iyr Semester-1 Course- 1	Title of the Course : Introduction to Classical Biology Course Code : 124501 Semester End Exam (2023-24)	
Time: 2 1/2 Hrs	Blue Print of Question Paper	Marks : 50

Part-A

I. Answer any 3 essay questions

3 X 10 M = 30 M

Question 1 from Unit I
Question 2 from Unit II
Question 3 from Unit III
Question 4 from Unit IV
Question 5 from Unit V

Part-B

II. Answer any 3 short answer questions

3 X 5 M = 15 M


Question 6 :fromUnitI
Question 7 :fromUnitII
Question 8 :fromUnitIII
Question 9 :fromUnit IV
Question 10 :fromUnit V

Part -C

III. Answer ALL very short answer questions

5 x 1 M = 5 M

Question 11 :fromUnitI
Question 12:fromUnitII
Question 13:fromUnitIII
Question 14 :fromUnit IV
Question 15:fromUnit V

	Government College (Autonomous) Rajahmundry Department Of Biotechnology	
	Major: Biotechnology	
B.Sc.-Iyr Semester-1 Paper- 1	Title of the course “ Introduction to Classical Biology” Course Code : 124501 Semester End Exam (2023-24)	
Time: 2 1/2 Hrs	Model Question Paper	Marks : 50

Part-A

I. Answer any 3 essay questions

3 X 10 M = 30 M

1. Write about Biodiversity and methods of conservation.
2. Write about the various physiological processes in plants .
3. Write about animal hormones and related disorders.
4. Describe the structure of chromosome in .detail
5. Write about various types of chemical bonds.

Part-B

II. Answer any 3 short answer questions

3 X 5 M = 15 M

6. Pollution and climate change.
7. Landscaping
8. Apiculture
9. Differences between Prokaryotic and Eukaryotic Cells.
10. Green Chemistry.

Part -C

III. Answer ALL very short answer questions

5 x 1 M = 5 M

- 11 : Trinomial nomenclature
- 12 : Macrosporogenesis
- 13 : Fertilization
- 14 : Central Dogma of Molecular Biology
- 15 : Chemistry in daily life.



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Practical Syllabus Course -1	Major : Biotechnology	Program : B.Sc Year -I Semester : 1			
	Title of the Practical Course " Introduction To Classical Biology" " - Lab Course Code: 124501P				
	Total Hours – 30hrs ; Per Week -2hrs	L <small>Lect ures</small>	T <small>Tutorial</small>	P <small>Practical</small>	C <small>Credits</small>
Pre-requisites:	Study material resources, basic experimental methods, handling of microscope and other analytical instruments, observation skills, notes writing skills, record maintaining skills, social interaction skills, Basic flower arrangement skills .	0	0	2	1

Objectives:

- The students should be able to find study material resources,
- Perform basic experimental methods,
- Handle of analytical instruments, improve observation skills, improve notes writing skills,
- Learn record maintaining skills, social interaction skills.


List of Experiments/Syllabus:

1. Make a display chart of life cycle of nonflowering plants.
2. Make a display chart of life cycle of flowering plants.
3. Study of stomata
4. Activity to prove that chlorophyll is essential for photosynthesis
5. Study of pollen grains.
6. Observation of pollen germination.
7. Ikebana.
8. Differentiate between edible and poisonous mushrooms.

9. Visit a nearby mushroom cultivation unit and know the economics of mushroomcultivation.
10. Draw the Ultrastructure of Prokaryotic and Eukaryotic Cell
11. Visit to Zoology Lab and observe different types of preservation of specimens
12. Hands-on experience of various equipment – Microscopes, Centrifuge, pH Meter,Electronic Weighing
Balance, Laminar Air Flow
13. Visit to Zoo / Sericulture / Apiculture / Aquaculture unit
14. List out different hormonal, genetic and physiological disorders from the society


Virtual LabLinks:

<https://vlab.amrita.edu/?sub=3&brch=63> <http://biotech01.vlabs.ac.in/>
<https://www.asbmb.org/education/online-teaching/online-lab-work>

	Government College (Autonomous) Rajahmundry Department Of Biotechnology		
	Major : Biotechnology		
B.Sc.-Iyr Semester-1 Course- 1	Title of the course “ Introduction To Classical Biology –Lab” Course code: 124501P Semester End Exam (2023-24)		
Time : 3Hrs	Practical - Model Question Paper	Credits : 1	Marks : 50

1. Major experiment.	15 M
2. Minor experiment.	10 M
3. Identify the given spotters and write a brief note on it	15M
4. Record	05 M
5. Viva-voce	05 M

	Total 50 M

	Government College (Autonomous) Rajahmundry Department Of Biotechnology					
Theory Syllabus Course-2	Major :Biotechnology		Program : B.Sc Year- I Semester : 1			
	Title of the Course “Introduction To Applied Biology” Course Code: 124502					
	Total Hours Allocated-45T + 30P=75Hrs ; Per Week –(3+2) hrs		L Lect ure	T Tutori al	P Practical	C Credits
Pre-requisites:	knowledge about Life style and achievements of scientists, Plant and animal kingdom, Organs in a living system, various types of cells in a living system, Uses of microorganisms. should know about basic structure of gene, genetic disorders, handling computer, basic analytical skills, searching information on system.		3		2	3+1= 4

Course Objectives:

- The student will be able to learn the foundations and principles of microbiology, immunology, biochemistry, biotechnology, analytical tools, quantitative methods, and bioinformatics.

On Completion of the course, the students will be able to-	
CO1	Learn the history, ultrastructure, diversity and importance of microorganisms.
CO2	Understand the structure and functions of macromolecules
CO3	Knowledge on biotechnology principles and its applications in food and medicine,
CO4	Outline the techniques, tools and their uses in diagnosis and therapy.
CO5	Demonstrate the bioinformatics and statistical tools in comprehending the complex biological data.

Course with focus on employability / entrepreneurship / Skill Development modules

<p>Skill Development</p>	<p>Applications of microorganisms in – Food, Agriculture, Environment, and Industry Applications of biotechnology in Plant, Animal, Industrial and Pharmaceutical sciences.</p>	<p>Employability</p>	<p>Stress tolerant plants (biotic stress – BT cotton, abiotic stress – salt tolerance) Introduction, Genomics, Proteomics, types of Biological data, biological databases- NCBI, EBI, Gen Bank; Protein 3D structures, Sequence alignment Accessing Nucleic Acid and Protein databases, NCBI Genome Workbench</p>	<p>Entrepreneurship</p>	<p>PCR and DNA fingerprinting Immunological techniques – Immunoblotting and ELISA. Monoclonal antibodies – Applications in diagnosis and therapy. Eugenics and Gene therapy</p>
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Government College (Autonomous) Rajahmundry
Department Of Biotechnology
B.Sc. -Iyr, Sem-1, Major : Biotechnology

Title of the Course 2 : Introduction to Applied Biology ; Course code : **124502**

Syllabus

Unit 1: Essentials of Microbiology and Immunology

- 1.1. History and Major Milestones of Microbiology; Contributions of Edward Jenner, Louis Pasteur, Robert Koch and Joseph Lister.
- 1.2. Groups of Microorganisms – Structure and characteristics of Bacteria, Fungi, Archaea and Virus.
- 1.3. Applications of microorganisms in – Food, Agriculture, Environment, and Industry.
- 1.4. Immune system – Immunity, types of immunity, cells and organs of immune system.

Unit 2: Essentials of Biochemistry

- 2.1. Biomolecules I – Carbohydrates, Lipids.
- 2.2. Biomolecules II – Amino acids & Proteins.
- 2.3. Biomolecules III – Nucleic acids -DNA and RNA.
- 2.4. Basics of Metabolism – Anabolism and catabolism.

Unit 3: Essentials of Biotechnology


- 3.1. History, scope, and significance of biotechnology. Applications of biotechnology in Plant, Animal, Industrial and Pharmaceutical sciences.
- 3.2. Environmental Biotechnology – Bioremediation and Biofuels, Biofertilizers and Biopesticides.
- 3.3. Genetic engineering – Gene manipulation using restriction enzymes and cloning
- 3.4. vectors; Physical, chemical, and biological methods of gene transfer.
- 3.5. Transgenic plants – Stress tolerant plants (biotic stress – BT cotton, abiotic stress – salt tolerance). Transgenic animals – Animal and disease models.

Unit 4: Analytical Tools and techniques in biology – Applications

- 4.1. Applications in forensics – PCR and DNA fingerprinting
- 4.2. Immunological techniques – Immunoblotting and ELISA.
- 4.3. Monoclonal antibodies – Applications in diagnosis and therapy.
- 4.4. Eugenics and Gene therapy

Unit 5: Biostatistics and Bioinformatics

- 5.1. Data collection and sampling. Measures of central tendency – Mean, Median, Mode.
- 5.2. Measures of dispersion – range, standard deviation and variance. Probability and tests of significance.
- 5.3. Introduction, Genomics, Proteomics, types of Biological data, biological databases- NCBI, EBI, Gen Bank; Protein 3D structures, Sequence alignment
- 5.4. Accessing Nucleic Acid and Protein databases, NCBI Genome Workbench

	Government College (Autonomous) Rajahmundry Department Of Biotechnology	
	Major : Biotechnology	
B.Sc.-I yr Semester-1 Course- 2	Title of the course “ Introduction To Applied Biology ” Course Code :124502 Semester End Exam (2023-24)	
Time : 2 1/2 Hrs	Blue Print of Question Paper	Marks : 50

Part–A

I. Answer any 3 essay questions 3 X 10 M = 30 M

Question 1 from Unit I
 Question 2 from Unit II
 Question 3 from Unit III
 Question 4 from Unit IV
 Question 5 from Unit V

Part-B

II. Answer any 3 short answer questions 3 X 5 M = 15 M

Question 6 :fromUnitI
 Question 7 :fromUnitII
 Question 8 :fromUnitIII
 Question 9 :fromUnit IV
 Question 10 :fromUnit V

Part –C

III. Answer ALL very short answer questions 5 x 1 M = 5 M

Question 11 :fromUnitI
 Question 12:fromUnitII
 Question 13:fromUnitIII
 Question 14 :fromUnit IV
 Question 15:fromUnit V



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Major : Biotechnology

**B.Sc.-I yr
Semester-1
Course- 2**

**Title of the course
“ Introduction To Applied Biology ”
Course Code– 124502
Semester End Exam (2023-24)**

Time : 2 1/2 Hrs

Model Question Paper

Marks : 50

Part-A

I. Answer any THREE questions. (Each answer carries TEN marks). 3X 10M=30M

1. Write an essay on immune system .
2. Describe the structure of DNA in detail.
3. Application of Biotechnology in pharmaceutical sciences.
4. Describe the technique ELISA.
5. Write an essay on biological data bases.

Part-B

II. Answer any 3 short answer questions 3 X 5 M = 15 M

6. Applications of microorganisms in food industry.
7. Metabolism.
8. Transgenic plant.
9. Applications of DNA fingerprinting.
10. Test Of Significance.

Part –C

III. Answer ALL very short answer questions 5 x 1 M = 5 M

- 11 : Vaccination was first administered by?
- 12: Name the 2 types of secondary structure of protein?
- 13: Bt in Bt cotoon stands for ?
- 14 : Abbreviate ELISA
- 15: Name few biological databases.



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Practical Syllabus Course -2	Subject : Biotechnology	Program : B.Sc.			
	Title of Course “ Introduction To Applied Biology ”-Lab Course Code- 124502P	Year -1 Semester : 1			
	Total Hours – 30hrs ; Per Week -2hrs	L Lect ures	T Tuto rial	P Practical	C Credits
Pre-requisites:	Observation skills, safe handling of hazardous material, notes making skills, drawing conclusions, handling computer, Handling of pipettes, Preparation of Solutions, Handling of analytical instruments.	0	0	2	1

Objectives:

1. The students should be able to improve observation skills, safe handling of hazardous material, notes making skills,.
2. The students should be able to draw conclusions, handle computer, Handle pipettes, Prepare Solution, Handle analytical instruments.

List of activities

1. Identification of given organism as harmful or beneficial.
2. Observation of microorganisms from house dust under microscope.
3. Finding microorganism from pond water.
4. Visit to a microbiology industry or biotech company.
5. Visit to a waste water treatment plant.
6. Retrieving a DNA or protein sequence of a gene'
7. Performing a BLAST analysis for DNA and protein.
8. Problems on biostatistics.
9. Field trip and awareness programs on environmental pollution by different types of wastes and hazardous materials.
10. Demonstration on basic biotechnology lab equipment.
11. Preparation of 3D models of genetic engineering techniques.
12. Preparation of 3D models of transgenic plants and animals.


Referencebooks:

1. David A. Thompson. 2011. Cell and Molecular Biology Lab. Manual.
2. P.Gunasekaran. 2007. Laboratory Manual in Microbiology. New Age International

Virtual LabLinks:

<https://vlab.amrita.edu/?sub=3&brch=73>

<https://www.labster.com/blog/popular-microbiology-virtual-lab-simulations/>

	Government College (Autonomous) Rajahmundry		
	Department Of Biotechnology		
	Major : Biotechnology		
B.Sc.-Iyr Semester-1 Paper- 2	Title of the course “ Introduction To Applied Biology - Lab ” Course code: 124502P Semester End Exam (2023-24)		
Time : 3Hrs	Practical - Model Question Paper	Credits : 1	Marks : 50

- | | |
|---|------|
| 1. Major experiment. | 15 M |
| 2. Minor experiment. | 10 M |
| 3. Identify the given spotters and write a brief note on it | 15M |
| 4. Record | 05 M |
| 5. Viva-voce | 05 M |

Total 50 M

	Government College (Autonomous) Rajahmundry Department Of Biotechnology				
Theory Syllabus Course-3	Major :Biotechnology		Program : B.Sc		
	Title of the Course “Biomolecules and Analytical Techniques ” Course Code: 124503		Year- I Semester : 2		
	Total Hours Allocated=45 T + 30 P = 75 Hrs; Per week (3+2) hrs		L Lect ure	T Tutori al	P Practical
Pre-requisites:	knowledge about ➤ Occurrence and Function of Carbohydrates, Proteins, Lipids, DNA , RNA, Vitamins. ➤ Basic Knowledge and handling about lab instruments.		3	2	3+1

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

CO1	Learn about classification, structure and properties of Carbohydrates, Proteins and Lipids.
CO2	Learn about structure and function of DNA, RNA, Vitamins and Bioenergetics.
CO3	Learn about basic principles of Centrifugation, Chromatography and Electrophoresis.
CO4	Learn about principles of Spectroscopy, Microscopy and Techniques.
CO5	Learn about basics of Biostatistics.

Course with focus on employability / entrepreneurship / Skill Development modules

<p>Skill Development</p>	<p>Introduction to basic instruments (Principle standard operation procedure) demonstration and record</p> <p>Calculation of molarity, normality, and molecular weight of compounds.</p> <p>Qualitative analysis of carbohydrates (sugars)</p> <p>Quantitative analysis of carbohydrates</p> <p>Quantitative estimation of protein - Lowery method</p> <p>Estimation of DNA by diphenylamine reagent</p> <p>Estimation of RNA by orcinol reagent</p> <p>Assay of protease activity</p> <p>Preparation of starch from potato and its hydrolyze by salivary amylase</p> <p>Preparation of standard buffer and pH determination</p> <p>Separation of amino acids by paper chromatography</p> <p>Separation of lipids of TLC</p> <p>Agarose gel electrophoresis</p> <p>Calculation of mean, median and mode</p>	<p>Employ ability</p>	<p>Basic principles of sedimentation and types of centrifugations.</p> <p>Principle, instrumentation, and application of partition, absorption, paper, TLC, ion exchange, gel permeation, and affinity chromatography.</p> <p>Basic principles and types of electrophoresis, factors affecting electrophoretic migration. PAGE (Native, SDS-PAGE).</p> <p>Introduction to 2D & Isoelectric Focusing.</p>	<p>Entrepre- neurship</p>	<p>Mean, median, mode, standard deviation, One-way ANOVA, Two-way Anova t-test, F-test and chi-square.</p>
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Government College (Autonomous) Rajahmendravaram

Department Of Biotechnology

B.Sc. –Major : Biotechnology ; Iyr ; Sem -2 ; Theory Syllabus.

Title of the Course -3: Biomolecules and Analytical Techniques ; Course code : 124503

Syllabus

Unit-I-Carbohydrates, Protein and Lipids

1. Classification, structure, properties of carbohydrates, amino acids, peptide bond and peptides.
2. Classification, structure (primary, secondary, tertiary, quaternary) and functions of proteins.
Denaturation and renaturation of proteins.
3. Classification structure and properties of saturated and unsaturated fatty acids.

Unit-II- Nucleic acid, Vitamins, and Bioenergetics

1. Structure and functions of DNA and RNA.
2. Source, structure, biological role, and deficiency manifestation of vitamin A, B, C, D, E, and K.
Free energy, entropy, enthalpy, and redox potential.
3. High energy compounds, Electron-Transport System and Oxidative Phosphorylation.

Unit-III-Centrifugation, Chromatography, and Electrophoresis

1. Basic principles of sedimentation and types of centrifugations.
2. Principle, instrumentation, and application of partition, absorption, paper, TLC, ion exchange, gel permeation, and affinity chromatography.
3. Basic principles and types of electrophoresis, factors affecting electrophoretic migration. PAGE (Native, SDS-PAGE). Introduction to 2D & Isoelectric Focusing.

Unit - IV-Spectroscopy, Microscopy and Laser Techniques

1. Beer-Lambert law, light absorption and transmission. Extinction coefficient, Design and application of photoelectric calorimeter and UV-visible spectrophotometer. Introduction to crystallography and application.
2. Types and design of microscopes - compound, phase contrast, fluorescent electron microscopy (TEM, SEM).
3. Introduction to radioisotopes, measurement of radioactivity (scintillation counter and autoradiography)


Unit –V- Biostatistics

1. Mean, median, mode, standard deviation,
2. One-way ANOVA, Two-way Anova
3. t-test, F-test and chi-square.

Unit no:	Co Curricular activity
1	Seminars
2	3d models & Live models
3	Hand on experiments
4	Demonstration of instruments usage
5	Assignments

References

1. Gerard J., Tortora, Berdell R. Funke, Christine L. Case., 2016. Microbiology: An Introduction. 11th Edition. Pearson publications, London, England.
2. Micale, J. Pelczar Jr., E.C.S. Chan., Noel R. Kraig., 2002. Pelczar Microbiology. 5th Edition. McGraw Education, New York, USA.
3. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers.
4. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.
5. R.C. Dubey, 2014. Advanced Biotechnology. S. Chand Publishers, New Delhi, India.
6. Colin Ratledge, Bjorn, Kristiansen, 2008. Basic Biotechnology. 3rd Edition. Cambridge Publishers.
7. U. Sathyanarayana, 2005. Biotechnology. 1st Edition. Books and Allied Publishers pvt. Ltd., Kolkata.
8. Upadhyay, Upadhyay and Nath. 2016. Biophysical Chemistry, Principles and Techniques. Himalaya Publishing House.
9. Arthur M. Lesk. Introduction to Bioinformatics. 5th Edition. Oxford publishers.
AP Kulkarni, 2020. Basics of Biostatistics. 2nd Edition. CBS publishers

	Government College (Autonomous) Rajahmundry Department Of Biotechnology	
	Major : Biotechnology	
B.Sc.-I yr Semester-2 Course- 3	Title of the course “ Biomolecules And Analytical Techniques” Course Code :124503 Semester End Exam (2023-24)	
Time : 2 1/2 Hrs	Blue Print of Question Paper	Marks : 50

Part–A

I. Answer any 3 essay questions 3 X 10 M = 30 M

Question 1 from Unit I
 Question 2 from Unit II
 Question 3 from Unit III
 Question 4 from Unit IV
 Question 5 from Unit V

Part-B


II. Answer any 3 short answer questions 3 X 5 M = 15 M

Question 6 :fromUnitI
 Question 7 :fromUnitII
 Question 8 :fromUnitIII
 Question 9 :fromUnit IV
 Question 10 :fromUnit V

Part –C

III. Answer ALL very short answer questions 5 x 1 M = 5 M

Question 11 :fromUnitI
 Question 12:fromUnitII
 Question 13:fromUnitIII
 Question 14 :fromUnit IV
 Question 15:fromUnit V

	Government College (Autonomous) Rajahmundry Department Of Biotechnology	
	Major : Biotechnology	
B.Sc.-I yr Semester-2 Course- 3	Title of the course “ Biomolecules And Analytical Techniques ” Course Code– 124503 Semester End Exam (2023-24)	
Time : 2 1/2 Hrs	Model Question Paper	Marks : 50

Part -A

I. Answer any 3 essay questions.

3X 10M=30M

1. Write classification and structure of saturated and unsaturated fatty acids.
2. Write about source, biological role, and deficiency manifestation of vitamin A, B, C, D, E, and K.
3. Write about Poly Acryl Amide Gel Electrophoresis.
4. Describe the UV-Visible Spectrophotometry..
5. Write an essay on ANOVA.

Part-B

II. Answer any 3 short answer questions

3 X 5 M = 15 M

6. Denaturation and renaturation of proteins.
7. High energy compounds.
8. TLC.
9. Compound microscope.
10. Standard deviation.

Part -C

III. Answer ALL very short answer questions

5 x 1 M = 5 M

- Question 11 : Name 3 polysaccharides.
 Question 12: Define entropy
 Question 13: Difference between Native and SDS –PAGE.
 Question 14 : Beer Lambert Law .
 Question 15: ANOVA



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Practical Syllabus Course -3	Subject : Biotechnology	Program : B.Sc. Year -1 Semester : 2			
	Title of Course “ Biomolecules And Analytical Techniques ”-Lab Course Code: 124503P				
	Total Hours – 30hrs ; Per Week -2hrs	L Lect ures	T Tuto rial	P Practical	C Credits
Pre-requisites:	Observation skills, safe handling of hazardous material, notes making skills, drawing conclusions, handling computer, Handling of pipettes, Calculations, Preparation of Solutions, Handling of analytical instruments.	0	0	2	1

Skills Outcome : On Successful Completion of this Course, Student shall be able to

1. learn about basic instruments and their operation
2. learn about Qualitative and Quantitative analysis of carbohydrates
3. Learn about estimations nucleic acids and protein by various methods
4. learn about the separation of molecules by chromatography and electrophoresis
5. Learn about problems on mean median mode

List of Practical

1. Introduction to basic instruments (Principle standard operation procedure) demonstration and record
2. Calculation of molarity, normality, and molecular weight of compounds.
3. Qualitative analysis of carbohydrates (sugars)
4. Quantitative analysis of carbohydrates
5. Quantitative estimation of protein - Lowery method
6. Estimation of DNA by diphenylamine reagent
7. Estimation of RNA by orcinol reagent
8. Assay of protease activity
9. Preparation of starch from potato and its hydrolyze by salivary amylase
10. Preparation of standard buffer and pH determination
11. Separation of amino acids by paper chromatography
12. Separation of lipids of TLC
13. Agarose gel electrophoresis
14. Calculation of mean, median and mode

Referencebooks:

1. Outlines of Biochemistry, 5th Edition, (2009), Erice Conn & Paul Stumpf; John Wiley and Sons, USA
2. Principles of Biochemistry, 4th edition, (1997), Jeffery Zubey; McGraw-Hill College, USA
3. Principles of Biochemistry, 5th Edition (2008), Lehninger, David Nelson & Michael Cox; W.H.Freeman and Company, NY
4. Fundamentals of Biochemistry, 3rd Edition (2008), Donald Voet & Judith Voet; John Wiley and Sons, Inc. USA
5. Biochemistry, 7th Edition, (2012), Jeremy Berg & Lubert Stryer; W.H.Freeman and Company, NY
6. An Introduction to Practical Biochemistry, 3rd Edition, (2001), David Plummer; Tata McGrawHill Edu. Pvt.Ltd. New Delhi, India
7. Biochemical Methods, 1st Edition, (1995), S.Sadashivam, A.Manickam; New Age International Publishers, India
8. Textbook of Biochemistry with Clinical Correlations, 7th Edition, (2010), Thomas M. Devlin; John Wiley and Sons, USA
9. Proteins: biotechnology and biochemistry, 1st edition, (2001), Gary Walsch; Wiley, USA
10. Biochemical Calculations, 2nd Ed., (1997), Segel Irvin H; John Wiley and Sons, NY
11. Biophysical Chemistry Principles & Techniques Handbook, (2003), A. Upadhyay, K.Upadhyay, and N. Nath
12. Enzymes: Biochemistry, Biotechnology & Clinical chemistry, (2001), Palmer Trevor, Publisher: Horwood Pub. Co., England.
13. Analytical Biochemistry, 3rd edition, (1998), David Holmes, H.Peck, Prentice-Hall, UK
14. Introductory Biostatistics, 1st edition, (2003), Chap T. Le; John Wiley, USA.
15. Methods in Biostatistics, (2002), B. K. Mahajan –Jaypee Brothers.
16. Statistical methods in biology, (1995), Bailey, N. T.; Cambridge university press


a) Suggested Co-Curricular Activities

1. Assignments
2. Seminars, Group Discussions on related topics
3. Charts preparation on vitamins

Virtual LabLinks:


<https://vlab.amrita.edu/?sub=3&brch=73>

<https://www.labster.com/blog/popular-microbiology-virtual-lab-simulations/>

	Government College (Autonomous) Rajahmundry		
	Department Of Biotechnology		
	Major : Biotechnology		
B.Sc.-Iyr Semester-2 Paper- 3	Title of the course “ Biomolecules And Analytical Techniques - Lab ” Course code: 124503P Semester End Exam (2023-24)		
Time : 3Hrs	Practical - Model Question Paper	Credits : 1	Marks : 50

- | | |
|---|------|
| 1. Major experiment. | 15 M |
| 2. Minor experiment. | 10 M |
| 3. Identify the given spotters and write a brief note on it | 15M |
| 4. Record | 05 M |
| 5. Viva-voce | 05 M |

Total 50 M

	Government College (Autonomous) Rajahmundry Department Of Biotechnology					
Theory Syllabus Course-4	Major :Biotechnology		Program : B.Sc. Year- I Semester : 2			
	Title of the Course “Microbiology, Cell Biology” Course Code: 124504					
	Total Hours Allocated- ; Per Week –(3+2) hrs	L Lect ure	T Tutori al	P Practical	C Credits	
Pre-requisites:	knowledge about ➤ Life style and achievements of scientists, Plant and animal kingdom, Organs in a living system, various types of cells in a living system, Uses of microorganisms. ➤ should know about basic structure of gene, genetic disorders, handling computer, basic analytical skills, searching information on system.		3		2	4

Course Objectives: On successful completion of the course, the students will be able to	
CO1	Learn about Scope and Techniques of Microbiology.
CO2	Learn about concept of Microbial species and strains.
CO3	Learn about cell structure and function.
CO4	Learn about cell signaling and control mechanisms.
CO5	Learn about genome organization of prokaryotic and eukaryotic organisms

Course with focus on employability / entrepreneurship / Skill Development modules

<p>Skill Development</p>	<p>Cleaning and preparation of glassware Preparation of nutrient agar medium for bacteria Preparation of PDA medium for fungi Sterilization techniques (autoclave, hot air oven, filter) Isolation of bacteria from soil Simple staining technique Differential staining technique Microbial counting by Haemocytometer Identification of different bacteria Motility test by hanging drop Biochemical identification of bacteria Preparation of pure culture by slab, slant, streak culture Study of stages of cell division Extraction and isolation of DNA from bacteria</p>	<p>Employability</p>	<p>Pure culture techniques Sterilization techniques, principles and application of physical methods (autoclave, hot air oven, incineration), chemical methods and radiation methods. Simple, gram and acid-fast staining.</p>	<p>Entrepreneurship</p>	<p>preparation of media for culturing of various microorganisms Isolation of microorganisms from different sources Staining techniques and biochemical identification of bacteria</p>
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Government College (Autonomous) Rajahmendravaram
Department Of Biotechnology
B.Sc-Iyr, Sem-2, Major : Biotechnology.

Title of the Course 4 : Microbiology, Cell Biology ; Course code : **124504**

Syllabus

Unit-I- Scope and Techniques of Microbiology

1. History and contribution of Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister and Alexander Fleming.
2. Ultrastructure of bacteria and growth curve. Pure culture techniques.
3. Sterilization techniques, principles and application of physical methods (autoclave, hot air oven, incineration), chemical methods and radiation methods. Simple, gram and acid-fast staining.

Unit-II-Microbial Taxonomy and Metabolism

1. Concepts of microbial species and strains. Classification of bacteria based on morphology, nutrition and environment. General characteristics, transmission and cultivation of viruses.
2. Structure and properties of plant (tobacco mosaic virus, TMV), animal (Newcastle disease virus, NDV), human (Human immunodeficiency virus, HIV) and bacterial viruses (T4 phage). Emerging and reemerging viruses (dengue) and zoonotic viruses (rabies, SARS-CoV-2).
3. Microbial production of penicillin. Bacterial toxins, tuberculosis, typhoid. Introduction to fungi, algae and mycoplasma.

Unit-III- Cell Structure and Functions


1. Structure, properties and functions of cellular organelles (E.R, Golgi bodies, Mitochondria, Ribosomes, lysosomes, nucleus) of eukaryotic cells.
2. Cell cycle and its regulation
3. cell division (mitosis and meiosis).

Unit-IV- Cell Signalling

1. Chemical composition and dynamic nature of the membrane,
2. Cell Surface Receptors
3. cell signaling and communication (GPCR, cAMP, cGMP, IP3-DAG)

Unit – V - Central Dogma of Molecular Biology

1. Genome organization of prokaryotic and eukaryotic organisms
2. Enzymes involved in Replication, Transcription, and Translation
3. DNA repair Mechanism

	Government College (Autonomous) Rajahmundry Department Of Biotechnology	
	Major : Biotechnology	
B.Sc.-I yr Semester-2 Course- 4	Title of the course : “ Microbiology, Cell Biology ” Course Code :124504 Semester End Exam (2023-24)	
Time : 2 1/2 Hrs	Blue Print of Question Paper	Marks : 50

Part–A

I. Answer any 3 essay questions 3 X 10 M = 30 M

Question 1 from Unit I
 Question 2 from Unit II
 Question 3 from Unit III
 Question 4 from Unit IV
 Question 5 from Unit V

Part-B

II. Answer any 3 short answer questions 3 X 5 M = 15 M

Question 6 :fromUnitI
 Question 7 :fromUnitII
 Question 8 :fromUnitIII
 Question 9 :fromUnit IV
 Question 10 :fromUnit V

Part –C

III. Answer ALL very short answer questions 5 x 1 M = 5 M

Question 11 :fromUnitI
 Question 12:fromUnitII
 Question 13:fromUnitIII
 Question 14 :fromUnit IV
 Question 15:fromUnit V



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Major : Biotechnology

**B.Sc.-I yr
Semester-2
Course- 4**

**Title of the course : “ Microbiology, Cell Biology ”
Course Code– 124504
Semester End Exam (2023-24)**

Time : 2 1/2 Hrs

Model Question Paper

Marks : 50

Part-A

I. Answer any 3 questions. (Each answer carries TEN marks). 3X 10M=30M

1. Write an essay on pure culture techniques .
2. Describe the microbial production of penicillin.
3. Write the process of cell division by meiosis.
4. Describe the dynamic structure of cell membrane.
5. Write an essay on DNA repair mechanism.

Part-B

II. Answer any 3 short answer questions 3 X 5 M = 15 M

6. Write about any 2 physical methods of sterilization.
7. Write about the disease Dengue.
8. Write about Mitochondria.
9. Write about cell surface receptors.
10. Write about functions of enzymes involved in replication.

Part –C

III. Answer ALL very short answer questions 5 x 1 M = 5 M

- 11 : Write the temperature and pressure reached in autolave..
- 12 : What is Sarcina.
- 13: Meiosis is also called as .
- 14 : Peripheral proteins are present in .
- 15: What is histone.



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Practical Syllabus Course -4	Subject : Biotechnology	Program : B.Sc.			
	Title of Course : “ Microbiology, Cell Biology ”-Lab	Year -1			
	Course Code: 124504P	Semester : 2			
	Total Hours – 30hrs ; Per Week -2hrs	L Lect ures	T Tuto rial	P Practical	C Credits
Pre-requisites:	Observation skills, safe handling of hazardous material, notes making skills, drawing conclusions, handling computer, Handling of pipettes, Preparation of Solutions, Handling of analytical instruments.	0	0	2	1

Skills Outcome

On Successful Completion of this Course, Student shall be able to

- Learn about preparation of media for culturing of various microorganisms
- Learn about isolation of microorganisms from different sources
- Learn about staining techniques and biochemical identification of bacteria
- Learn about different stages of cell division.

Practical

- i. Cleaning and preparation of glassware
- ii. Preparation of nutrient agar medium for bacteria
- iii. Preparation of PDA medium for fungi
- iv. Sterilization techniques (autoclave, hot air oven, filter)
- v. Isolation of bacteria from soil
- vi. Simple staining technique
- vii. Differential staining technique
- viii. Microbial counting by Haemocytometer
- ix. Identification of different bacteria
- x. Motility test by hanging drop
- xi. Biochemical identification of bacteria
- xii. Preparation of pure culture by slab, slant, streak culture
- xiii. Study of stages of cell division
- xiv. 14 Extraction and isolation of DNA from bacteria

a) Suggested Co-Curricular Activities

1. Assignments
2. Seminars, Group Discussions on related topics
3. Charts on Replication, cell cycle , cell signalling


Referencebooks:

3. Microbiology–6th Edition, (2006), Pelczar M.J., Chan E.C.S., Krieg N.R.; The McGrawHill Companies Inc. NY
4. Prescott's Microbiology, 8th edition, (2010), Joanne M Willey, Joanne Willey, Linda Sherwood, Linda M Sherwood, Christopher J Woolverton, Chris Woolverton; McGrawHill Science Engineering, USA
5. Textbook of Microbiology, Anantnarayan and Paniker (2017)
6. Brock biology of microorganisms, 2003, Brock, T. D., Madigan, M. T., Martinko, J. M., &Parker, J.; Upper Saddle River (NJ): Prentice-Hall, 2003.
7. Genes XI, 11th edition, (2012), Benjamin Lewin; Publisher - Jones and Barlett Inc. USA
8. Molecular Biology of the Gene, 6th Edition, (2008), James D. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R.; Cold Spring Harbour Lab. Press, Pearson Pub.
9. Molecular Biology, 5th Edition, (2011), Weaver R.; McGraw Hill Science. USA
10. Fundamentals of Molecular Biology, (2009), Pal J.K. and Saroj Ghaskadbi; Oxford UniversityPress.
11. Molecular Biology: Genes to Proteins, 4th edition (2011), Burton E Tropp Jones& BartlettLearning, USA.
12. Cell and Molecular Biology: Concepts and Experiments, 6th Edition, Karp, G. 2010.; JohnWiley & Sons. Inc.

Virtual LabLinks:

<https://vlab.amrita.edu/?sub=3&brch=73>

<https://www.labster.com/blog/popular-microbiology-virtual-lab-simulations/>

	Government College (Autonomous) Rajahmundry		
	Department Of Biotechnology		
	Major : Biotechnology		
B.Sc.-Iyr Semester-2 Paper- 4	Title of the course “Microbiology, Cell Biology”-Lab Course code: 124504P Semester End Exam (2023-24)		
Time : 3Hrs	Practical - Model Question Paper	Credits : 1	Marks : 50

- | | |
|---|------|
| 1. Major experiment. | 15 M |
| 2. Minor experiment. | 10 M |
| 3. Identify the given spotters and write a brief note on it | 15M |
| 4. Record | 05 M |
| 5. Viva-voce | 05 M |

Total 50 M

3 CORE PROGRAM

For both

BIOTECHNOLOGY

And

AGROBIOTECHNOLOGY

Curriculum and Credit Frame work for 3 Majors Program

B.Sc., BIOTECHNOLOGY WITH 3 MAJOR SYSTEM

Year	Sem	Paper	Title of course	Hrs per week	Marks			Credits	Course code
				Total 15 weeks (60+30)					
IIyr	3	3	Immunology and rDNA Technology	4	50	50	100	4	BTL 124
IIyr	3	3	Immunology and rDNA Technology-Lab	2	-	50	50	1	BTL 124P
IIyr	4	4	Plant and Animal Biotechnology	4	50	50	100	4	BTL123
IIyr	4	4	Plant and Animal Biotechnology Lab	2	-	50	50	1	BTL123P
IIyr	4	5	Environmental and Industrial Biotechnology	4	50	50	100	4	BTL153
IIyr	4	5	Environmental and Industrial Biotechnology Lab	2	-	50	50	1	BTL153P
summer	4 th sem end		2 nd Internship for BBC & AGRO						
IIIyr	5 th sem Internship		3 rd Internship for BBC / AGRO for one of the program and below syllabus for remaining program						
IIIyr	5	6A	Organic farming	3	50	50	100	3	BTL156
IIIyr	5	6A	Organic farming-Lab	2		50	50	2	BTL156P
IIIyr	5	7A	Biofertilizers and Biopesticide production	3	50	50	100	3	BTL205
IIIyr	5	7A	Biofertilizers and Biopesticide production Lab	2		50	50	2	BTL205P
OR									
IIIyr	5	6B	Techniques in Nursery Development	3	50	50	100	3	BTL204
IIIyr	5	6B	Techniques in Nursery Development - lab	2		50	50	2	BTL204P
IIIyr	5	7B	Hydroponics cultivation	3	50	50	100	3	BTL 203
IIIyr	5	7B	Hydroponics cultivation -- lab	2		50	100	2	BTL 203P
OR									
IIIyr	5	6C	Crop Improvement Technology	3	50	50	100	3	BTL 148
IIIyr	5	6C	Crop Improvement Technology-Lab	2		50	50	2	BTL 148P
IIIyr	5	7C	Vegetable Science	3	50	50	100	3	BTL143
IIIyr	5	7C	Vegetable Science - Lab	2		50	50	2	BTL143P
IIIyr	6 th sem	Internship	3 rd Internship for AGRO / BBC for one of the program and above syllabus for remaining program .						

Semester wise subjects for students of 3 Majors Program

Semester – 3 (2022-25)			
S.No.	Subjects	Core / Paper	Title
1	I-Language (English)		
2	II-Language (Hin / Tel/Sanskrit)		
3	Life Skill Courses	<i>Analytical skills</i>	
4	<i>Skill Development courses</i>	--	
5	Major 1 Biotechnology	Core	Immunology and rDNA technology
6	Major 2 Botany	Core	
7	Major 3 Chemistry	Core	

Semester – 4 (2022-25)			
S.No.	Subjects	Core / Paper	Title
1	Paper-4 Biotechnology	Core	Plant and Animal biotechnology
2	Paper-4 Botany	Core	
3	Paper-4 Chemistry	Core	
4	Paper-5 Biotechnology	Core	Environmental and Industrial Biotechnology
5	Paper-5 Botany	Core	
6	Paper-5 Chemistry	Core	
7	Certificate course		Biophysical & Microbiological techniques

Semester – 5 or 6 (2021-2024)			
S.No.	Subjects	Title	
1	Major 1 Biotechnology	Organic farming	
		Biofertilizers and Biopesticides	
2	Major 2 Botany		
3	Major 3 Chemistry		



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Theory Syllabus Paper - 3	Subject : Biotechnology & Agro Biotechnology	Program : B.Sc Group : BBC Year- II Semester : 3			
	Title of the Course “ Immunology and rDNA Technology ” Course Code: BTL151				
	Total Hours Allocated - 60 ; Per Week -4 hrs	L Lect ure	T Tutori al	P Pract ical	C Credits
Pre-requisites:	<ul style="list-style-type: none"> ➤ Knowledge of organs of human system. ➤ Types of cells in the human body. ➤ Immunity and resistance in general 	4	2	-	4

Course Objectives:

1. The students should be able to describe the roles of the immune system in both maintaining health and contributing to disease.
2. The students should be able to describe immunological response and how it is triggered and regulated.
3. The students should be able to identify the cellular and molecular basis of immune responsiveness.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	➤ Immunology is a branch of biology that encompasses the study of host defence mechanisms and resistance towards pathogens.
CO2	➤ This course enables the pupil to understand the basics of immune system functioning through study of organs and cells involved in immune response.
CO3	➤ Apart from understanding ⁵² the mounting of immune responses , the pupil will now acknowledge the applications of immunology. in numerous disciplines like medicine, organ transplantation, oncology, rheumatology, virology, bacteriology, parasitology.
CO4	➤ The cutting edge Recombinant DNA technology, which is about bringing together useful genes from across species and producing genetically modified organisms is sure to make the pupil understand the processes involved thoroughly .
CO5	➤ Overall the interesting course design is likely to instil a research tempo in the pupil and ultimately contribute to the welfare of humankind.

Course with focus on employability / entrepreneurship / Skill Development modules

<p>Skill Development</p>	<p>Databases (PubMed, NCBI, EMBL and ExPASy), nucleotide and protein BLAST analysis, CLustal W and phylogenetic tree construction. Introduction to omics (proteomics, genomics and transcriptomics). Introduction to nanotechnology.</p>	<p>Employability</p>	<p>Live, killed, attenuated, subunit and recombinant vaccines</p> <p>Principles and application of PCR. Southern, Northern and Western Blotting. Introduction to DNA sequencing</p>	<p>Entrepreneurship</p> <p>Hybridoma technology, Monoclonal antibodies and their application in immunodiagnosis</p> <p>Applications of rDNA technology in agriculture (transgenic plants, edible vaccines and antibodies) and medicine (disease diagnosis and DNA fingerprinting)</p>
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Government College (Autonomous) Rajamahendravaram.
Department Of Biotechnology
B.Sc. – Biotechnology & Agro Biotechnology ; II yr ; Sem 3 ; Theory Syllabus.

Title of the Course 3 : Immunology & r DNA Technology ; Course code : **BTL151**

Syllabus

UNIT–I : Concepts and Cells of the Immune System:

Antigen, hapten, antibody (types), antigenicity Versus immunogenicity ., Innate and adaptive immunity. Basic concepts of humoral and cell-mediated immune response.

Additional input : Blood group antigens

Unit II : Organs and mediators of Immune system

Hematopoiesis , organs, tissues, cells and mediators of the immune system (primary and secondary lymphoid organs, lymphocytes and cytokines).Introduction to complement components, MHC.

Additional Input : Immune boosting diet., Transplant rejection.

Unit–III : Vaccinology and Clinical Immunology:

Live, killed, attenuated, subunit and recombinant vaccines. Role and properties of adjuvants. Hybridoma technology, Monoclonal antibodies and their application in immunodiagnosis. Antigen and antibody interactions -precipitation, agglutination, immune diffusion and ELISA. Introduction to hypersensitivity and autoimmunity.

Additional Input : Natural remedies for Hypersensitivity and Autoimmunity.

Unit–IV : Introduction, Tools and Techniques of rDNA Technology:

Introduction to rDNA technology, tools of genetic engineering (Genes, Cloning vectors - plasmids and cosmids, Enzymes – restriction endonucleases and DNA Ligase,). Principle and application of PCR. Southern Blotting. Introduction to DNA sequencing (Sanger Sequencing)

Unit – V :Cloning Strategies and Application of rDNA Technology:

cDNA library construction : Methods of transformation, recombinant selection and screening methods. Applications of rDNA technology in agriculture and medicine (transgenic plants, and edible vaccines) .

Additional Input and Assignment			
unit no:	Additional input	Deletion	Justification
1	Blood group antigens and Bombay blood group	Terminology	It is important to know about blood group antigens for safe blood transfusion
2	Transplant rejection, Immune boosting diet.		
3	edible vaccines, Natural remedies for Hypersensitivity and Autoimmunity		Very important in present lifestyle
4	Site-directed Mutagenesis		
5	Recombinant insulin		Very useful knowledge

unit no:	Co Curricular activity
1	Extension work
2	Group Discussion
3	Guest lecture
4	Role Play
5	Seminars

Textbooks:

1. Textbook of basic and clinical immunology, 1st edition (2013), SudhaGangal and ShubhangiSontakke, University Press, India
2. Immuno diagnostics, 1996, By S.C. Rastogi, Publ: New Age
3. Introduction to Immunology- 2002, C. V. Rao- Narosa Publishing House
4. Textbook of Biotechnology - 2007, By H.K. Das (Wiley Publications)
5. Molecular Biology & Biotechnology- 1996, By H.D. Kumar, Publ: Vikas
6. Introduction to Bioinformatics – 2007, By V. Kothekar.

Referencebooks:

- . Kuby immunology, Judy Owen, Jenni Punt, Sharon Stranford., 7th edition (2012), Freeman and Co., NY
1. Immunology, 7th edition (2006), David Male, Jonathan Brostoff, David Roth, IvanRoitt, Mosby, USA.
 2. Principles of Gene Manipulation - 7 th edition, 2006, By R.W. Old & S.B. Primrose, Publ: Blackwell
 3. Molecular Biotechnology - 4 th edition, 2010, G.R. Click and J.J. Pasternak, Publ:Panima
 4. Genes and Genomes – 1991, By Maxine Singer and Paul Berg
 5. Genes VII- 2000, By B. Lewin - Oxford Univ. Press
 6. Molecular Biology - 4 th Edition, 2008, By D. Freifelder, Publ: NarosaPublishinghouse New York, Delhi
 7. Brown TA. (2006). Gene Cloning and DNA Analysis. 5th edition. BlackwellPublishing, Oxford, U.K. 14.Clark DP and Pazdernik NJ. (2009). Biotechnology-Appling the Genetic Revolution. Elsevier Academic Press, USA.
 8. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles andApplications of recombinant DNA. ASM Press, Washington

9. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.

10. Introduction to Bioinformatics – 2013, By Arthur M. Lesk

11. Bioinformatics: 2001, Sequence and Genome Analysis by David W. Mount, Cold Spring Harbor Laboratory Press
 Biological Sequence Analysis: 1st Edition, 1998, Probabilistic Models of Proteins and Nucleic Acids by Richard Durbin, Sean R. Eddy, Anders Krogh, Graeme Mitchison, Cambridge University Press.


WebLinks:

1. Bioinformatics tools and Resources – free online tools, software

CO-POMapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], 4:No Correlation

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PS O1	PS O2	PS O3
CO1	3	2	1	2	2	2	1	1	1	4	3	2	1
CO2	3	2	1	2	2	2	1	1	1	4	3	2	1
CO3	3	3	2	2	2	2	1	1	1	4	3	2	1
CO4	3	3	1	2	3	1	1	2	1	4	3	2	1
CO5	3	3	1	3	3	2	1	1	2	1	3	2	1

	Government College (Autonomous) Rajahmundry	
	Department Of Biotechnology	
	Subject : Biotechnology & Agro Biotechnology	Group : BBC
B.Sc.-II yr Semester-3 Paper- 3	Title of Course “ Immunology and rDNA Technology ” Course Code :BTL151 Semester End Exam (2022-23)	
Time : 2 1/2 Hrs	Blue Print of Question Paper	Marks : 50

Part – A

I. Essay questions: answer any THREE

3 X 10 = 30 M

Each answer carries TEN marks.

- Question 1 from Unit I
- Question 2 from Unit II
- Question 3 from Unit III
- Question 4 from Unit IV
- Question 5 from Unit V
- Question 6 from additional input


Part-B

II. Short answer questions: answer any FOUR

4 X 5= 20 M

Each answer carries FIVE marks.

- Question 7: from Unit I
- Question 8: from Unit I
- Question 9: from Unit II
- Question 10: from Unit II
- Question 11: from Unit III
- Question 12: from Unit III
- Question 13: from Unit IV
- Question 14: from Unit V

	Government College (Autonomous) Rajahmundry Department Of Biotechnology	
	Subject : Biotechnology & Agro Biotechnology	Group : BBC
B.Sc.-II yr Semester-3 Paper- 3	Title of Course “ Immunology and rDNA Technology ” Course Code : BTL151 Semester End Exam (2022-23)	
Time : 2 1/2 Hrs	Model Question Paper	Marks : 50

Part – A

Answer any THREE questions. Each carries TEN marks.

3 X 10= 30M

1. Explain the different cells of immune system (I)
2. What is various organs of the immune system? (II)
3. Write about steps involved in Hybridoma Technology (III)
4. Write about principle and applications of Blotting techniques. (IV)
5. Write the applications of r-DNA technology in agricultural field (V)
6. Write an essay on production of recombinant insulin . (Additional input)

PART-B

Answer any FOUR questions. Each carries FIVE marks.

5 X4 = 20 M

7. Antibody (I)
8. Humoral immunity. (I)
9. MHC (II)
10. Hematopoiesis (II)
11. Precipitation (III)
12. Recombinant vaccine (III)
13. Cosmids (IV)
14. Edible vaccines (V)



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Practical Syllabus Paper-3	Subject : Biotechnology & Agro Biotechnology	Program : B.Sc			
	Title of Course “ Immunology and rDNA Technology ”-Lab	Group : BBC			
	Course Code: BTL151P	Year-II			
	Total Hours – 30hrs ; Per Week -2hrs	L	T	P	C
		Lect ures	Tuto rial	Practical	Credits
Pre-requisites:	Handling of pipettes. Preparation of Solutions Handling and Disposal of bio hazardous material	0	0	2	1

Title of Course

“ Immunology and rDNA Technology ”-Lab

Objectives:

1. The students should be able to understand the principle behind the assays.
2. The students should be able to understand the concept behind the diagnostic tests.
3. The students should be able to interpret the result obtained after performing the assay

List of Experiments/Syllabus:

1. Determination of Blood Groups
2. Pregnancy test
3. Widal test
4. Ouchterlonyimmunodiffusion
5. RBC and WBC count
6. ELISA
7. Radial immune diffusion
8. Production of antibodies (theory exercise)
9. Bleeding, separation of serum and storage
Lymphoid organs (theory exercise)
10. Isolation of plasmid DNA (alkaline lysis method)
11. Analysis of plasmid DNA by Agarose gel electrophoresis
12. Southern blotting (theory exercise)
13. PCR Amplification

Referencebooks:

1. Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press.
2. Bioinformatics: 2004, A Practical Guide to the Analysis of Genes and Proteins, Andreas D. Baxevanis, B. F. Francis Ouellette, Wiley-Interscience

Weblinks

<https://www.yourgenome.org/facts/what-is-gene-expression>

<https://microbenotes.com/gene-expression/>

https://en.wikipedia.org/wiki/Gene_expression


<https://microbenotes.com/recombinant-dna-technology-steps-applications-and-limitations/>

<https://www.biotechnologynotes.com/recombinant-dna-technology/recombinant-dna-technology-notes/259>

virtual lab links

<https://ocw.mit.edu/courses/biology/7-01sc-fundamentals-of-biology-fall-2011/recombinant-dna/>

<https://www.coursera.org/lecture/genes/gene-expression-Ob3FQ>

	Government College (Autonomous) Rajahmundry Department Of Biotechnology		
	Subject : Biotechnology & Agro Biotechnology		Group : BBC
B.Sc.-II yr Semester-3 Paper- 3	Title of Course “ Immunology and r DNA technology ” Course code: BTL151P Semester End Exam (2022-23)		
Time : 3Hrs	Practical - Model Question Paper	Credits : 1	Marks : 50

1. Major

20 M

Isolate the plasmid DNA from given bacterial culture and perform agarose gel electrophoresis?

2. Minor

10M

Determine the blood group of the given blood sample ?

3. Spotters (5x2)

10 M

a) Lymphoid organs

b) Cosmids

c) ELISA

d) BLAST

e) RIA

4. Record

05M

5. Viva-voce

05M

Total =

50M



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Theory Paper - 4	Subject : Biotechnology & Agro Biotechnology	Program : B.Sc Group : BBC Year -II Semester : 4			
	Title of the Course “ Plant and Animal Biotechnology ” Course Code: BTL152				
	Total Hours Allocated - 60 ; Per Week -4 hrs	L Lect ure	T Tutori al	P Pract ical	C Credits
Pre-requisites:	<ul style="list-style-type: none"> ➤ Knowledge about plant and animal physiology. ➤ Knowledge about structure and functions of both plant and animal cells. 	4	1	-	4

Course Objectives:

- The student should be able to understand the basic mechanisms in animal and plant cells
- The students should be able to recognize special features of plant and animal cells.
- The student should be able to understand the applications of plant and animal for welfare of humankind and environment altogether.

Course Outcomes:

On Completion of the course, the students will be able to-

CO1	Plant biotechnology encompasses and enables the pupil to understand tissue culture techniques and various applications like production and propagation of hybrids which are of superior quality.
CO2	Animal biotechnology encompasses the growing of animal cells <i>invitro</i> and its study enables in understanding the secrets of life and the requirements & mechanisms of genetic corrections
CO3	The course provides thorough understanding of techniques involved in making the life of human kind easier.
CO4	This very interesting course not only encourages the pupil to further go for higher studies but also induces a quest to learn more and more and also to pursue research
CO5	The pupil will understand nutritional requirements of plants and animal cells, which enables the student to grow the cells on artificial medium invitro. Also the course confers understanding and application of cellular mechanisms to produce industrially important products.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development	<p>media preparation</p> <p>sterilization techniques</p> <p>Agrobacterium mediated Gene transfer</p> <p>Animal cell culture</p> <p>Transfection methods (calcium phosphate precipitation, electroporation, Microinjection) and applications</p>	Employability	<p>establishment of cultures</p> <p>Cryopreservation</p> <p>Molecular markers - RAPD, RFLP and DNA fingerprinting-principles and applications. Tests: cell viability and cytotoxicity</p>	Entrepreneurship	<p>applications of tissue culture</p> <p>Plant secondary metabolites</p> <p>Transgenic plants as bioreactors</p> <p>Production of vaccines, diagnostics, hormones and other recombinant DNA products in medicine (insulin, somatostatin, vaccines), IVF, Concept of Gene therapy, Concept of transgenic animals –</p> <p>Bio safety-introduction to biological safety cabinets; primary containment for biohazards; biosafety levels; GLP, GMP, Introduction to IP- Types of IP: patents, trademarks & copyright</p>
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Government College (Autonomous) Rajamahendravaram
Department Of Biotechnology

B.Sc. – Biotechnology & Agro Biotechnology; Iyr ; Sem - 4 ; Theory Syllabus.

Title of the Course 4 : Plant and Animal Biotechnology ; Course code : **BTL152**

UNIT I: Plant tissue culture techniques & secondary metabolites production:

Plant tissue culture : Totipotency, media preparation – nutrients and plant hormones; sterilization techniques; establishment of cultures – callus culture, cell suspension culture ,applications of tissue culture-micro propagation; Somatic embryogenesis; synthetic seed production; protoplast culture and somatic hybridization - applications. Cryopreservation, Plant secondary metabolites-concept and their importance.

UNIT II: Transgenesis and Molecular markers:

Plant transformation technology-- Agrobacterium mediated Gene transfer (Ti plasmid), , Transgenic plants as bioreactors. Herbicide resistance – glyphosate, Insect resistance- Bt cotton, Molecular markers - RAPD, RFLP and DNA fingerprinting-principles and applications.

UNIT III: Animal tissue culture techniques:

Animal cell culture: cell culture media and reagents; culture of mammalian cells, tissues and organs; primary culture, secondary culture, cell lines, stem cell cultures; Tests: cell viability and cytotoxicity, Cryopreservation. Transfection methods (calcium phosphate precipitation, electroporation, Microinjection) and applications.

UNIT IV: Transgenic animals & Gene Therapy:

Production of vaccines, diagnostics, hormones and other recombinant DNA products in medicine (insulin, somatostatin, vaccines),IVF, Concept of Gene therapy, Concept of transgenic animals – Merits and demerits -

UNIT V: Bioethics, Biosafety and IPR:

Bioethics in cloning and stem cell research, Human and animal experimentation, animal rights/welfare. Bio safety-introduction to biological safety cabinets; primary containment for biohazards; biosafety levels; GLP, GMP, Introduction to IP-Types of IP: patents, trademarks & copyright.

Additional Input and Assignment			
unit no:	Additional Input	Deletion	Justification
1	Multipotent Vs Totipotent		
2	Hairy root features of Ri plasmid		
3	Advantages of tissue culture, 3-D bioprinting		
4	Ethical issues in animal biotechnology.		
5	Infringment (IPR)		

unit no:	Co Curricular activity
1	Seminars
2	3D Models
3	Project work
4	Group Discussion
5	Debate

Textbooks:

Recommended Books :

1. Introduction to Plant Tissue Culture..M.K. Razdan ,2003,Science Publishers
2. Plant Tissue Culture, kalyan Kumar De,199 M7, New Central Book Agency
3. Biotechnology – By U. Satyanarayana ;1997
4. Plant Cell, Tissue and Organ Culture, Applied and Fundamental Aspects By Y.P.S. Bajaj and A. Reinhard ,2001
5. Introduction to Plant Tissue Culture, M. K. Razdan, 2003,Science Publishers
6. A Textbook of Biotechnology,R C Dubey,S. 2014,Chand Publishing
7. Elements of Biotechnology,P. K. Gupta, 1994,Rastogi Publications
8. M.M. Ranga, Animal Biotechnology; Agrobios (India) ,2006.

Referencebooks:

- ✓ Daniel R. Marshak, Richard L. Gardner, David Gottlieb “Stem cell Biology” edited by Daniel 2001, Cold Spring Harbour Laboratory press, New York

Weblinks

1. <https://www.helpforag.app/2018/03/biotechnology.html>
2. <http://velhightech.com/wp-content/uploads/2019/04/BT-6010-Plant-Biotechnology.pdf>
3. <https://nifa.usda.gov/plant-biotechnology>


Virtual lab Links

1. https://webstor.srmist.edu.in/web_assets/downloads/2021/18BTC108J-lab-manual.pdf
2. <https://www.onlinebiologynotes.com/equipment-and-materials-used-in-animal-cell-culture/>

CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], 4:No Correlation

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	1	2	3	2	1	3	3	2	3	3	1
CO2	3	1	1	2	3	2	2	3	3	2	2	4	1
CO3	3	3	1	1	2	2	2	3	3	2	3	3	3
CO4	3	3	1	1	2	2	2	3	3	2	2	2	2
CO5	3	3	1	1	1	2	1	1	1	2	3	3	3

	Government College (Autonomous) Rajahmundry Department Of Biotechnology	
	Subject : Biotechnology & Agro Biotechnology	Group : BBC
B.Sc.-IYr Semester-4 Paper- 4	Title of Course “ Plant and Animal Biotechnology ” Course Code :BTL152 Semester End Exam (2022-23)	
Time : 2 1/2 Hrs	Blue Print of Question Paper	Marks : 50

Part – A

I. Essay questions: answer any THREE

3 X 10 = 30 M

Each answer carries TEN marks.

- Question 1 from Unit I
- Question 2 from Unit II
- Question 3 from Unit III
- Question 4 from Unit IV
- Question 5 from Unit V
- Question 6 from additional input


Part-B

II. Short answer questions: answer any FOUR

4 X 5= 20 M

Each answer carries FIVE marks.

- Question 7: from Unit I
- Question 8: from Unit I
- Question 9: from Unit II
- Question 10: from Unit II
- Question 11: from Unit III
- Question 12: from Unit III
- Question 13: from Unit IV
- Question 14: from Unit V

	Government College (Autonomous) Rajahmundry Department Of Biotechnology	
	Subject : Biotechnology & Agro Biotechnology	Group : BBC
B.Sc.-Ilyr Semester-4 Paper- 4	Title of Course “ Plant and Animal Biotechnology ” Course Code : BTL152 Semester End Exam (2022-23)	
Time : 2 1/2 Hrs	Model Question Paper	Marks : 50

PART –A

ANSWER any three questions. Each answer carries ten marks 3X10=30 marks

1. What are metabolites and explain different plant secondary metabolites (Unit 1)
2. What are transgenic plants? Write a note on transgenic plants as bioreactors (Unit 2)
3. What are cell cultures and explain different types of cell cultures (Unit 3)
4. Write a note on transgenic animals with merits and demerits (Unit 4)
5. Explain about biosafety and different levels in biosafety (Unit 5)
6. Write an essay on advantages of tissue culture techniques (Additional input)

PART –B

Answer any FOUR questions. Each answer carries Five marks. 4x5 =20 Marks

- 7.. Micro propagation
- 8.. Cryopreservation
- 9.. RAPD
10. Ti-Plasmid
11. Somatic embryogenesis
12. Cell lines
13. IVF
14. Animal rights



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Practical Syllabus Paper-4	Subject : Biotechnology & Agro Biotechnology	Program : B.Sc			
	Title of Course “ Plant and Animal Biotechnology Lab ”	Group : BBC			
	Course Code: BTL152P	Year-II			
	Total Hours – 30hrs ; Per Week -2hrs	L Lect ures	T Tuto rial	P Practical	C Credits
Pre-requisites:	<ul style="list-style-type: none"> ➤ Aseptic techniques. ➤ Preparation and sterilization of solutions. 	0	0	2	1

Objectives:

- To induce logical thinking with respect to understanding nutritional requirements of plants and animal cells.
- To enable the student to grow the cells on artificial medium invitro.
- To extrapolate and apply the cellular mechanisms to produce industrially important products.

List of Practical Experiments/Syllabus


- Plant culture media and composition of MS media
- Raising of aseptic seedlings
- Induction of callus from different explants, cytology of callus
- Plant propagation through Tissue culture (shoot tip and Nodal culture)
- Establishing a plant cell culture (both in solid and liquid media)
- Suspension cell culture
- Cell count by hemocytometer.
- Establishing primary cell culture of chicken embryo fibroblasts.
- Animal tissue culture – maintenance of established cell lines.
- Animal tissue culture – virus cultivation.
- Estimation of cell viability by dye exclusion (Trypan blue).

Referencebooks:

1. R. Ian Freshney, “Culture of animal cells – A manual of basic techniques” 4th edition, John Wiley & Sons, 2000, Inc, publication, New York.
2. Plant Tissue Culture : Theory and Practice By S.S. Bhojwani and A. Razdan, 1998.

Weblinks:

1. <https://www.helpforag.app/2018/03/biotechnology.html>.
2. <http://velhightech.com/wp-content/uploads/2019/04/BT-6010-Plant-Biotechnology.pdf>
3. <https://nifa.usda.gov/plant-biotechnology>.
4. <https://velhightech.com/wp-content/uploads/2019/04/BT-6007-Animal-Biotechnology.pdf>

	Government College (Autonomous) Rajahmundry Department Of Biotechnology		
	Subject : Biotechnology & Agro Biotechnology		Group : BBC
B.Sc.-IYr Semester-4 Paper- 4	Title of Course “ Plant and Animal Biotechnology Lab ” Course code: BTL152P Semester End Exam (2022-23)		
Time : 3Hrs	Practical - Model Question Paper	Credits : 1	Marks : 50

Major Question

20M

1. Use the given explant sample to induce callus and write the protocol and procedure of the experiment?

Minor Question

10M

2. Determine the number of cells in given sample using haemocytometer

3. Spotters

2 x 5 = 10M

a) RFLP

b) Bt-Cotton

c) Bioreactor

d) Plasmid

e) Chick embryo fibroblast

4. Record

5M

5. Viva

5M

Total = 50 M



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Theory Paper - 5	Subject : Biotechnology & Agro Biotechnology	Program : B. Sc Group : BBC Year -II Semester : 4			
	Title of the Course “ Environment and Industrial Biotechnology” Course Code: BTL153				
	Total Hours Allocated – 60T + 30P =90hrs ; Per Week -4 +2 =6hrs	L Lect ure	T Tutori al	P Pract ical	C Credits
Pre-requisites:	<ul style="list-style-type: none"> ➤ Various Causes of Environmental pollution ➤ Knowledge about General features of microbes 	4	1	-	4

Course Objectives:

1. To understand the pollution effect caused by industrialization.
2. To understand the environmental pollution caused by technology.
3. To understand the importance of microbes and their products.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	The pupil will understand the pollution effect caused by industrialization
CO2	The pupil will be able to understand, design and solve the environmental pollution through Green technology Approach.
CO3	The pupil will understand the importance of microbes and their products
CO4	The pupil will be able to understand the requirements for commercial production of industrially important microbial products
CO5	The pupil will be able to contribute to development of industrialisation while still protecting the environment.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development	<p>Measurement of water pollution, sources of water pollution. Microbiology of waste water treatment, aerobic processes, activated sludge, oxidation ponds, trickling filters, and rotating biological contactors. Anaerobic processes: Anaerobic digesters, upward flow anaerobic sludge blanket reactors. microbial groups involved in biogas production & interactions, factors affecting biogas production, Industrially important microbes, its screening, selection and identification</p>	Employability	<p>air pollution & its control through Biotechnology, Biofilters, Bioscrubbers, Biotrickling filter. Bioremediation of Hydrocarbons and its applications Degradation of pesticides and other toxic chemicals by microorganism</p> <p>Maintenance and preservation of industrially important microbial cultures.</p> <p>Microbial production of Organic acids (Lactic acid, citric acid), Amino acids (Glutamic acid, Aspartic acid And Lysine</p>	Entrepreneurship	<p>Role of genetically Engineered microbes, Concept of Phytoremediation, environmental safety guidelines</p> <p>Biofertilizers, Vermiculture.</p> <p>Strain Improvement, Basic concepts of fermentation; Design of fermenter and applications.</p> <p>dairy products (Cheese, Yogurt), beverages (Beer, Wine) and antibiotics (Streptomycin, Pencillin)</p>
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Government College (Autonomous) Rajamahendravaram
Department Of Biotechnology

B.Sc. – Biotechnology & Agro Biotechnology ; IYr ; Sem - 4 ; Theory Syllabus.

Title of the Course 5 : Environment and Industrial Biotechnology ; Course code : BTL 153

UNIT I: Pollution Types and Control:

Environmental Biotechnology-Environmental Pollution: Types of pollution, air pollution & its control through Biotechnology, Biofilters, Bioscrubbers, Biotrickling filter.

Water pollution and its management:, sources of water pollution. Microbiology of waste water treatment, aerobic processes, activated sludge, oxidation ponds, trickling filters, and rotating biological contactors.

Anaerobic processes: Anaerobic digesters, upward flow anaerobic sludge blanket reactors.

UNIT II: Bioremediation:

Biodegradation and Bioremediation: Concepts & principles of Bioremediation, Bioremediation of Hydrocarbons and its applications Degradation of pesticides and other toxic chemicals by microorganism. Role of genetically Engineered microbes, Concept of Phytoremediation, environmental safety guidelines.

UNIT III: Biofuels:

Biofuels-biogas, microbial groups involved in biogas production & interactions, factors affecting biogas production, Biofertilizers,.

UNIT IV: Basic principles of Microbial technology:

Industrially important microbes, its screening, selection and identification. Maintenance and preservation of industrially important microbial cultures. Strain Improvement, Basic concepts of fermentation;

UNIT V: Commercial Production of Microbial products:

Microbial technology products and applications; Microbial production of Organic acids (Lactic acid, citric acid), Amino acids (Glutamic acid, Aspartic acid and Lysine). Fermentation by microbes for food additives: dairy products (Cheese, Yogurt), beverages (Beer, Wine)

Additional Input and Assignment			
unit no:	Additional Input	Deletion	Justification
1	Measurement of water pollution		
2	Biodegradable products		
3	Vermiculture		
4	Design of fermenter and applications.		
5	Microbial production of antibiotics (Streptomycin, Pencillin).		

unit no:	Co Curricular activity
1	Extension work, Live models
2	Field work
3	Project work
4	Seminars
5	Project work

Textbooks:

1. K. Vijaya Ramesh, Environmental Microbiology, 2004, MJP Publishers, Chennai.
2. A.G. Murugesan, C. Raja Kumari, Environmental Science & Biotechnology - Theory & Techniques, 2005, MJP Publishers.

Introduction to Environmental Sciences, Y. Anjaneyulu ,2004, BS Publications

3. Industrial Microbiology by A.H.Patel,2009

Referencebooks:

1. Environmental microbiology by Raina M. Maier Ian L. Pepper & Charles P. Gerba, 2000, Academic press.
2. Environmental Chemistry, A.K. De. Wiley Eastern Ltd., 2001, New Delhi
3. Introduction of Biodeterioration, D. Allsopp and K.J. Seal, ELBS/Edward Arnold, 2008
4. Power un seen: How microbes rule the world. By Dixon, B. Freeman/ Spectrum, 1994, Oxford.
5. Environmental Microbiology. By. Mitchell. R. Wiley, 1992, New York
6. Prescott & Dum (2002) Industrial Microbiology, Agrabiros (India) ,2005, Publishers
7. Creueger W. & Crueger A. A Text of Industrial Microbiology, 2000, 2nd Edition, Panima Publishers

corp.

Weblinks

1. https://www.brainkart.com/subject/Environmental-Biotechnology_242/
2. <https://www.biotechnologynotes.com/environment/environmental-biotechnology-with-meaning/735>
3. https://issuu.com/brainkart.com/docs/environmental_biotechnology
4. <https://www.edx.org/learn/biotechnology>


Virtual lab links

1. <https://www.epfl.ch/labs/lbe/>
2. <https://www.srmist.edu.in/engineering/department-of-biotechnology/environmental>

CO-POMapping:

(1:Slight[Low];2:Moderate[Medium];3:Substantial[High], :No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	1	2	3	2	2	3	3	2	3	2	2
CO2	3	3	3	3	3	3	3	3	3	3	3	2	2
CO3	3	3	2	2	1	2	2	3	3	3	3	2	2
CO4	3	3	3	3	3	3	3	3	3	3	3	2	2
CO5	3	3	3	3	3	3	3	3	3	3	3	2	2

	Government College (Autonomous) Rajahmundry Department Of Biotechnology	
	Subject : Biotechnology & Agro Biotechnology	Group : BBC
B.Sc.-IYr Semester-4 Paper- 5	Title of Course “Environment and Industrial Biotechnology ” Course Code :BTL153 Semester End Exam (2022-23) Max.Marks: 50	
Time : 2 1/2 Hrs	Blue Print of Question Paper	Marks : 50

Part – A

I. Essay questions: answer any THREE

3 X 10 = 30

M Each answer carries TEN marks.

- Question 1 from Unit I
- Question 2 from Unit II
- Question 3 from Unit III
- Question 4 from Unit IV
- Question 5 from Unit V
- Question 6 from additional input


Part-B

II. Short answer questions: answer any FOUR

4 X 5= 20 M

Each answer carries FIVE marks.

- Question 7: from Unit I
- Question 8: from Unit I
- Question 9: from Unit II
- Question 10: from Unit II
- Question 11: from Unit III
- Question 12: from Unit III
- Question 13: from Unit IV
- Question 14: from Unit V

	Government College (Autonomous) Rajahmundry Department Of Biotechnology	
	Subject : Biotechnology & Agro Biotechnology	Group : BBC
B.Sc.-Ilyr Semester-4 Paper- 5	Title of Course . “Environment and Industrial Biotechnology” Course Code : BTL153 Semester End Exam (2022-23)	
Time : 2 1/2 Hrs	Model Question Paper	Marks : 50

PART –A

Answer any THREE questions. Each answer carries TEN marks. 3x10=30 Marks

1. Explain the microbiology of waste water treatment (Unit 1)
2. Write about role of genetically engineered microbes (Unit 2)
3. Write about biogas production (Unit 3)
4. Explain about preservation of industrial microbial cultures (Unit 4)
5. Explain about microbial production of organic acids (Unit 5)
6. Write an essay on biodegradable products (Additional input)

PART –B

Answer any FOUR questions. Each answer carries Five marks. 4x5 =20 Marks

7. Air pollution
8. Oxidation ponds
9. Hydro carbons applications
10. Phytoremediation
11. Biofertilizers
12. Vermiculture
13. Fermenter applications
14. Streptomycin



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Practical Syllabus Paper-5	Subject : Biotechnology & Agro Biotechnology	Program : B.Sc Group : BBC Year-II Semester : 4			
	Title of Course “ Environment and Industrial Biotechnology ”-Lab Course Code: BTL153P				
	Total Hours – 30hrs ; Per Week -2hrs	L Lect ures	T Tuto rial	P Practical	C Credits
Pre-requisites:	Volumetric Titrations Knowledge about handling and growing microbes .	0	0	2	1

Title of Course

“ Environment and Industrial Biotechnology ”-Lab

Course Code: BTL153P

Objectives:

1. To understand the biological and chemical content of water.
2. To understand the standard test used to determine the pollution level in water.
3. To understand the exploitation of microbes to produce industrially important quality products.

List of Experiments/Syllabus:

1. Detection of coliforms for determination of the purity of potable water.
2. Determination of total dissolved solids of water
3. Determination of Hardness and alkalinity of water sample.
4. Determination of dissolved oxygen concentration of water sample
5. Determination of biological oxygen demand of sewage sample
6. Determination of chemical oxygen demand (COD) of sewage sample.
7. Isolation of industrially important microorganisms from soil.
8. Isolation of amylase producing organisms from soil.
9. Production of α – amylase from Bacillus Spp. by shake flask culture.
10. Production of alcohol or wine using different substrates.
11. Production of citric acid by submerged fermentation
12. Estimation of citric acid by titrimetry.



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Subject : Biotechnology & Agro Biotechnology

Group : BBC

**B.Sc.-IYr
Semester-4
Paper- 5**

**Title of Course
“ Environmental and Industrial Biotechnology ”
Course code: BTL153P
Semester End Exam (2022-23)**

Time : 3Hrs

Practical - Model Question Paper

Credits : 1

Marks : 50

- | | |
|---|-------|
| 1. Determine the BOD of given water sample | 15 M |
| 2. Determination the hardness of given water sample | 10M |
| 3. Spotters | 15M |
| a) Fermenter | |
| b) Principle of wine preparation | |
| c) Identify given product from the spotter | |
| d) Biodegradation principle | |
| e) Identify structure of amino acid | |
| 4. Record | 5M |
| 5. Viva | 5M |
| | ----- |
| | 50M |
| | ----- |



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Theory Paper - 6A	Subject : AgroBiotechnology & Biotechnology	Stream : B.Sc			
	Title of the Course “ Organic farming ”	Program : AgroBBC & BBC			
	Course Code: BTL156	Year -III Semster : 5			
	Total Hours Allocated - 60 ; Per Week - 4 hrs	L Lecture	T Tutorial	P Practical	C Credits
Pre-requisites:	➤ Basic knowledge about farming technique and natural products used in farming.	4	1	-	4

Course Objectives:

- This course aims to teach complete knowledge about organic farming.
- This course also teaches about multiple cropping methods

On Completion of the course, the students will be able to-

CO1	The students have basic knowledge of organic farming. Understand the soil profile and nutrients in soil
CO2	The students will be able to understand about eco-friendly farming systems. Appreciate the importance of organic manure and bio fertilizers
CO3	The students will have knowledge about organic nutrient sources and green manures. Produce vermi compost, farmyard manure from bio waste
CO4	The students will be able to know about nutrient management in organic farming. Acquire skill on isolation and maintenance of bio fertilizers.
CO5	The students will have knowledge of multiple cropping.

Course with focus on employability / entrepreneurship / Skill Development modules

<p>Skill Development</p>	<p>Nutrient management in organic farming. Choice of crops and varieties in organic farming – crop rotations – need and benefits Organic farming – definition – need – scope – principles – characteristics relevance to modern agriculture</p>	<p>Employability</p>	<p>Different eco-friendly farming systems- biological farming, natural farming, regenerative agriculture – permaculture - biodynamic farming</p>	<p>Entrepreneurship</p>	<p>Green manures- bio fertilisers – types, methods of application – benefits and limitations. Nutrient use in organic farming- scope and limitations</p>
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Government College (Autonomous) Rajamahendravaram
Department Of Biotechnology
B.Sc. – Biotechnology & Agro Biotechnology ; IIIyr ; Sem - 5 ; Theory
Syllabus.

Title of the Course 6A : “Organic farming” ; Course code : BTL156

UNIT -1-Soil:

Definition, soil formation, composition and characteristics. Types of soils. Acidic, Alkaline and heavy metal contaminated soil. Effects of chemical dependent farming on yield and soil health.

UNIT-2 -Plant Nutrition

Macro and micro nutrients, functions of nutrients in plant growth and development. Nutrient uptake and utilization by plant. Types of fertilizers. Organic, inorganic and bio fertilizers. Chemical fertilizer- Advantages & disadvantages of their use. Importance of organic and bio fertilizers.

UNIT -3 -Organic Farming

Definition, concept, benefits. Integrated farming system (combination of organic and inorganic).Mixed farming system. Concept of different cropping systems in relation to organic farming, Inter cropping, crop rotation. Integrated Pest and Disease Management under Organic Farming

UNIT- 4 –Organic compost

Definition, types of compost, farm yard compost, green leaf compost.

Vermi compost: Introduction, vermi composting material, species of earthworms, small scale, large scale composting process. Vermi castings, harvesting, processing and drying. Nutrient content of vermi compost.

UNIT –5-Biofertilizers

Introduction, status and scope. Structure and characteristic features of bacterial bio fertilizers- Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium and Frankia. Cyanobacterial biofertilizers- Anabaena, Nostoc, Hapalosiph on and fungal biofertilizers- VAM mycorrhiza and ectomycorrhiza.

Unit No:	Additional input:	Deletion	Justification
1	Nutrient use in organic farming-scope and limitations		
2	Organic nutrient sources and their fortification – organic manures		
3	Small scale, large scale composting process		
4	Mechanism of nitrogen fixation and phosphorus solubilization.		
5	Nutrient management in organic farming		

unit no:	Co Curricular activity
1	Field work
2	Group Discussion
3	Seminar, Extension work
4	Extension work
5	Guest Lecture

Reference books:

1. Arun K. Sharma. 2002. A Hand book of organic farming. Agrobios, India.627p.
2. Palaniappan, S.P and Annadurai, K.1999. Organic farming-Theory and Practice.Scientific publishers, Jodhpur, India. 257p.
3. Mukund Joshi and PrabhakarasettyT.K. 2006. Sustainability through organic farming. Kalyani publishers, New Delhi. 349p.
4. Balasubramanian, R., Balakishnan, K and Siva Subramanian, K. 2013.
5. Principles and practices of organic farming. Satish Serial Publishing House. 453p

Weblinks


1. <https://science.umd.edu/classroom/bsci124/lec41.html>
2. <https://www.encyclopedia.com/food/encyclopedias-almanacs-transcripts-and-maps/crop>

3. <https://academic.oup.com/jxb/article/51/342/1/485700>

CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS O1	PS O2	PS O3
CO1	3	2	1	2	2	2	1	1	1	4	3	2	1
CO2	3	2	1	2	2	2	1	1	1	4	3	2	1
CO3	3	3	2	2	2	2	1	1	1	4	3	2	1
CO4	3	3	1	2	3	1	1	2	1	4	3	2	1
CO5	3	3	1	3	3	2	1	1	2	1	3	2	1

	Government College (Autonomous) Rajahmundry Department Of Biotechnology	
	Subject : AgroBiotechnology & Biotechnology	Program : AgroBBC & BBC
B.Sc.-IIIyr Semester-5 Paper- 6A	Title of Course “ Organic farming ” Course Code :BTL156 Semester End Exam (2023-24)	
Time : 2 1/2 Hrs	Blue Print of Question Paper	Marks : 50

Part-A

Essay questions: answer any THREE

3 X 10M = 30M

Each answer carries TEN marks.

Question1 from Unit I

Question2from Unit II

Question3 from Unit III

Question4 from Unit IV

Question5 from Unit V

Part-B

Short answer questions : answer all the 5

5 X 4 M = 20 M

Each answer carries FOUR marks.


Question6 :from UnitI

Question7:from UnitII

Question8:from UnitIII

Question9:from Unit IV

Question10 :from Unit V

	Government College (Autonomous) Rajahmundry Department Of Biotechnology	
	Subject :AgroBiotechnology & Biotechnology	Program:AgroBBC & BBC
B.Sc.-IIIyr Semester-5 Paper- 6A	Title of Course “ Organic farming ” Course Code : BTL156 Semester End Exam (2023-24)	
Time : 2 1/2 Hrs	Model Question Paper	Marks : 50

Part – A

Essay questions:

answer any 3

3X 10 M = 30 M

1. Write about effects of chemical farming on yield and soil health. (I)
2. Write an essay on types of fertilizers.(II)
3. Write about integrated farming system.(III)
4. Write an essay on vermicomposting. (IV)
5. Write the benefits and limitations of using biofertilizers.(IV)


Part- B

Short Answer , questions

Answer ALL 5 questions

5 x 4M = 20 M

6. Types of soils
7. Importance of organic and biofertilizers
8. Crop rotation
9. Green manures
10. Nutrient management in organic farming.

	Government College (Autonomous) Rajahmundry Department Of Biotechnology						
Practical Syllabus Paper-6A	Subject : AgroBiotechnology & Biotechnology			Stream : B.Sc.			
	Title of Course “ Organic farming ”-Lab			Program : AgroBBC & BBC			
	Course Code: BTL156P			Year-III Semester : 5			
	Total Hours – 30hrs ; Per Week -2hrs			L Lect ures	T Tuto rial	P Practical	C Credits
Pre-requisites:	Basic knowledge about organic farming technique.			0	0	2	1

Objectives:

1. 1.The students should be able to understand the principle behind the estimations.
2. 2.The students should be able to understand the concept behind the general soil tests

List of experiments:

- Collection of different soil samples
- Qualitative estimation of nitrogen, phosphorus and potassium in soil samples
- Collection of fruit, vegetable and other domestic waste
- Preparation of compost beds and introducing earthworms
- Collection of vermin castings
- Sieving, drying and packing of vermin compost
- Visit to animal shed and observing farm yard manure production
- Preparation of media and isolation of bio fertilizers.
- Visit to organic farm to study the various components, identification and Utilization of organic products.
- Compost making- aerobic and anaerobic methods
- Vermi compost preparation
- Preparation of enriched farm yard manure

- Visit to organic clusters and bio control lab to study the maintenance of Bio fertilizers/bio-inoculant cultures
- Biological nitrogen fixers.
- Methods of application of Bio-pesticides (Trichocards, BT, NPV)
- Preparation of neem products and other botanicals for pest and disease Control
- Preparation of green pesticides (panchagavya, beezamrutam, jeevamrutam, ghanajeevamrutam, dravajeevamrutam).
- Different methods of bio fertiliser applications.

Reference books:

- Principles of Organic Farming:: by E Somasundaram,D Udhaya Nandhini,M Meyyappan ;2021
1. Organic farming in India:: by Arpita Mukherjee; 2017
 2. Biofertilizer and biocontrol agents for agriculture;; by AM Pirttilä · 2021
 3. Trends in Organic Farming in India;; by S. S. Purohit, 2006
 4. Biofertilizers for Sustainable Agriculture and Environment;; by Bhoopander Giri Ram Prasad, Qiang-Sheng Wu, Ajit Varma; 2019

Virtual LabLinks

Co-curricular activities:

a. **Mandatory:**(Training of students by teacher on field related skills;15hrs)

1. **For teacher;** Training of students by teacher in laboratory and field for a total of 15hrs on soil sample collection, NPK analysis, collection of biodegradable waste, vermi composting, collection of castings, processing, drying& packing. In addition teacher should demonstrate the media preparation, sterilization, and isolation of microorganisms from soil.
2. **For students:** Visit to local organic farm, collection of earthworms, observing the crop growth raised in organic farms. Submission of field work report of 10 pages in the prescribed format.
3. Maximum marks for field work report:05
4. Suggested format for field work report: Title page, student details, content page, introduction, work done, findings, conclusion and acknowledgements.
5. Unit test (IE)

b. Suggested co-curricular activities:

1. Comparing mineral content in different agricultural soil
2. Learning techniques of basic instruments handling related to field work
3. Preparation of videos on compost preparation and application
4. Visit to local organic fields

Attending special lectures, group discussions and seminars on organic farming.



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Subject : AgroBiotechnology & Biotechnology

**Program : AgroBBC &
BBC**

**B.Sc.-III yr
Sem-5
Paper- 6A**

**Title of Course
“ Organic Farming - Lab ”
Course code: BTL156P
Semester End Exam (2023-24)**


Time : 3Hrs

Practical - Model Question Paper

Credits : 1

Marks : 50

1. Major experiment. Estimate the pH of soil in given sample 'A'	15M
2. Minor experiment. Estimate the nitrogen content in given soil sample 'B'	10 M
3. Identify the given spotters and write a brief note on it	15 M
➤ Identify different earth worm species/photograph	
➤ Sieving and processing of vermi compost –photograph	
➤ VAM identification	
➤ Farm yard manure	
➤ Scientific observation and data analysis	
4. Record	05 M
5. Viva-voce	05 M
Total	50M

		Government College (Autonomous) Rajahmundry Department Of Biotechnology				
Theory Paper - 7A	Subject : AgroBiotechnology & Biotechnology	Stream : B.Sc .				
	Title of the Course Bio fertilizers and Bio pesticides production Course Code: BTL205	Program : AgroBBC & BBC Year -III Semester : 5				
	Total Hours Allocated - 60 ; Per Week -4 hrs	L Lect ure	T Tutori al	P Pract ical	C Credits	
Pre-requisites:	Knowledge about nutrient content in various biological wastes. Knowledge about natural insect repellent plants, trees or their extracts		4	1	-	4

Course Objectives:

- To be able to understand the importance of bio fertilizers for sustainable agricultural practices .
- To Appreciate the role of VAM in solubilization
- To Define bio pesticide and its nature
- To Produce bio fertilizers and bio pesticides on large scale
- To be Able to prepare inoculums for field application

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	The pupil will understand the harms caused by chemical fertilizers and usefulness of Biofertilizers
CO2	The pupil will know in detail about naturally available low cost non harmful biofertilizers .
CO3	The pupil will understand the harms caused by chemical pesticides s and usefulness of Biopesticides.
CO4	The pupil will understand the methods of producing the biofertilizers and biopesticides in large scale in an economical way
CO5	The pupil will understand the methods of applying the biofertilizers and biopesticides to the agricultural field to get maximum yield which devoid of harmful chemicals

Course with focus on employability / entrepreneurship / Skill Development modules

<p>Skill Development</p>	<p>Measurement of water pollution, sources of water pollution. Microbiology of waste water treatment, aerobic processes, activated sludge, oxidation ponds, trickling filters, and rotating biological contactors. Anaerobic processes: Anaerobic digesters, upward flow anaerobic sludge blanket reactors.</p> <p>microbial groups involved in biogas production & interactions, factors affecting biogas production,</p> <p>Industrially important microbes, its screening, selection and identification</p>	<p>Employability</p>	<p>air pollution & its control through Biotechnology, Biofilters, Bioscrubbers, Biotrickling filter. Bioremediation of Hydrocarbons and its applications Degradation of pesticides and other toxic chemicals by microorganism</p> <p>Maintenance and preservation of industrially important microbial cultures.</p> <p>Microbial production of Organic acids (Lactic acid, citric acid), Amino acids (Glutamic acid, Aspartic acid and Lysine).</p>	<p>Entrepreneurship</p>	<p>Role of genetically Engineered microbes, Concept of Phytoremediation, environmental safety guidelines</p> <p>Biofertilizers, Vermiculture.</p> <p>Strain Improvement, Basic concepts of fermentation; Design of fermenter and applications.</p> <p>dairy products (Cheese, Yogurt), beverages (Beer, Wine) and antibiotics (Streptomycin, Pencillin)</p>
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Government College (Autonomous) Rajahmahendravaram
Department Of Biotechnology

B.Sc. – Biotechnology & Aro Biotechnology ; IIIyr ; Sem - 5 ; Theory Syllabus.

Title of the Course 7A : “Biofertilizers and Biopesticides” ; Course code

Unit -1 : Biofertilizers:-

Classification, microorganisms used as bio fertilizers. Bacterial, fungal and algal bio fertilizers. Symbiotic and a symbiotic microorganisms. Mechanism of nodulation and nitrogen fixation.

Unit - 2 : Mycorrhizal biofertilizers : -

Importance, types, characteristic features of ecto and endomycorrhiza. Mechanism of phosphorus solubilization. Uptake of phosphates by the roots..

Unit - 3 : Bio pesticides : -

Definition, Classification - botanicals, bacterial, fungal and viral based biopesticides. Mechanism of action of *Bacillus thuringiensis* and *Trichoderma viridiae* bio control agents.

Unit - 4 : Mass production techniques:-

, purification and identification of microorganisms used as bio fertilizers and bio pesticides. Mass production and packing techniques.

Unit – 5 : Field application methods:-

Preparation of carrier based inoculum. Sphagnum, peat, vermiculite as inoculums carriers. Dosage standardisation. Seed treatment, foliar application, root dressing and soil application techniques.

Additional Input and Assignment			
UNIT NO:	Additional Input	Deletion	Justification
1	History, concept, scope of bio fertilizers in India		
2	Consortium based inoculums and significance		
3	Concept, history, scope and importance of biopesticides		
4	Media, types, preparation. Methods of isolation, streak plate, spread plate and pour plate techniques		
5	Storage and maintenance of inoculum		

unit no:	Co Curricular activity
1	Seminar, Working Models
2	Group Discussion
3	Seminar & Guest lecture
4	Project work
5	Field work

References:

1. Biofertilizers: Commercial Production Technology and Quality Control, 2017 by Dr. P.Hyma
2. Biofertilizers Technology, 2010, by S.Kaniyan, K.Kumar and K. Govindarajan
3. Biofertilizers for Sustainable Agriculture, 2017; by Arun KSharma
4. Advances In Plant Biopesticides 2021, by Dwijendra Singh, SpringerIndia
5. A Textbook of Integrated Pest Management, 2013 by Ram Singh & Vikas Jindal G.S.Dhaliwal

Cocurricular activities:

a) **Mandatory:** (Training of students by teacher on field related skills:15hrs)

1. **For teacher:** Training of students by teacher on preparation of different microbial media, isolation techniques – streak plate , spread plate, pour plate, Grams staining of bacteria , VAM and Trichoderma observation. Preparation of Rhizobium inoculum and application to legume seedlings.
2. **For students:** Raising of seedlings of Leguminaceae species, maintaining of the seedlings in nursery/green house. Comparing the growth of seedlings treated with biofertilizer and chemical fertilizer. Visit to Bio

fertilizer and Bio pesticides commercial lab. Submission of field work report of 10 pages in the prescribed format.

3. Maximum marks for field work report: 05
4. Suggested format for field work book; Title page, student details, content page, introduction, work done, findings, conclusion and acknowledgements.
5. Unit test (IE).

b) Suggested co-curricular activities;


1. Training of students by the industrial experts
2. Identification and collection of botanical pesticides
3. Assignments/seminars/group discussion /quiz on bio fertilizers and biopesticides
4. Preparation of videos, charts on inoculum development and field application
5. Attending invited guest lectures on the concerned topics

WebLinks:

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-': No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS O1	PS O2	PS O3
CO1	3	2	1	2	2	2	1	1	1	4	3	2	1
CO2	3	2	1	2	2	2	1	1	1	4	3	2	1
CO3	3	3	2	2	2	2	1	1	1	4	3	2	1
CO4	3	3	1	2	3	1	1	2	1	4	3	2	1
CO5	3	3	1	3	3	2	1	1	2	1	3	2	1

	Government College (Autonomous) Rajahmundry Department Of Biotechnology	
	Subject :AgroBiotechnology& Biotechnology	Program :AgroBBC & BBC
B.Sc.-Ilyr Semester-5 Paper-7A	Title of Course “ Bio fertilizers and Bio pesticides production” Course Code :BTL205 Semester End Exam (2023-24)	
Time : 2 1/2 Hrs	Blue Print of Question Paper	Marks : 50

Part–A

Essay questions: answer any THREE

3 X 10M = 30M

Each answer carries TEN marks.

Question1 from Unit I

Question2from Unit II

Question3 from Unit III

Question4 from Unit IV

Question5 from Unit V

Part-B

Short answer questions : answer all the 5

5 X 4 M = 20 M

Each answer carries FOUR marks.


Question6 :from UnitI

Question7:from UnitII

Question8:from UnitIII

Question9:from Unit IV

Question10 :from Unit V

	Government College (Autonomous) Rajahmundry Department Of Biotechnology	
	Subject : AgroBiotechnology & Biotechnology	Program : AgroBBC & BBC
B.Sc.-IIyr Semester-5 Paper- 7A	Title of Course “ Bio fertilizers and Bio pesticides production ” Course Code : BTL205 Semester End Exam (2023-24)	
Time : 2 1/2 Hrs	Model Question Paper	Marks : 50

Part – A

I. Essay questions : answer any 3 : 3 X 10M = 30 M

1. Write about scope and importance of biofertilizers(I)
2. Write about importance and characteristic features of ecto and endomycorrhiza(II)
3. Write about mechanism of action of *Bacillus thuringiensis* and *Trichoderma viridiae* as biocontrol agents (III)
4. Discuss in detail about mass production and packing techniques(IV)
5. Write about different field application techniques(V)

Part-B

II. Short answer questions : Answer all FIVE Questions 5 X 4M = 20 M

6. Bacterial biofertilizers-I
7. Micorrhiza-II
8. *Bacillus thuringiensis*-III
9. Microbiological media -IV
10. Storage of inoculum-V



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**


Practical Syllabus Paper-7A	Subject : AgroBiotechnology & Biotechnology	Stream: B.Sc Program : AgroBBC & BBC Year-III Semster : 5			
	Title of Course “ Bio fertilizers and Bio pesticides production ”-Lab Course Code: BTL205 P				
	Total Hours – 30hrs ; Per Week -2hrs	L Lect ures	T Tuto rial	P Practical	C Credits
Pre-requisites:	Handling of pipettes. Preparation of Solutions Handling of analytical instruments.	0	0	2	1

Objectives

- To be able to prepare various media for microbial growth .
- To be able to isolate and grow useful microbes used as biofertilizers.
- To be able to identify microbes in soil .
- To be able to Produce bio fertilizers and bio pesticides on large scale
- To be able to prepare inoculums for field application and test for successful association of inoculum with target roots.

List of Experiments/Syllabus:

1. Preparation of Nutrient agar, YEMA, and PDA media
2. Isolation of *Rhizobium* from root nodules
3. Isolation of *Azotobacter* from soil samples
4. Isolation of *Trichoderma*
5. Gram staining of bacteria
6. VAM root staining
7. Raising of legume seedlings with *Rhizobium* treatment
8. Visit to commercial bio control units and Krishi seva Kendra

	Government College (Autonomous) Rajahmundry Department Of Biotechnology		
	Subject : AgroBiotechnology & Biotechnology		Program : AgroBBC & BBC
B.Sc.-IYr Semester-5 Paper- 7A	Title of Course “ Bio fertilizers and Bio pesticides production ”-Lab Course code: BTL205P Semester End Exam (2023-24)		
Time : 3Hrs	Practical - Model Question Paper	Credits : 1	Marks : 50

Major Experiment :

1. Identify the given microbial sample based on morphological characteristics ‘A’ 15M

Minor Experiment :

2. Identify the given culture based on microscopic Observation ‘B’ 10 M

3. Spotters (Scientific observation and data analysis) 3 x 5 =15M

A. Identify the given algal fertilizer/photograph

B. Identify the fungal bio fertilizer -photograph

C. VAM identification

4. Record 5M

5. Viva-voce 5M

Total = 50M



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Theory Paper - 6B	Subject : AgroBiotechnology & Biotechnology	Stream : B.Sc			
	Title of the Course “ Techniques in Nursery Development ” Course Code: BTL204	Program: AGROBBC & BBC			
		Year -III			
		Semester : 5/6			
	Total Hours Allocated - 60 ; Per Week -4 hrs	L	T	P	C
		Lect ure	Tutori al	Pract ical	Credits
Pre-requisites:	<ul style="list-style-type: none"> ➤ Basic knowledge about planting tress ➤ Basic knowledge about seasonal changes in plants ➤ Natural manures 	4	1	-	4

Course Objectives:

- To enable the pupil to understand the types of nurseries
- To impart the pupil the knowledge of facilities and expertise required to set up nursery
- To impart skills to the pupil to procure employment or to become entrepreneur

Course Outcomes:

On Completion of the course, the students will be able to-

CO1	➤ Understand different types of nurseries
CO2	➤ Identify various facilities required to set up of a nursery
CO3	➤ Understood expertise related to various practices in a nursery
CO4	➤ Acquire skills to get an employment or to become an entrepreneur.
CO5	➤ Latest hands on technique to produce novel plants

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development	Tools, implements and containers. Nursery media. Electricity, equipment and machinery management. Types of nursery beds and their preparations. Precautions and maintenance of nursery beds.	Employability	Selection of seed and different sowing methods. Use of different plant parts for vegetative propagation to raise nursery. Different techniques of vegetative propagation	Entrepreneurship	Definition, objectives and importance. Basic requirements for a nursery layout and components of a good nursery. Types of nurseries. Bureau of Indian standards (BIS - 2008) related to nursery
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Syllabus: Techniques in Nursery Development

UNIT -1: Introduction to Nursery

Definition, objectives and importance. Basic requirements for a nursery layout and components of a good nursery. Types of nurseries. Bureau of Indian standards (BIS - 2008) related to nursery.

UNIT-2: Nursery inputs

Tools, implements and containers. Nursery media. Electricity, equipment and machinery management. Types of nursery beds and their preparations..

UNIT -3: Seeds and Propagules

Selection of seed and different sowing methods. Use of different plant parts for vegetative propagation to raise nursery.

UNIT- 4: Management Practices

Routine seasonal operations in a nursery. Supply of water, nutrients and removal of weeds., control and prevention methods of pests and diseases.

UNIT – 5: Grafting techniques

Introduction to grafting, definition, types and tools for grafting. Steps involved in simple, splice graft, tongue graft, Whip graft, cleft graft and wedge graft. Grafting of horticultural & floricultural crops

Additional Input : Table shown below.

	Additional input:	Deletion	Justification
1	Information on local Nurseries .		
2	Precautions and maintenance of nursery beds		

3	Different techniques of vegetative propagation.		
4	Identification of pests and diseases		
5	Applications.of grafting		

unit no:	Co Curricular activity
1	Field work
2	Seminar, Guest lecture
3	Group Discussion
4	Extension work
5	Project work

Recommended Books:

1. Ratha Krishnan, M., *et al.* (2014) Plant Nursery
2. Management: Principles and Practices, Central Arid Zone Research Institute ICMR, Jodhpur, Rajasthan.
3. Vikas Kumar, Anjali Tiwari, Practical manual of Nursery management, Agri – biotech Press, New Delhi.
4. Tarai Ranjan Kumar, (2020) Plant propagation and nursery management, New India Publishers.
5. P.K.Ray, (2020) Essentials of plant nursery management.
6. P.K.Ray, (2012) How to start and operate a Plant Nursery.

WebLinks:

CO-PO Mapping:


(1:Slight[Low];

2:Moderate[Medium];

3:Substantial[High],

'-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS O1	PS O2	PS O3
CO1	3	2	1	2	2	2	1	1	1	4	3	2	1
CO2	3	2	1	2	2	2	1	1	1	4	3	2	1
CO3	3	3	2	2	2	2	1	1	1	4	3	2	1
CO4	3	3	1	2	3	1	1	2	1	4	3	2	1
CO5	3	3	1	3	3	2	1	1	2	1	3	2	1

	Government College (Autonomous) Rajahmundry Department Of Biotechnology	
	Subject : AgroBiotechnology & Biotechnology	Program : AGROBBC & BBC
B.Sc.-IYr Semester-5/6 Paper- 6B	Title of Course “ Techniques in Nursery Development ” Course Code :BTL204 Semester End Exam (2023-24)	
Time : 2 1/2 Hrs	Blue Print of Question Paper	Marks : 50

Part-A

Essay questions: answer any THREE

3 X 10M = 30M

Each answer carries TEN marks.

Question1 from Unit I

Question2from Unit II

Question3 from Unit III

Question4 from Unit IV

Question5 from Unit V

Part-B

Short answer questions : answer all the 5

5 X 4 M = 20 M

Each answer carries FOUR marks.


Question6 :from UnitI

Question7:from UnitII

Question8:from UnitIII

Question9:from Unit IV

Question10 :from Unit V

	Government College (Autonomous) Rajahmundry Department Of Biotechnology	
	Subject : AgroBiotechnology & Biotechnology	Program:AGRO BBC
B.Sc.-IIIyr Semester-5/6 Paper- 6B	Title of Course “ Techniques in Nursery Development ” Course Code : BTL204 Semester End Exam (2023-24)	
Time : 2 1/2 Hrs	Model Question Paper	Marks : 50

Part – A

Answer any 4 of the following essay questions

3 X 10= 30M

Note: Draw Diagrams wherever necessary for both essay and short answers

1. Write about basic requirements for a nursery lay out and components of a good nursery. (I)
2. Write about precautions and maintenance of nursery beds. (II)
3. Write about different techniques of vegetative propagation . (III)
4. Write about routine seasonal operations in a nursery. (IV)
5. Write about grafting of horticultural and floricultural crops and various applications. (V)

Part-B

Answer All the five of the following short answer questions

4x 5 = 20M

- 6..Importance of nursery
- 7.Nursery media
- 8.Selection of seeds for nursery
- 9.Prevention of pests
- 10.Grafting



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Practical Syllabus Paper-6B	Subject : AgroBiotechnology & Biotechnology	Stream : B.Sc			
	Title of Course “ Techniques in Nursery Development ”-Lab Course Code: BTL204 P	Program : AGROBBC & BBC Year-III Semester : 5/6			
	Total Hours – 30hrs ; Per Week -2hrs	L Lectures	T Tutorial	P Practical	C Credits
Pre-requisites:	Handling of pipettes. Preparation of Solutions Handling of analytical instruments.	0	0	2	1

Title of Course

“ Techniques in Nursery Development ”-Lab ; Course Code: BTL204 P

Objectives:

- 1.The students should be able to understand the principle behind the estimations.
- 2.The students should be able to understand the concept behind the general tests

List of Experiments/Syllabus:

1. Demonstration of different types of nurseries
2. Handling of nursery tools, equipment and types of containers
3. Laying of nursery bed with soil and Seed collection, treatment and rising of seedlings on nursery bed
4. Handling of grafting and layering techniques in the nursery
5. Watering, weeding and management of nursery
6. Maintaining of the seedlings / cuttings in the nursery

Reference books:

Virtual Lab Links:



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Subject : AgroBiotechnology & Biotechnology

**Program
:AGROBBC& BBC**

**B.Sc.-III yr
Semester-5/6
Paper- 6B**

**Title of Course
“ Techniques in Nursery Development ”-Lab
Course code: BTL204 P
Semester End Exam (2023-24)**

Time : 3Hrs

Practical - Model Question Paper

Credits : 1 Marks : 50

- | | |
|---|------|
| 1. Major experiment. | 15 M |
| 2. Minor experiment. | 10 M |
| 3. Identify the given spotter and a brief note Unit | 15 M |
| 4. Record | 05M |
| 5. Viva-voce | 05M |

Total 50 M

5. Viva- voce 5M

50M



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Theory Paper - 7B	Subject : AgroBiotechnology & Biotechnology	Stream : B.Sc			
	Title of the Course “ Hydroponics cultivation ”	Program : AGROBBC & BBC			
	Course Code: BTL203	Year -III			
	Semester : 5/6				
	Total Hours Allocated - 60 ; Per Week -4 hrs	L	T	P	C
		Lecture	Tutorial	Practical	Credits
Pre-requisites:	➤ Basic knowledge of plant nutrients and gardening	4	1	-	4

Course Objectives:

- List out macronutrients, micronutrients- functions and effect on plants, deficiency symptoms.
- Demonstrate the importance of temperature and light in hydroponics
- Develop skill of media production for Hydroponics cultivation
- Equip with the skill of weed management, diseases and pest management

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	➤ Understand the concept of hydroponics
CO2	➤ Acquire the knowledge on soilless cultivation system
CO3	➤ Prepare media for hydroponics cultivation
CO4	➤ Learn the hydroponic cultivation technique
CO5	➤ Novel methods of watering plants

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development	Applications & future developments	Employability	Selection of fertilizers, media used for hydroponics	Entrepreneurship	continuous-flow solution culture and aeroponics.
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Syllabus:

UNIT -1 - Introduction to Soilless culture

Definition, History and origin of soilless culture, Present status of hydroponics-contrasts with soil based culture,.

UNIT-2- Macronutrients, micronutrients

Functions and effect on plants, deficiency symptoms of the following essential minerals N, P, Mg, Ca, K, S, Fe, Mn, Cu, Zn, B, Mo, Physical factors, light (Quantity, energy, photoperiodism*etc*), Temperature (Heating and cooling), Humidity, CO₂, ppm,.

UNIT –3 -Cultural conditions

Plant nutrition. Inorganic salts (fertilizers) major and minor nutrients formulating, monitoring and analysing. Selection of fertilizers, media used for hydroponics-expanded clay, rock wool, coir, perlite, pumice, vermiculite, sand gravel *etc.*, diseases and pest control.

UNIT- 4 - Techniques in hydroponics

Static solution culture, continuous-flow solution culture and aeroponics. Hydroponics Vs Aeroponics

UNIT –5 - Cultivation of crop hyhydroponics

Passive sub-irrigation, Ebb and flow or flood and chain irrigation. Deep water culture protocols for –Tomato cultivation through Dutch bucket method, chilly cultivation through NFT system, Spinach through raft System .

	Additional input:	Deletion	Justification
1	Soilless culture Applications & future developments		
2	pH and TDS Functions and effect on plants		
3	Weed management		
4	Hydroponics Vs Aeroponics		
5	measurements of yield.		

unit no:	Co Curricular activity
1	Debate
2	Role play & Group Discussion
3	Field work
4	Project work
5	3D Models

References


1. Keith Roberto, *How to Hydroponics*. The future Garden Press New York. 4th Edition
2. Howard M. Resh. *Hobby Hydroponics*. CRC Press, USA.
3. Prasad S and Kumar U. *Green House management for Horticultural crops*. Agro-Bios India.
4. Dahama A.K. *Organic Farming for Sustainable Agriculture*. Agrobios, India
5. SubbaRao N.S. (1995). *Biofertilizers in Agriculture and Forestry*. Oxford and IBH Publishing Company. Pvt. Ltd New Delhi

WebLinks:

CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], 4: (No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS O1	PS O2	PS O3
CO1	3	2	1	2	2	2	1	1	1	4	3	2	1
CO2	3	2	1	2	2	2	1	1	1	4	3	2	1
CO3	3	3	2	2	2	2	1	1	1	4	3	2	1
CO4	3	3	1	2	3	1	1	2	1	4	3	2	1
CO5	3	3	1	3	3	2	1	1	2	1	3	2	1

	Government College (Autonomous) Rajahmundry Department Of Biotechnology	
	Subject : AgroBiotechnology & Biotechnology	
	Program : AGROBBC & BBC	
B.Sc.-IIIyr Semester-5/6 Paper- 7B	Title of Course “ Hydroponics cultivation ” Course Code: BTL203 Semester End Exam (2023-24)	
Time : 2 1/2 Hrs	Blue Print of Question Paper	Marks : 50

Part-A

Essay questions: answer any THREE

3 X 10M = 30M

Each answer carries TEN marks.

Question1 from Unit I

Question2 from Unit II

Question3 from Unit III

Question4 from Unit IV

Question5 from Unit V

Part-B

Short answer questions : answer all the 5

5 X 4 M = 20 M

Each answer carries FOUR marks.


Question6 :from UnitI

Question7:from UnitII

Question8:from UnitIII

Question9:from Unit IV

Question10 :from Unit V

	Government College (Autonomous) Rajahmundry Department Of Biotechnology	
	Subject : AgroBiotechnology & Biotechnology	Stream : AGROBBC & BBC
B.Sc.-II yr Semester-5/6 Paper- 7B	Title of Course “ Hydroponics cultivation ” Course Code: BTL203 Semester End Exam (2023-24)	
Time : 2 1/2 Hrs	Model Question Paper	Marks : 50

Part – A

I. Essay questions: answer any 3 : 3 X 10 M= 30 M

1. Write about History and origin of soilless culture (I)
2. Write about functions, effects and deficiency symptoms of the essential minerals in plants.(II)
3. Write about selection of fertilizers, media used for hydroponics.(III)
4. Write about different techniques used in hydroponics.(IV)
5. Write about various irrigation techniques implemented in hydroponics.(V)

Part-B

II. Short answer questions : Answer all 5 Questions 5 X 4 = 20 M

6. Write about soil based (I)
7. Write about functions of macronutrients in plants(II)
8. Static solution culture(IV)
9. Disease and pest control(III)
10. Deep water culture protocols for tomato cultivation(V)



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Practical Syllabus Paper-7B	Subject : AgroBiotechnology & Biotechnology	Stream : B.Sc			
	Title of Course “ Hydroponics cultivation ” Course Code: BTL203P	Program : AGROBBC & BBC Year-III Semester : 5/6			
	Total Hours – 30hrs ; Per Week -2hrs	L Lect ures	T Tuto rial	P Practical	C Credits
Pre-requisites:	Handling of pipettes. Preparation of Solutions Handling of analytical instruments.	0	0	2	1

Objectives:


1. The students should be able to understand the principle behind the estimations.
2. The students should be able to understand the concept behind the general tests

List of experiments:

- Handling of tools required for hydroponic setup
- Preparation of macronutrients and micronutrients solutions/stockcultures
- Preparation of different media for hydroponicsystem.
- Evaluating the effect of bio fertilizers on hydroponiccultivation
- Weeding management techniques -demonstration
- Demonstration of pests and diseases control and preventionmethods
- Cultivation of tomato by hydroponicsystem
- Cultivation of chilli through hydroponiccultivation.

Referencebooks:

Virtual LabLinks:

	Government College (Autonomous) Rajahmundry Department Of Biotechnology		
	Subject : AgroBiotechnology & Biotechnology		Group : AGROBBC & BBC
B.Sc.-IIIyr Semester-5/6 Paper- 7B	Title of Course “ Hydroponics cultivation ” Course Code: BTL203 Semester End Exam (2023-24)		
Time : 3Hrs	Practical - Model Question Paper		Credits : 1 Marks : 50

1. Major experiment.	15 M
2. Minor experiment.	10 M
3. Identify the given spotter (3x5M)	15 M
3. Record	05 M
4. Viva-voce	05 M

	Total 50



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Theory Paper - 6C	Subject : Agro Biotechnology & Biotechnology	Stream : B.Sc			
	Title of the Course “ Crop Improvement Technology ” Course Code: BTL148	Program: AGROBBC & BBC Year -III Semester : 5			
	Total Hours Allocated - 60 ; Per Week -4 hrs	L Lect ure	T Tutori al	P Pract ical	C Credits
Pre-requisites:	<ul style="list-style-type: none"> ➤ Traditional Crop Improvement Techniques. ➤ Basic Plant Tissue Culture Techniques 	4	1	-	4

Course Objectives:

- This course aims to teach plant tissue culture.
- This course gives idea about transgenic plants.

On Completion of the course, the students will be able to-	
CO1	The students will gain knowledge of plant tissue culture.
CO2	The students will be able to understand the micropropagation technique which is useful in commercial purpose.
CO3	The students will have knowledge of recombinant technology in plants.
CO4	The students will understand the concept of transgenic plants
CO5	The students will understand how transgenic plants are used in crop improvement.

Course with focus on employability / entrepreneurship / Skill Development modules

<p>Skill Development</p>	<p>Introduction to plant tissue culture – History – Scientists – Terminology , Steps in general tissue culture Lab Organisation – Types of sterilization and nutrient media – Types of cultures – Organ cultures, cell suspension culture, callus culture, pollen culture and their application Micro propagation Procedure techniques Types of sterilization and nutrient media</p>	<p>Employability</p>	<p>Recombinant DNA methods - Introduction to genetic engineering –Definitions – Gene cloning - Vectors. Gene transfer methods – Indirect methods (Agrobacterium) and direct methods (particle bombardment/gen e gun method; chemical-PEG mediated and other methods) with case studies / examples.</p>	<p>Entrepreneurship</p>	<p>Protoplast isolation and fusion – Somatic hybridization –Cybrids – Soma clonal variations and applications in crop improvement –Cryo preservation RFLP, RAPD and SSR Marker assisted selection for crop improvement</p>
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Title of the Course

**“ Crop Improvement Technology ”
Course Code: BTL148**

Syllabus

Unit I:

Introduction to plant tissue culture — Terminology, Steps in general tissue culture Lab Organisation – Types of sterilization and nutrient media – Types of cultures – Organ cultures, cell suspension culture, callus culture, pollen culture and their application

Unit II:

Micro propagation – Procedure techniques – Organogenesis and Embryogenesis – Problems – Advantages – Limitations - Applications of Micro propagation. Anther culture – embryo culture – Ovule culture – Somatic embryogenesis - .

Unit III:

Protoplast isolation and fusion – Somatic hybridization – Cybrids – Soma clonal variations and applications in crop improvement –

Unit IV:

Recombinant DNA methods - Introduction to genetic engineering – Definitions – Gene cloning - Vectors. Gene transfer methods – Indirect methods (Agrobacterium) and direct methods (particle bombardment/gene gun method; chemical-PEG mediated and other methods) with case studies / examples.

Unit V:

Transgenic plants – Present status - Applications in crop improvement – Limitations – biotechnology regulations. Markers - Morphological, biochemical and molecular markers – RFLP, RAPD and SSR

	Additional input:	Deletion	Justification
1	History – Scientists of plant tissue culture		
2	Synthetic seeds and its applications		
3	Cryo preservation		
4	Ti Plasmid		
5	Marker assisted selection for crop improvement.		

unit no:	Co Curricular activity
1	Field work
2	Seminar
3	Project work
4	3D Models
5	Debate

References:


1. Plant tissue culture by Bhojwani and M.K.Rajdan
2. Elements of Biotechnology by P.K.Gupta
3. Biotechnology by V.Kumaresan
4. Plant Biotechnology by H.S.Chawla
5. Biotechnology by U.Satyanarayana

WebLinks:

1. <https://science.umd.edu/classroom/bsci124/lec41.html>
2. <https://academic.oup.com/jxb/article/51/342/1/485700>

CO-PO Mapping:**(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-' :No Correlation)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS O1	PS O2	PS O3
CO1	3	2	1	2	2	2	1	1	1	4	3	2	1
CO2	3	2	1	2	2	2	1	1	1	4	3	2	1
CO3	3	3	2	2	2	2	1	1	1	4	3	2	1
CO4	3	3	1	2	3	1	1	2	1	4	3	2	1
CO5	3	3	1	3	3	2	1	1	2	1	3	2	1

	Government College (Autonomous) Rajahmundry Department Of Biotechnology	
	Subject : AgroBiotechnology & Biotechnology	Program : AGROBBC & BBC
B.Sc.-IIIyr Semester-5 Paper- 6C	Title of Course “ Crop Improvement Technology ” Course Code :BTL148 Semester End Exam (2023-24)	
Time : 2 1/2 Hrs	Blue Print of Question Paper	Marks : 50

Part–A

Essay questions: answer any THREE

3 X 10M = 30M

Each answer carries TEN marks.

Question1 from Unit I

Question2from Unit II

Question3 from Unit III

Question4 from Unit IV

Question5 from Unit V

Part-B

Short answer questions : answer all the 5

5 X 4 M = 20 M

Each answer carries FOUR marks.

Question6 :from UnitI

Question7:from UnitII

Question8:from UnitIII

Question9:from Unit IV

Question10 :from Unit V



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Subject : AgroBiotechnology & Biotechnology

**Program : AGROBBC &
BBC**

**B.Sc.-IIIyr
Semester-5
Paper- 6C**

Title of Course

“ Crop Improvement Technology ”

Course Code : BTL148

Semester End Exam (20232-24)

Time : 2 1/2 Hrs

Model Question Paper

Marks : 50

Part – A

Answer any THREE essay questions

3 X 10M = 30 M

1. Write an essay on preparation of plant tissue culture media. (I)
2. What is micropropagation. write in detail about somatic embryogenesis and its applications.(II)
3. Write in detail about cybrids.(III)
4. Write about Agrobacterium mediated gene transfer method in plants.(IV)
5. Write an essay on molecular markers used for crop improvement .(V)

Part – B

II. Answer all FIVE of the following questions

5 x 4M = 20M

- 6 . Pollen culture (I)
7. Organogenesis (II)
8. Protoplast .(III)
9. Gene gun method (IV)
10. Molecular markers. (V)



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Practical Syllabus Paper-6C	Subject : AgroBiotechnology & Biotechnology	Stream: B.Sc			
	Title of Course “ Crop Improvement Technology ”-Lab Course Code: BTL148P	Program: AGROBBC & BBC			
	Total Hours – 30hrs ; Per Week -2hrs	L Lect ures	T Tuto rial	P Practical	C Credits
Pre-requisites:	Basic knowledge about crop improvement technology .	0	0	2	1

Objectives:


- To enable the pupil to understand the modern techniques of crop improvement

List of Experiments/Syllabus:

- Preparation of Plant tissue culture medium
- Callus culture
- Regeneration from callus cells
- Cytology of callus
- Suspension culture.
- Isolation of Protoplast
- Anther culture
- Preparation of synthetic seeds

Referencebooks:

Virtual LabLinks:

	Government College (Autonomous) Rajahmundry Department Of Biotechnology		
	Subject : AgroBiotechnology & Biotechnology		Program : AgroBBC & BBC
B.Sc.-IYr Semester-5 Paper- 6C	Title of Course “ Crop Improvement Technology “ - Lab ” Course code: BTL148P Semester End Exam (2023-24)		
Time : 3Hrs	Practical - Model Question Paper	Credits : 1	Marks : 50

- | | |
|---|------|
| 1. Major experiment. | 15 M |
| 2. Minor experiment. | 10 M |
| 3. Identify the given spotters and write a brief note on it | 15M |
| 4. Record | 05 M |
| 5. Viva-voce | 05 M |

Total 50 M



**Government College (Autonomous) Rajahmundry
Department Of Biotechnology**

Theory Paper - 7C	Domain Subject : AgroBiotechnology & Biotechnology	Stream : B.Sc			
	Title of the Course “ Vegetable Science ”	Program : AGROBBC & BBC			
	Course Code: BTL143 (Skill Enhancement Course (Elective), 05 Credits)	Year -III Semester : 5			
	Total Hours Allocated - 60 ; Per Week -4 hrs	L Lecture	T Tutorial	P Practical	C Credits
Pre-requisites:	➤ Basic knowledge of plant nutrients and gardening	4	1	-	4

Course Objectives:

- This course aims to teach complete knowledge about vegetable science.
- This course also teaches about vegetable crops.

On Completion of the course, the students will be able to-

CO1	The students have basic knowledge of Production technology of cool season and warm season vegetable Crops.
CO2	The students will be able to understand about Breeding of vegetable crops
CO3	The students will have knowledge about Growth and Development of vegetable crops.
CO4	The students will be able to know about Seed production
CO5	The students will have knowledge of Methods and practices of storage of vegetables.

Course with focus on employability / entrepreneurship / Skill Development modules

<p>Skill Development</p>	<p>Breeding of vegetable crops breeding methods (introduction, selection, hybridization, mutation), varieties and varietal characterization, biotechnology and their use in breeding in vegetable crops</p>	<p>Employability</p>	<p>Production technology of cool season vegetable Crops seed production of: Tomato, eggplant, hot and Okra, beans</p>	<p>Entrepreneurship</p>	<p>Seedproduction: Seed morphology and development in vegetable seeds; steps in quality seed production; post-harvest, diseases and prevention from infestation, principles of transport</p>
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Title of the Course
“ Vegetable Science ”

Course Code: BTL143

Syllabus:

Unit 1. Production technology of cool season vegetable Crops:

Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods,

Unit 2. Production technology of warm season vegetable crops. Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods. seed production of: Tomato, eggplant, hot and Okra, beans .

Unit 3. Breeding of vegetable crops breeding methods (introduction, selection, hybridization mutation), varieties and varietal characterization, biotechnology and their use in breeding in vegetable crops

Unit 4. Growth and Development : Definition of growth and development, growth analysis and its importance in vegetable production;; Role of auxins, gibberellins, Cytokinin and abscissic acid; Role of light, temperature and photoperiod on growth, development of underground parts, flowering and sex expression in vegetable crops; apical dominance; Physiology of fruit set, fruit development, fruit growth, flower and fruit drop;

Unit 5. Seed production:Seed morphology and development in vegetable seeds; steps in quality seed production; post-harvest, diseases and prevention from infestation, principles of transport

Additional Input : Methods and practices of storage- ventilated, refrigerated, storage, hypobaric storage, pre-cooling and cold storage, zero energy cool chamber; storage disorders

unit no:	Co Curricular activity
1	Seminar
2	Extension work
3	Field work
4	Role Play
5	Project work

Suggested books:

1. Vegetable crops by T.R.GOPALAKRISHNAN

Webinks

1. <https://agrimoon.com/wp-content/uploads/Production-Technology-of-Vegetables.pdf>

2. <https://www.britannica.com/topic/vegetable-farming>

VIRTUAL LAB LINKS

1. <https://onlineagriculture.org/exam-list/asrb-net-vegetable-science>

Government College (Autonomous), Rajamahendravaram

**Department of Biotechnology
III B.Sc., Agro biotechnology &
Biotechnology Semester –V(2023-2024)**

Course title: Vegetable Science - Course code: BTL143

Question Paper Design and Guidelines to Paper setter — 2022-23

Time: 2 ½ hours

Max. Marks: 50

Part – A

I. Essay questions: answer any 3 :

3 X 10 = 40 M

Question 1 from Unit I

- Question 2 from Unit II
- Question 3 from Unit III
- Question 4 from Unit IV
- Question 5 from Unit V
- Question 6 from additional input

Part-B

II. Short answer questions :

4 X 5 = 20 M

- Question 7: from Unit I
- Question 8: from Unit II
- Question 9: from Unit III
- Question 10: from Unit IV
- Question 11: from Unit V

Government College (Autonomous), Rajamahendravaram

**Department of Biotechnology
III B.Sc., Agro biotechnology &
Biotechnology Semester –V 2022-2023)**

Course title: Vegetable Science - Course code: BTL143

Question Paper Design and Guidelines to Paper setter –2022-23

Time: 2 ½ Hours

Max. Marks: 50M

Part – A

Essay question : answer any 3

3 X 10 =30M

1. Write an essay on commercial varieties of warm season vegetable crops.
2. Write in detail about breeding methods of vegetable crops.
3. Write an essay on phytochromes.
4. Write an essay on vegetable seed diseases.
5. Write about methods of seed storage.

Part – B

Answer all 5 questions

4 x 5 = 20 M

6. Planting times of different vegetable
7. Seed production
8. Selection of crop for breeding
9. Apical dominance
10. Steps in quality seed production.

SS



Government College (Autonomous) Rajahmundry

Course Code: BTL143P	SUBJECT : Biotechnology & Agro Biotechnology	Program & Sem 5 III B.Sc. AgroBBC & BBC			
	TITLE OF THE COURSE Vegetable Science				
Teaching	Total Hours Allocated :30(Lab)	L	T	P	C
Pre-requisites:	➤ Basic knowledge about vegetable science			2	2

TITLE OF THE COURSE : Vegetable Science

List of experiments:

1. Seed extraction methods in vegetable crops.
2. Methods of hybrid seed production.
3. Experiment with the plant growth hormone gibberellins.
4. Study of physiological disorders of cole vegetable crops.
5. Observing stages of Somatic Embryogenesis.
6. Collect information about common diseases caused in vegetable plants.
7. Prepare a report on Pre-treatment of plants after postharvest technology.
8. Visit to commercial green house / Poly house.

MODEL QUESTION PAPER FOR SEMESTER END PRACTICAL EXAMINATIONS

TIME: 3 hours

Max. Marks: 50 M

- | | |
|---|------|
| 1. Major experiment. | 15M |
| 2. Minor experiment. | 10 M |
| 3. Identify the given spotters and write a brief note on it | 15 M |
| 4. Record | 05 M |
| 5. Viva-voce | 05 M |

Total: 50M

Government College (Autonomous), Rajamahendravaram
Department of Biotechnology
College Specific : Allocation of Internal component (CIA : SEE as 50:50)

□
Concept document on CIA : SEE as 50:50 (April 2021)

Prologue

The Assessment has been a common practice in educational institutes to evaluate, measure, and document the academic inclination, learning progress, and skill attainment of students through out their learning in the institution by systematically gathering information about their academic performance. Assessment is very important for tracking their academic progress thereby planning further steps and also for reporting and involving parents in policy making and curriculum design. Out of different terminologies used for assessment (such as Measurement, Tests, Examination, Appraisal and Evaluation), Examinations have become an indispensable tool in evaluating both curriculum and student performance as well as the adaptability and core competency of the faculty involved. The examinations involve written exercises, Oral questions or practical tasks, set to test a candidate's knowledge and skill. Evaluation is a broader term that refers to systematic acquisition and assessment of information to provide useful feedback about students through which the students learning abilities and teachers teaching abilities can be assessed. It can also be used to identify and address the students learning needs.

Generally, continuous internal examinations and semester end (external) examinations have been used to evaluate academic performance. More importantly, parents are informed about their wards academic progress and made involved in policy making.

Existing Practice

After conferred with autonomous status by UGC in the year 2000, the Government College (Autonomous), Rajamahendravaram has enhanced the CIA: SEE as 25:75, from 20:80, on par with the affiliating university. During the academic year 2016, the CIA: SEE is further reformed and made 40:60. It is to be noted here that the institution is in the IV cycle of autonomy as well as accreditation.

Further, the autonomy review committee which visited the institution during 2015, for extension of autonomy, orally suggested to have more marks for internal assessment than the SEE. Similarly, the NAAC Peer team in its visit to the institution for III cycle of accreditation during March 2019, has remarked and appreciated the move of institution to go with 50:50 for CIA and SEE. Therefore, the institution is going to implement the 50:50 scheme from the academic year 2019 - 2020. Following is the Standard Operating Procedure for the internal assessment.

Standard Operating Procedure for Continuous Internal Assessment (Internal Marks – 50)

The Internal marks in all the courses/subjects will be awarded based on continuous internal assessment made during the semester concerned. For each Course/subject 50 marks are allotted for internal assessment and 50 marks are allocated for the End Semester Examination.

Continuous Internal Evaluation (CIA):

It has been decided to introduce Continuous Internal assessment marks for a total of **50 marks**, which are to be distributed as follows:

S.No.	Component	Distribution of Marks
1	CIE I (after completion of 50% of syllabus)	20
2	CIE II (Online Exam)	10

3	ATTENDANCE/ EXTENSION SERVICE/NSS / CLEAN AND GREEN	Above95%	5	5
		91%to 95%	4	
		86%to 90%	3	
		81%to 85%	2	
		75%to 80%	1	
		Below75%	0	
Pedagogical Strategies				
4	ASSIGNMENT			5
5	Participation or Paper Presentation in Student Seminars/Workshops/Group Discussions/ Quiz/ Student Study Project/ FieldVisit/Survey			5
6	Viva-voce			5
TOTAL				50

Component I :CIEI& CIEII(20+10 =30Marks)

Two Internal Examinations, out of which one is Mandatorily Online examination,for each Course shall be conducted for assessment. These examinations will be conducted during August/September(CIE –I) and January/February (CIE-II). CIE-I carries 20 marks and CIE-IIcarries10marks. CIE-I will be conducted after completion of 50% of syllabus. These second internal examination, i.e., CIE–II, which is **mandatorily online examination** will cover the entire syllabus and consists of 20multiple choice questions having ½mark for each question. The sum of both the CIEs will be considered for awarding marks for CIA.

1.1.1. Suggestive Question Paper Pattern for CIEI&CIEII (Based on Blooms Taxonomy):

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

Q. No	Learning Objective	Marks
1	Memory based (Remember)	2
2	Understand(Comprehension)	2
3	Application	3
4	Analysis	3
5	Evaluation	5
6	Creativity	5
	TOTAL	20marks

The active verbs used to frame the question based on Blooms Taxonomy is given below for the convenience.

Active verbs developed based on Bloom's Taxonomy

Knowledge	Understand	Apply	Analyze	Evaluate	Create
define	explain	solve	analyze	reframe	design
identify	describe	apply	compare	criticize	compose
describe	interpret	illustrate	classify	evaluate	create
label	paraphrase	modify	contrast	order	plan
list	summarize	use	distinguish	appraise	combine
name	classify	calculate	infer	judge	formulate
state	compare	change	separate	support	invent
match	differentiate	choose	explain	compare	hypothesize
recognize	discuss	demonstrate	select	decide	substitute
select	distinguish	discover	categorize	discriminate	write
examine	extend	experiment	connect	recommend	compile
locate	predict	relate	differentiate	summarize	construct
memorize	associate	show	discriminate	assess	develop
quote	contrast	sketch	divide	choose	generalize
recall	convert	complete	order	convince	integrate
reproduce	demonstrate	construct	point out	defend	modify
tabulate	estimate	dramatize	prioritize	estimate	organize
tell	express	interpret	subdivide	find errors	prepare
copy	Identify	Manipulate	survey	grade	produce
discover	indicate	Paint	advertise	measure	rearrange
duplicate	Infer	Prepare	appraise	predict	rewrite
enumerate	relate	produce	Break down	rank	role-play

IE II will consist of multiple choice questions (MCQs). Number of questions and distribution of marks is at the discretion of the faculty concerned. However, a half an hour exam consisting of 20 MCQs with ½ mark for each question is suggestible in view of the huge number of students. All the HODs should supply a question bank of MCQs of all the courses covering the entire syllabus along with key to the Computer Science department to enable them to conduct the online examination in the designated laboratories. Alternatively, all the HODs may upload the MCQs in the portal throughout their logins.

Further, all the HoDs should submit their schedule of CIE II to IQAC in advance to monitor the systematic conduct of the online examination.

Important Note:

Students who absent themselves from any CIE will lose the marks for the respective test

.However, if a student is not able to write the CIE I / II because of his/her participation in an important event related to NSS/NCC or Games/Sports representing the College/University/health grounds, the student has to get the prior permission of the Principal through the proper channel and submit the same to the Office of the Controller of Examinations. Deadline is 7 days after the CIE. Applications submitted after the deadline will not be considered for the retest.

Component III: Attendance (5 Marks)

Attendance mark will be awarded to the students based on their attendance percentage on a particular course. Faculty of each course has toward the attendance mark based on their subject attendance. The marks split-up is given below

Above 95%	5
91% to 95%	4
86% to 90%	3
81% to 85%	2
75% to 80%	1
Below 75%	0

Component IV: Assignment (5 Marks)

One Assignment for each course must be submitted by a student in each semester. The marks allotted to this component will be awarded based on the performance of the student. The assignment topic may be assigned either individually or group. Assignment should be

submitted by the student in the first half of the semester. Also maximum of 7 days should be given to students to submit the assignment. Assignments should be evaluated by the faculty concerned and the same to be verified by the student. The assignment should be kept in department for the Academic Audit by IQAC and also for external academic audit conducted by office of Commissionerate of Collegiate Education. The marks should be awarded by the faculty.

Component V (Pedagogical Strategies): Participation/Paper Presentation in Student Seminars/Workshops/ Group Discussions/Quiz/Student Study Project/Field Visit/Survey (5 Marks)

For this component, the marks will be provided to student, if he/she participate / win in the external college technical events. To score marks, the student has to participate / present papers related to subject in the technical events organized in the other colleges/other departments in the college.

Name of the event	Participation	Second Prize	First Prize/ Best Paper
Workshop/Seminar/Technical Symposium	2	3	5
National/International Conference	3	4	5

In case of Classroom seminar, one seminar for each course must be presented by a student in each semester. Each student should be given individual topic for seminar, the student has to submit the seminar topic as assignment and the same will be presented minimum of 10 minutes in the class through ICT. The seminar presented by the student should be evaluated by the subject faculty and based on the performance of the presentation, the marks will be awarded. Similarly, reports on field visits, educational tours, and study projects in prescribed form at will be considered for awarding marks in this component.

In case of Quiz, preferably online quiz, it should be conducted after the CIE II and well before the SEE. Faculty concerned has to announce the schedule for the quiz and create the quiz in the ERP (College Management System). The subject staff has to upload all the questions (unit-wise) in the ERP. Quiz should be created with 30 questions (ERP should choose 30 questions randomly out of 100 questions uploaded). Then timing for quiz should be 30 minutes. No negative marking. Each question carries 1 mark. The marks secured should be converted to 10.

Semester End Examinations (SEE)

For all Semesters, the question paper will be of 2 ½ hrs duration for 50 marks. The suggestive question paper model given in section 1.1.1. May be used for framing the question. This kind of question paper will be helpful in CO-PO Mapping and there by graduate attributes.

(Prepared by IQAC & Academic Cell and submitted to the Chairman, IQAC & Principal on April 2019)

Government College (A), Rajamahendravaram



**Certificate course on
“Biophysical and microbiological techniques”
Offered by
Department of Biotechnology
GDC (A) RJY**

Government College (A), Rajamahendravaram
Department of Biotechnology
Certificate course on
“Biophysical and microbiological techniques”
Theory syllabus (2020-21)

Total Instruction hours : 60hrs

Marks : 50

Unit-I:

Buffers- preparation of solution (molarity, normality, molality), preparation of standard buffers(acidic, basic, neutral), determination of pH of the solution.

Unit-II:

Colorimeter/ UV Spectrophotometer: Principle, construction and its applications.

Chromatography: partition principle, partition coefficient, brief account of paper chromatography, thin layer chromatography

Unit -III:

Gel electrophoresis: types of gels, Agarose gel electrophoresis, SDS-PAGE and applications

Centrifugation: Basic principle, concepts of RCF, types of centrifuges (clinical, high speed and ultracentrifuges), Application of fractionation in research.

Unit-IV:

Microscopy - Light microscope- Parts of microscope and its uses

sterilization methods - Physical, chemical and radiation

Isolation of of microorganisms - serial dilution, pure cultures isolation methods, culture media - types;

Identification of bacteria - simple staining and Gram's staining

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Government College (A), Rajamahendravaram
Department of Biotechnology
Certificate course on
“Biophysical and microbiological techniques”
Model question paper(2020-21)

Time: 3hrs

Max.marks:50M

Answer any FIVE questions and draw labelled diagram where ever necessary. 5×10 = 50M

1. Explain the preparation of standard acidic buffer solution
2. Describe about principle and applications of light microscope
3. Write an essay on SDS-PAGE.
4. Write about the principle and types of centrifuges.
5. Write a brief account on paper chromatography.
6. Describe the principle and applications of colorimeter.
7. Write about different methods of isolation of pure culture
8. Describe gram staining method.

Blue print

Time: 3hrs

Max.marks:50

UNIT	Essay
Unit – I	2
Unit – II	2
Unit – III	2
Unit – IV	2

Government College (A), Rajamahendravaram
Department of Biotechnology
Certificate course on
“Biophysical and microbiological techniques”
Practical syllabus(2020-21)

1. Preparation of standard buffers and determination of pH of a solution
2. Gel electrophoresis of DNA
3. SDS-PAGE of protein
4. Paper chromatography of amino acids or sugars
5. TLC of sugars or amino acids
6. Quantitative estimation of carbohydrates
7. Quantitative estimation of proteins
8. Quantitative estimation of nucleic acids
9. Preparation of media, sterilization
10. Isolation of bacteria
11. Simple staining of bacteria
12. Gram staining of bacteria

NOTE: Depending on the availability of chemicals and equipment, any 10 of the above practicals should be performed.

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Practical model question paper (2020-21)

Time: 3hrs

Max.marks:50M

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|---|---------|
| 1. Perform SDS-PAGE for the given oligomeric protein and determine its molecular weight | 15M |
| 2. Identify the given bacterial culture by gram staining method | 10M |
| 3. Identify the given Spotters | 3×5=15M |
| 4. Record | 5M |
| 5. Viva-voice | 5M |

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