

**Government College(Autonomous) Rajamahendravaram**

**Accredited “A<sup>+</sup>” Grade by NAAC**

**Department of Biotechnology**



**Syllabus for courses offered (I , II, IIIyr)**

**in**

**4 yr B.Sc. ( Domain subject) AgroBiotechnology**

**Under CBCS ( Choice Based Credit System)**

**Program / Code : AGROBBC / (2211)**

**Approved by Board Of Studies**

**(2022-2023)**

Government College (Autonomous), Rajamahendravaram

Department of Biotechnology

**Board Of Studies Document**

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PROCEEDINGS OF THE PRINCIPAL  
GOVERNMENT AUTONOMOUS COLLEGE, RAJAHMUNDRY

PRESENT: Dr.R. David Kumar, M.Sc., M.Phil., Ph.D.

RC. NO. 152/GCRJY/ACAD. CELL//BOS/2021/, DATED. 05.07. 2022

Sub: GCRJY-Conduct of BoS Meetings for the Academic Year 2022-23 - Regarding

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**ORDER:**

With reference to the subject cited, the lecturers-in-Charge of all the departments are hereby informed to conduct their respective Board of Studies (BoS) meetings by the end of July 2022.

You are also informed to intimate the date of your BoS meeting well in advance to the subject experts/University nominee/Industrial Nominee/members of BoS/Student nominee concerned to get their valuable views and suggestions in the deliberations to frame the concrete syllabi for your subjects keeping in view the objectives of the college and interest of the stake holders. The date should also be indicated to Academic Cell in advance.

You are further suggested to utilize the academic autonomy in incorporating the additional modules in the syllabi and identify the pedagogical strategies to implement the same.

Please note that your BoS document should contain the following contents in order

- Proceedings of the Principal pertaining to BoS
- Composition of BoS
- Table showing the Allocation of Credits in the following table for both theory and Lab in case of science subjects

S. No	Semester	Course Code	Title of the Course (Paper)	Max. Marks (SEE)	Marks in CIA	Hrs./week			
						L	T	P	C

L= Lecture, T= Tutorial, P= Practical, C= Credits

- Agenda wise Resolutions adopted in the meeting with detailed discussions
- Table showing Members present with signatures
- List of Examiners & Paper setters
- Syllabus for each course in the **Proforma given** (both theory & Practical in case of Science subjects) followed by model question papers (theory & practical)
- Unit wise Assignment questions at the end of syllabus of each course

You are requested to submit a separate document regarding addition/deletion of specific topics from the syllabus in each course (paper) with justification, if any.

ACADEMIC CELL, GOVERNMENT COLLEGE  
(AUTONOMOUS) RAJAHMUNDRY

All the *new Courses/certificate courses* proposed for the calendar year 2022, Seminars/workshops, field visits, study tours for 2022-23 should be placed before the respective Board and get them approved.

You are also requested to submit 2 hard copies & 2 soft copies (CDs) of BoS document to the Academic cell along with original bills and settle the bills after completion of the BoS meeting. You can approach the Academic Cell for necessary documents.

***Most Important:*** You are requested to submit soft & hard copies of *Resolutions (including discussion)* separately to IQAC immediately after BoS meeting is completed.



PRINCIPAL ·  
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RAJAHMUNDRY

Copy to:

1. Lecturers-in-Charge of all the departments
2. File

**Government (Autonomous) College, Rajamahendravaram**

**Department of Biotechnology**

**Composition of Board of Studies Committee 2022-2023**

<b>S.No</b>	<b>Nominee</b>	<b>Name and Designation</b>
1	Chairman	<b>Dr.B.Nageshwari,</b> Lecturer in Charge , Department of Biotechnology, Govt (A) College, Rjy Phone : 9866219559 email Id: <a href="mailto:b.nageshwari@gcrjy.ac.in">b.nageshwari@gcrjy.ac.in</a>
2	Member	<b>Dr K.Vasudha,</b> Lecturer , Department of Biotechnology, Govt (A) College, Rjy Phone : 9704723056 email Id: <a href="mailto:kvasudhabt@gcrjy.ac.in">kvasudhabt@gcrjy.ac.in</a>
3	Subject Expert	<b>Sri. K. Suresh Babu,</b> ABN College, Kovvuru, WG Dist. Phone :9966845824 email Id: <a href="mailto:sureshbiozeal@gmail.com">sureshbiozeal@gmail.com</a>
4	Subject Expert	<b>Sri.G.Sam Babu</b> Sri Y.N. College (A), Narsapur. Phone: 9866611379 email Id: <a href="mailto:biotechsnyamsir@gmail.com">biotechsnyamsir@gmail.com</a>
5	University Nominee	<b>Dr.D. Kalyani,</b> Associate Professor of Zoology ,UCST, AKNU Phone :9849419160 email Id: <a href="mailto:dk.zoo@aknu.edu.in">dk.zoo@aknu.edu.in</a>
6	Expert from Industry / Corporate Sector	<b>Dr.K.Sarala</b> Principal Scientist,Crop Improvement Division,CTRI, Rjy. Phone: 9849726890 email Id:
7	Student Nominee	<b>Name: B.Thiruvalli</b> Present job / study : M.Sc, Biotechnology (AKNU-RJY) Phone: 8247260790 email Id: <a href="mailto:thiruvalli2723@gmail.com">thiruvalli2723@gmail.com</a>
8	Student Nominee	<b>Name: B. Lakshmi Sahitya</b> Present job / study : M.Sc., Biotechnology (AKNU-RJY) Phone:9494434719 email Id: <a href="mailto:b1sahitya459@gmail.com">b1sahitya459@gmail.com</a> 98

**Government College (Autonomous), Rajamahendravaram  
Department of Biotechnology  
Board Of Studies – Committee Members : ( 2022-23 )**

**Date : 30-07-2022**

**Time :11:30 A.M.**



Left to Right : University nominee : **Dr.D. Kalyani** , Associate Professor of Zoology ,UCST, AKNU.

Industrial expert : **Dr.K.Sarala**, Principal Scientist,Crop Improvement Division,CTRI, Rjy.

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

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

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

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

Standing Behind :

Student Nominee 1 **B.Thiruvalli** B.Sc Biotechnology GDC(A) RJY (2018 -2021) (Now P.G. Biotechnology at AKNU, Rjy)

Student Nominee 2 **B.Lakshmi Sahithya** B.Sc Biotechnology GDC (A) RJY(2018-2021) (Now P.G. Biotechnology at AKNU, Rjy)



Deliberations - (BoS- Meeting)

## Allocation of Credits , Teaching hours and Marks.

Semester	Paper	Title of course	Thero y/ Lab Hrs per week	Marks			Credits	Course code
				CI A	SEE	Total		
1	1	Elements of Biotechnology	4	50	50	100	4	BTL201
1	1	Elements of Biotechnology- lab	2	-	50	50	1	BTL201P
2	2	Advanced Biotechnology	4	50	50	100	4	BTL202
2	2	Advanced Biotechnology-Lab	2	-	50	50	1	BTL202P
2 <sup>nd</sup> Sem end	CSP	Community Service Project (Log Book (30M) ; Project Implementation (20M) Project Report (25M) ; Project viva (25M)				100		
3	3	Hydroponics cultivation	4	50	50	100	4	BTL203
3	3	Hydroponics cultivation -- lab	2	-	50	50	1	BTL203P
4	4	Techniques in Nursery Development	4	50	50	100	4	BTL204
4	4	- Techniques in Nursery Development - lab	4	-	50	50	1	BTL204P
4	5	Crop Improvement Technology	4	50	50	100	4	BTL148
4	5	- Crop Improvement Technology - lab	2	-	50	50	1	BTL148P
4 <sup>th</sup> sem end		2 <sup>nd</sup> Internship for BBC & AGRO						
5 <sup>th</sup> sem / 6 <sup>th</sup> Sem Internship		3 <sup>rd</sup> Internship for						
5/6	6A	Apiculture	3	50	50	100	4	BTL206
5/6	6A	Apiculture -Lab	3		50	50	1	BTL206P
5/6	7A	Pearl culture	3	50	50	100	4	BTL207
5/6	7A	Pearl Culture Lab	2		50	50	1	BTL207P
OR								
5/6	6B	Organic farming	3	50	50	100	4	BTL156
5/6	6B	Organic farming lab	2		50	50	1	BTL156P
5/6	7B	Bio fertilizers and Bio pesticides production	3	50	50	100	4	BTL205
5/6	7B	Bio fertilizers and Bio pesticides production Lab	2		50	50	1	BTL205P
OR								
5/6	6C	Vegetable Science	3	50	50	100	4	BTL143
5/6	6C	Vegetable Science - Lab	2		50	50	1	BTL143 P
5/6	7C	Plant and Environmental Biotechnology.	3	50	50	100	4	BTL208
5 / 6	7C	Plant and Environmental Biotechnology - Lab	2		50	100	1	BTL208

<b>SEMESTER – I</b>			
<b>S.No.</b>	<b>Subjects</b>	<b>Core / Paper</b>	<b>Title</b>
<b>1</b>	<b>I-Language (English)</b>		
<b>2</b>	<b>II-Language (Hindi / Telugu /Sanskrit)</b>		
<b>3</b>	<b>Life Skill Courses</b>		
<b>4</b>	<b>Skill Development courses</b>		
<b>5</b>	<b>Major 1 AgroBiotechnology</b>	<b>Core 1</b>	<b>Elements Of Biotechnology</b>
<b>6</b>	<b>Major 2 AgroBotany</b>	<b>Core 2</b>	
<b>7</b>	<b>Major 3 AgroChemistry</b>	<b>Core 3</b>	

<b>SEMESTER – II</b>			
<b>S.No.</b>	<b>Subjects</b>	<b>Core / Paper</b>	<b>Title</b>
<b>1</b>	<b>I-Language (English)</b>		
<b>2</b>	<b>II-Language (Hindi / Telugu /Sanskrit)</b>		
<b>3</b>	<b>Life Skill Courses</b>		
<b>4</b>	<b>Skill Development courses</b>		
<b>5</b>	<b>Major 1 AgroBiotechnology</b>	<b>Core 2</b>	<b>Advanced Biotechnology</b>
<b>6</b>	<b>Major 2 AgroBotany</b>	<b>Core 2</b>	
<b>7</b>	<b>Major 3 AgroChemistry</b>	<b>Core 2</b>	

<b>Credits : 4</b>
<b>Community Service Project</b>



<b>SEMESTER – III</b>			
<b>S.No.</b>	<b>Subjects</b>	<b>Core / Paper</b>	<b>Title</b>
<b>1</b>	<b>I-Language (English)</b>		<b>English</b>
<b>2</b>	<b>II-Language (Hindi / Telugu /Sanskrit)</b>		<b>Hindi / Telugu /Sanskrit</b>
<b>3</b>	<b>Life Skill Courses</b>		
<b>4</b>	<b>Skill Development courses</b>		
<b>5</b>	<b>Major 1 AgroBiotechnology</b>	<b>Core 3</b>	<b>Hydroponics Cultivation</b>
<b>6</b>	<b>Major 2 AgroBotany</b>	<b>Core 3</b>	
<b>7</b>	<b>Major 3 AgroChemistry</b>	<b>Core 3</b>	

<b>SEMESTER – IV</b>			
<b>S.No.</b>	<b>Subjects</b>	<b>Core / Paper</b>	<b>Title</b>
<b>1</b>	<b>Major 1 AgroBiotechnology</b>	<b>Core 4</b>	<b>Techniques in Nursery Development</b>
<b>2</b>	<b>Major 2 AgroBotany</b>	<b>Core 4</b>	
<b>3</b>	<b>Major 3 AgroChemistry</b>	<b>Core 4</b>	
<b>4</b>	<b>Major 1 AgroBiotechnology</b>	<b>Core 5</b>	<b>Crop Improvement Technology</b>
<b>5</b>	<b>Major 2 AgroBotany</b>	<b>Core 5</b>	
<b>6</b>	<b>Major 3 AgroChemistry</b>	<b>Core 5</b>	

<b>Credits : 4</b>
<b>Internship / Project</b>

<b>SEMESTER – V</b>			
<b>S.No.</b>	<b>Subjects</b>	<b>Skill Enhancement Courses</b>	<b>Title</b>
<b>1</b>	<b>Major 1 Biotechnology</b>	Skill Enhancement Courses (6 & 7)	<b>6B Organic farming 7B Biofertilizers and Biopesticide production</b>
<b>2</b>	<b>Major 2 Botany</b>	Skill Enhancement Courses (6 & 7)	
<b>3</b>	<b>Major 3 Chemistry</b>	Skill Enhancement Courses (6 & 7)	

<b>Credits : 4</b>
<b>Internship / Project</b>

**Government College (Autonomous), Rajamahendravaram  
Department of Biotechnology  
Syllabus up gradation meeting 2022 -2023**

DATE: 30/07/2022

TIME: 11:30 P.M

**Resolutions adopted in the Board of Studies meeting**

A Board Of Studies meeting was conducted in the Department Of Biotechnology , in an offline mode on 30<sup>th</sup> July 2022 at 11:30 A.M. with all the Committee members to review and upgrade the syllabus for all semesters of the programs offered by the Department Of Biotechnology. The members present discussed various aspects including UG Biotechnology Syllabi, Courses offered , Model Question Papers of both Theory and Practical etc., that are to be implemented for the academic year 2022-2023.

**The following resolutions were adopted by the committee members.**

**Agenda -1 : To propose altogether separate courses for the program Agrobiotechnology Right from semester -1 through semester -6.**

**Discussion** : On basis of the feedback provided by the students pursuing master's degree and also based on Suggestions provided by the committee, it is concluded that separate courses need to be offered for agro Biotechnology right from semester 1 itself hence is it approved to prepare a separate BoS document for the program Agro biotechnology with separate courses.

**Resolution - 1:** It is resolved to introduce Agro biotechnology based separate courses for the Agro biotechnology program from semester - 1 itself and to prepare a separate BoS document for the program Agro biotechnology .

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**Agenda-2.** To discuss, consider, propose and approve basic frame work for Agrobiotechnology syllabus for all the semesters and other components like carrying out of Internships in summers and in semester 5<sup>th</sup> or 6<sup>th</sup> 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 according to the needs of the student , department and college and it also decided to follow CBCS pattern in offering courses. A new curriculum has been released for 5<sup>th</sup> and 6<sup>th</sup> semesters by APSCHE which also adopted from the present year 2022-23.

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

❖ The students shall have to undergo 10 months mandatory internship in 3 phases for 4 yr conventional degree program:

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 , 2 months and 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 (April – May )	Log Book (20M) Project Implemetation(30M) Project Report (25M) Project presentation / viva (25M) ----- TOTAL= 100 M -----	4
2	Second phase	Internship/ Apprenticeship/ On job training	2 months	At the end of Sem 4 (April-May)	100 M	
3	Third phase	Internship/ Apprenticeship/ On job training	6 months (One full semester)	5 <sup>th</sup> sem or 6 <sup>th</sup> sem	Internal External (viva) ----- TOTAL = 200M -----	
At the end of 2 <sup>nd</sup> and 3 <sup>rd</sup> phases the student will have to present his project work, submit a project thesis, take viva .						

Later as per the present practice the marks are converted into grades and grade points to include finally in the SGPA and CGPA.

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

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

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**Agenda 3** : 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 3**: 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.

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**Agenda 4** : 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 AKNU 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 4** : It is resolved to mention the designed course objectives and course outcomes in the courses before syllabus and it is resolved to introduce such topics in the syllabus which cater to wide variety of needs of the students as mentioned above in the discussion.

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**Agenda - 5 :** Proposing courses and Framing syllabus for I, II and III yr B.Sc., AgroBiotechnology along with introduction of additional inputs .

**Discussion :** The committee proposed the syllabus for I , II & IIIyr and also introduced additional inputs, the committee also introduced Skill Development courses in the fifth semester in the academic year 2022-23, 3 sets of (Skill Development ) courses as electives ( 2 courses in each set) will be framed and offered to the student , of which the student will have to choose 1 set only consisting of 2 courses.

**The titles of new courses introduced introduced for Agrobiotechnology are as follows**

Core	Paper	Sem	Title
Core 1	1	1	Elements of Biotechnology
Core 2	2	2	Advanced Biotechnology
Core 3	3	3	Hydroponics cultivation
Core 4	4	4	Techniques in Nursery Development
Core 5	5	4	Crop Improvement Technology
<b>Set - 1 :</b> Skill development Courses	6A	5	Apiculture
	7A	5	Pearl culture
<b>Set - 2</b> Skill development Courses	6B	5	Organic farming
	7B	5	Bio fertilizers and Bio pesticides production
<b>Set - 3</b> Skill development Courses	6C	5	Vegetable Science
	7C	5	Plant and Environmental Biotechnology

Further, the committee discussed and decided that some advanced topics of the field may be introduced as additional inputs so that the student are up to date with knowledge in the field of their study. A separate document with topics as additional inputs is enclosed in the document.

**Resolution - 5 :** It is resolved to propose new courses and frame syllabus for all the semesters of the program Agrobiotechnology with introduction of advanced topics as additional inputs . A separate document with additional inputs is to be provided in the BoS document. Futher it is resolved to introduce skill development courses in the fifth semester in the academic year 2022-23 the approved course titles are mentioned above in the discussion part and approved syllabus is enclosed this BoS document 2022-23.

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**Agenda - 6** : 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 - 6** : It is resolved to introduce such practical in to the syllabus which are feasible to carry out in the department / college.

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**Agenda 7:** 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 - 7:** it is resolved to give internet based assignments to the students and such topics which enhance skills , employability and entrepreneurship.

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**Agenda - 8** : 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 mention below.

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

S.No.	Component			Distribution of Marks
	Q No	Learning Objective	Marks	
1	1	Memory based (Remember)	2	CIE I (after completion of 50% of
	2	Understand (Comprehension)	2	

CIE I	3	Application	3	syllabus)
	4	Analysis	3	
	5	Evaluation	5	
	6	Creativity	5	
	<b>TOTAL</b>		<b>20 marks</b>	
				<b>20</b>
2	CIE II (Online Exam)			<b>10</b>
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	
<b>Pedagogical Strategies</b>				
4	ASSIGNMENT			<b>5</b>
5	Participation or Paper Presentation in Student Seminars/Workshops/Group Discussions/ Quiz/ Student Study Project/Field Visit/Survey			
		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			<b>5</b>
<b>TOTAL</b>				<b>50</b>

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 year.



- Internal practical exam at the end of 1<sup>st</sup>, 3<sup>rd</sup> and 5<sup>th</sup> each for - 50marks.
  - External practical exam at the end of 2<sup>th</sup>, 4<sup>th</sup>, and 6<sup>th</sup> semester each for - 50marks.
9. Studying 7<sup>th</sup> and 8<sup>th</sup> semesters is optional , if the students continue to study 7<sup>th</sup> an 8<sup>th</sup> semesters , they will be trained in Research methodology .

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.

#### 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

#### **Department Best Practices for CIA:**

1. Weekly wall magazine : Poster  
Presentation on notice board.

2. Extension service: Awareness  
programme/ rally.

3. MOOCs : Enrolment and  
completion of one course

4. Internship / summer project.

**Resolution - 8:** It is resolved to follow the evolved Biotechnology Department specific Allocation of Internal component and external component (CIA : SEE as 50:50) .

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**Agenda - 9 :** 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. 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 2022-23.

**Resolution - 9:** It is resolved to continue the same pattern of question paper with 50% choice in section –A essay, and Section – B ,short answer type questions for theory .It is resolved to continue the same pattern of question paper for Practical exam.

\*\*\*\*\*

**Agenda - 10 :** 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 - 10 :** It is resolved to approve the list of colleges proposed by the department of biotechnology for setting papers and for acting as examiners.

\*\*\*\*\*

**Agenda - 11:** 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 - 11:** 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 - 12** : 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 20<sup>th</sup> Oct , Kary B Mullis ( Inventor of PCR technique) on 28<sup>th</sup> Dec , Alexander Fleming ( Discoverer of antibiotic Penicillin) on 6<sup>th</sup> 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 - 12**: It is resolved to celebrate the birth anniversaries of of Karl Ereky on 20<sup>th</sup> Oct , Kary B Mullis on 28<sup>th</sup> Dec , Alexander Fleming on 6<sup>th</sup> Aug by the department of biotechnology by organizing some useful event like seminar, awareness campaigns and lab to school extension activities.

\*\*\*\*\*

**Agenda - 13**: 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.

**Resolution - 13**: It is resolved to run the certificate course titled “ Biophysical and microbiological techniques”.

\*\*\*\*\*

**Agenda - 14** : Identification of events to carried out by the department for the academic year 2022 2023 and to propose and approve the approximate amount to meet the expenses for carrying ut 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 28<sup>th</sup> Feb of every year.

The estimated budget was worked out and an amount of Rs 85,500 was approved.

The estimate sheet with signatures of committee members is enclosed in this BoS document for reference.

**Resolution - 14 :** It is resolved to observe the above mentioned activities proposed by the committee and to approve the budget estimate of Rs 85,000 -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 may be carried out by meeting the expenses from the approved budget estimate only after due permission from concerned authority ( IQAC / Academic cell / Principal) .

\*\*\*\*\*

**Government (Autonomous) College, Rajamahendravaram  
Department of Biotechnology  
Board of Studies Meeting : 2022-23.**

The Board of Studies meeting of the Department of Biotechnology was convened at 11:30 a.m. on 30<sup>th</sup> July 2022 under the Chairmanship of Dr.B.Nageshwari. Assistant professor, In charge, Department of Biotechnology.

S.No	Nominee	Name and Designation	Signature
1	Chairman	<b>Dr.B.Nageshwari,</b> Lecturer in Charge , Department of Biotechnology, Govt (A) College, Rjy Phone : 9866219559 email Id: b.nageshwari@gcrjy.ac.in	B. Nageshwari 30/7/22
2	Member	<b>Dr.K.Vasudha,</b> Lecturer , Department of Biotechnology, Govt (A) College, Rjy Phone : 9704723056 email Id: kvasudhabt@gcrjy.ac.in	Dr.K.Vasudha 30/7/2022
3	Subject Expert	<b>Sri. K.Suresh Babu,</b> Head,Dept.of Biotechnology ABN College, Kovvuru, WG Dist. Phone : 9966845824 email Id: Sureshbiozeal@gmail.com	K.Suresh Babu 30.07.2022
4	Subject Expert	<b>Sub.Lt.G. SyamBabu,</b> Head,Dept.of Biotechnology Sri Y.N. College (A), Narsapur. Phone : 9866611379 email Id: biotechsyamsir@gmail.com	Sub.Lt.G. SyamBabu 30/7/22
5	University Nominee	<b>Dr.D. Kalyani,</b> Associate Professor of zoology ,UCST, AKNU Phone : 9849419160 email Id: dk.200@aknu.edu.in	D. Kalyani 30/7/2022
6	Expert from Industry / Corporate Sector	<b>Dr.K.Sarala</b> Principal Scientist,Crop Improvement Division,CTRI, Rjy. Phone : email Id:	Sarala.K 30/7/22
7	Student Nominee	Name: B.Thiruvalli Present job / study M.Sc. Biotechnology. Phone : 8247260490 email Id: thiruvalli2723@gmail.com.	B.Thiruvalli 30/07/2022
8	Student Nominee	Name: B.Lakshmi Sahitya Present job / study M.Sc Biotechnology Phone : 9494434719 email Id: blsahitya459@gmail.com	B.Lakshmi Sahitya 30/7/22

## Government College(A) ,RajahendravaramDepartment 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

**New Courses introduced in Program : Agrobiotechnology  
For Academic year 2022-23**

<b>Semester</b>	<b>Paper</b>	<b>Title of course</b>	<b>Course code</b>
1	1	Elements of Biotechnology	BTL201
1	1	Elements of Biotechnology- lab	BTL201P
2	2	Advanced Biotechnology	BTL202
2	2	Advanced Biotechnology-Lab	BTL202P
3	3	Hydroponics cultivation	BTL203
3	3	Hydroponics cultivation -- lab	BTL203P
4	4	Techniques in Nursery Development	BTL204
4	4	Techniques in Nursery Development - lab	BTL204P
4	5	Crop Improvement Technology	BTL148
4	5	Crop Improvement Technology - lab	BTL148P
<b>Skill Enhancement Courses</b>			
6	6A	Apiculture	BTL206
6	6A	Apiculture -Lab	BTL206P
6	7A	Pearl culture	BTL207
6	7A	Pearl Culture Lab	BTL207P
6	6B	Organic farming	BTL156
6	6B	Organic farming lab	BTL156P
6	7B	Bio fertilizers and Bio pesticides production	BTL205
6	7B	Bio fertilizers and Bio pesticides production Lab	BTL205P
6	6C	Vegetable Science	BTL143
6	6C	Vegetable Science - Lab	BTL143 P
6	7C	Plant and Environmental Biotechnology.	BTL208
6	7C	Plant and Environmental Biotechnology - Lab	BTL208





Government College (Autonomous) Rajamahendravaram

Department Of Biotechnology

Discussions and Suggestions Proposed by BOS members

to be implemented in the syllabus after review

Suggestion : We Students (Student members of BOS)

Requested the members of BOS-Biotechnology (2022-2023) to include fundamentals of Biotechnology which will be useful to clearing entrance exams/ Job interviews.

As a student of Agso BBC student of department of Biotechnology (2018-2021) requested the members of BOS to offer separate courses of Agso BBC in semester 1<sup>st</sup> and 3<sup>rd</sup> also

Proposed by :- Name :

B.Thiruvalli

B. Lakshmi Sahitya

Signature:

B.Thiruvalli

B. Lakshmi Sahitya

30/7/22.

30/07/2022.

Government College (Autonomous) Rajamahendravaram  
Department Of Biotechnology

Discussions and Suggestions Proposed by BOS members  
to be implemented in the syllabus after review

Suggestion :

1. For introducing the "Fundamentals of the Biotechnology." for Agro Biotechnology Students.
2. Conducting Workshops, Seminars, Poster presentations, important eminent Scientist birthdays to motivate the students to learn the innovative day-to-day importance of Biotechnology News, Research development.
3. For Project work publication is must

Proposed by :- Name :

Signature:

K. S. Baru

30.07.2022

K. SURESH BARU  
HOD, Dept. of Biotechnology  
ARV & PRR College,  
KOVVUR.

Government College (Autonomous) Rajamahendravaram

Department Of Biotechnology

Discussions and Suggestions Proposed by BOS members

to be implemented in the syllabus after review

Suggestion :

- Introduce "fundamental of biotechnology" course for Sem-I for Agro-biotech program.
  - Course on "Crop Improvement" may be introduced in Sem-III to give comprehensive understanding of improving crops.
  - The topics on Biostatistics, Bio-informatics and ITs may be suitably incorporated.
- Organic farming → Unit 3 may be dealt at the end of the course.
- Syllabus revised during BOS may be followed.

Proposed by :- Name : K. SARALA Signature:

Sarala.K  
30/7/22

Government College (Autonomous) Rajamahendravaram  
Department Of Biotechnology

Discussions and Suggestions Proposed by BOS members  
to be implemented in the syllabus after review

Suggestion :

Additional inputs for Paper - I

Unit - III

HPLC  
Deletion of Paper - I

Unit - V :

Measurement of radioactivity

Proposed by :- Name :

K. SURESH BABU  
HOD, Dept of Biotechnology  
Agn & PRR College  
Kovva.

Signature:

K. S. (Signature)  
30.07.2022

Government College (Autonomous) Rajamahendravaram

Department Of Biotechnology

Discussions and Suggestions Proposed by BOS members

to be implemented in the syllabus after review

Suggestion : Additional inputs for II Semester  
① DNA Replication in Eukaryotes,  
② Acetylation  
③ Introns & Exons,

Proposed by :- Name :

Sub. H. P., Syam Babu.

Signature:

S-H-P  
30/2/22

Government College (Autonomous) Rajamahendravaram

Department Of Biotechnology

Discussions and Suggestions Proposed by BOS members

to be implemented in the syllabus after review

- Suggestion :
- ⊗ Introduce Fundamentals of Biotechnology for Agronomy students (I<sup>st</sup> Semester) to Agrobiotechnology program.
  - ⊗ my suggestion regarding final year, start to introduce Genetics (Human genetics) one paper.
  - ⊗ Biostatistics, Bioinformatics, IPR, Patents

Proposed by :- Name :

Sub. Lt. G. Sankar

Signature:

S-S-G  
30/7/22

## **Agrobiotechnology**

### **Program Specific Outcomes**

**B.Sc., Agro B.B.C.(Agro biotechnology, Agro botany and Agro chemistry)**


**This program of Agro biotechnology, Agro botany and Agro chemistry is specially designed to solve the problems related to agriculture and to fortify the crop products, to produce genetically modified crops to withstand various biotic and abiotic stress. To enhance production of economically important plants.**

**With advanced techniques in Agro biotechnology, shelf life is enhanced, artificial ripening is caused which helps efficient trading**

**In Agro botany the study about structure, classification and evolution of plants. Study about physicochemical characters of soil, which helps us to know about requirements and hindrances faced in the agriculture. So It helps to find solutions.**

**In Agro chemistry the study about the chemical compositions present in different soils. Study of production, usage of various chemical fertilizers, pesticides, insecticides on the crops.**

**////////////////////**

	<b>Government College (Autonomous) Rajahmundry</b>				
<b>Theory</b>  <b>Syllabus</b>  <b>Paper - 1</b> Course Objectives:	<b>Subject : Biotechnology</b>	<b>Stream : B. Sc</b>			
	<b>Title of the Course</b> <b>“ Elements of Biotechnology ”</b> <b>Course Code: BTL201</b>	<b>Program: AGROBBC</b>			
	<b>Total Hours Allocated - 60 ; Per Week -4 hrs</b>	<b>Year -1</b>			
		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Pre-requisites</b>	<ul style="list-style-type: none"> <li>➤ Concepts Of Basic Biology</li> <li>➤ Basics in Genetics</li> <li>➤ Basics in genetic engineering</li> </ul>	4 Lecture	2 Tutorial	- Practical	4 Credits

**Objectives :**

- To make the pupil learn the basics of existence of life
- To make the pupil understand the structure of cell and organelles and molecules present in it to better understand the causes and prevention and treatment of diseases.
- To make the pupil aware of scope of genetic corrections.

On Completion of the course, the students will be able to-	
CO1	Understand the basic mechanisms of survival present in cell and life
CO2	Will understand the working and importance of cell and its organelles
CO3	The importance of macromolecules in health and disease will be understood Focus on Skill Development modules / employability / entrepreneurship /
CO4	The mechanism responsible for passing genetic traits will be understood
CO5	The latest developments in disease treatment through genetic corrections will be understood

**Syllabus  
Unit -1 :**

Skill Development	Collection, Classification and Tabulation of data, Normal distribution and their application to biology	Employability	Concept of sampling and sampling distribution Simple regression and correlation. Concept of analysis of variance (one-way classification)	Entrepreneurship	Introduction to Intellectual property Introduction to copyright Importance of intellectual property rights.
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**Microbiology: (Bacteria & Virus)**

**Bacteria** - Ultrastructure fine structure of bacteria and growth curve. Pure culture techniques.. Sterilization



techniques, Gram staining of bacteria . Detailed study of Typhoid.

**Viruses** : General characteristics, transmission and cultivation of viruses. Detailed study of SARS-CoV-2.

## **Unit 2 : Cell & Molecular Biology.**

**Cell biology:** Ultrafine structure of Eukaryotic cell.. Mitosis Versus Meiosis , Cell cycle Fluid mosaic model of cell membrane.

**Molecular biology:** DNA replication in prokaryotes & eukaryotes .. Genome organization of prokaryotic and eukaryotic organisms. Genetic code , prokaryotic and eukaryotic transcription and translation, Post-transcriptional versus translational modifications .

## **Unit-3 : Biomolecules, Bioenergetics, Analytical techniques.**

**Biomolecules** : General account of carbohydrates, amino acids, fatty acids , DNA , RNA. Vitamins.

**Bioenergetics** : Free energy, entropy, enthalpy and redox potential. High energy compounds, Glycolysis, TCA cycle,.

**Analytical techniques** : Working principle and uses of – Centrifugation, Chromatography – (Paper, TLC, ionexchange, gel permeation, affinity chromatography ) , Electrophoresis- ( PAGE, AGE and IEF ),

## **Unit-4 :Classical Genetics & Human molecular genetics:**

### **Classical Genetics :**

Mendel Laws and Deviations ( Incomplete dominance and Codominance ) Penetrance and Expressivity pleiotropy , Concept of multiple alleles, gene copies and heterogeneity, abnormalities in animals and plants, Linkage, recombination, genemaps, interference and coincidence, Sex determination,.

**Human Molecular Genetics** : Genetic population studies and HardyWeinberg Equations Pedigree Analysis DNA Cloning and Hybridization Techniques, , , Disease Gene Discovery

## **Unit -5 : Immunology & rDNA technology :**

**Immunology** : Cells and Organs and tissues and mediators of the Immune System, Antigen Vs hapten, antibody (types), antigenicity Vs immunogenicity , types of immunity.( Innate and adaptive , Active and Passive, Humoral and Cell mediated). Vaccines, Adjuvants, Hybridoma technology, Ag-Ab interactions,

**rDNA technology** : Steps involved in cloning, tools of genetic engineering , Genes structure, . Principles and application of PCR. Bbotting techniques, cDNA library construction. Application of rDNA technology- transgenic plants, edible vaccines.

## **Additional Inputs : Table :-**

U	Additional input:	Deletion	Justification
1	Principle and description of microscopes- compound, phase contrast, fluorescent electron microscopy (TEM, SEM). Classification of bacteria based on morphology, nutrition and environment.,	History related to scientists. Concepts of microbial species and strains.	
2	<b>.Additional Input :</b> cell signaling and communication, DNA damage and repair , Regulation of gene expression in prokaryotes Lac operon concept.	Mitosis and meiosis	
3	<b>Additional Input :</b> Electron-Transport System and Oxidative Phosphorylation , Laser techniques - crystallography and applications in biology. <b>Analytical techniques</b> Spectroscopy-Colorimetry,		
4	<b>Additional Input :</b> Recessive and Dominant epispastic gene interaction , gene and environment , The Hap Map Project. Mutations and instability of human DNA (From pedigree to molecular pathology) Animal Models for Human Diseases		
5	<b>Additional Input :</b> MHC., Outlines of Hypersensitivity and Autoimmunity. <b>Additional Input :</b> Introduction to DNA sequencing (Sanger Sequencing) and Site-directed Mutagenesis		

#### References

1. Fundamentals of Biostatistics by Khan and Khanum, Ukaaz Publishers
2. A text book of Bioinformatics by Sharma, Munjal, Shankar
3. Elements of Biotechnology by PK.Gupta.
4. Dutta, N. K. (2004). Fundamentals of Biostatistics, Kanishka Publishers.
5. Gurumani N. (2005) . An Introduction to Biostatistics, MJP Publishers.
6. Daniel, W. W. (2007). Biostatistics- A Foundation for Analysis in the Health Sciences,Wiley.
7. Rao, K. V. (2007). Biostatistics – A Manual of Statistical Methods for use in HealthNutrition and Anthropology.
8. Pagano, M.& Gauvreau, K. (2007). Principles of Biostatistics.
9. Rohatgi, V.K.& Saleh, A.K.Md. (2001). An Introduction to Probability and Statistics,John Wiley & Sons.
10. Sundaram, K.R.(2010) Medical Statistics-Principles & Methods, BI Publications,NewDelhi


#### Weblinks

1. <https://www.yourgenome.org/facts/what-is-gene-expression>
2. <https://microbenotes.com/gene-expression/>

#### 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

	<b>Government College (Autonomous) Rajahmundry</b> <b>Department Of Biotechnology</b>	<b>Group : AGROBBC</b>
<b>B.Sc.-I</b> <b>Sem-1</b> <b>Paper- 1</b>	<b>Title of the course</b> <b>Elements of Biotechnology</b>	
<b>Time : 2 1/2 Hrs</b>	<b>Blue Print o Question Paper</b>	<b>Marks : 50</b>

**Part-A**

**I. Essay questions: answer any THREE**

**3X10=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
- Question6 from additional input


**Part-B**

**II. Short answer questions : answer any FOUR**

**4 X 5= 20 M**

**Each answer carries FIVE marks.**

- Question7:fromUnitI
- Question8:fromUnitI
- Question9:fromUnitII
- Question10:fromUnit II
- Question11:fromUnit III
- Question12:fromUnit III
- Question13:fromUnit IV
- Question14:fromUnit V

	<b>Government College (Autonomous) Rajahmundry Department Of Biotechnology</b>	<b>Group : AGROBBC</b>
<b>B.Sc.-I Sem-1 Paper- 1</b>	<b>TITLE OF THE COURSE Elements of Biotechnology</b>	
<b>Time : 2 1/2 Hrs</b>	<b>Model Question Paper</b>	<b>Marks : 50</b>

**PART-A**


**Answer any THREE questions. Each answer carries TEN marks 3X10 =30M**

1. Write about SARS – CoV-2 in detail. (I)
2. Write about ultra structure of eukaryotic cell. (II)
3. Write a general account of Vitamins. (III)
4. Describe the chromosomal abnormalities in plants and animals (IV)
5. Describe the Hybridoma technology in detail (V)
6. Write about working principles of various microbiological microscopes. (Additional Input)

**PART-B**

**Answer any FOUR questions. Each answer carries Five marks. 4X5=20M**

7. Bacterial growth curve (I)
8. Genetic code.(II)
9. Fatty acids (III)
10. Pedigree analysis (IV)
11. Types of immunity (V)
12. Typhoid (I)
13. Iso Electric Focusing (III)
14. Post transcriptional and post translational modifications. (II)

	<b>Government College (Autonomous) Rajahmundry</b>	<b>Program : AGROBBC</b> <b>B.Sc- (Iyr)</b> <b>Semester : I</b> <b>Paper – I</b>			
Practical Syllabus	<b>Subject : Biotechnology</b>				
Course Code : <b>BTL201P</b>	<b>Title of the Practical Course :</b>  <b>Elements of Biotechnology</b>				
Teaching	Total Hours Allocated : 30	L Lecture	T Tutoria 1	P Practical	C Credits
Pre-requisites:	<ul style="list-style-type: none"> <li>➤ Should know basics of biostatistics like mean.</li> <li>➤ Should have basic knowledge about computer.</li> </ul>	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/Syllabus:

1. Qualitative analysis of carbohydrates(sugars)
2. Quantitative analysis of carbohydrates by using DNS reagent
3. Quantitative estimation of protein –Lowry’s method
4. Estimation of DNA by diphenylamine reagent
5. Estimation of RNA by orcinol reagent
6. Preparation of standard buffer and pH determination
7. Separation of amino acids by paper chromatography
8. Preparation of nutrient agar medium for bacteria
9. Preparation of PDA medium for fungi
10. Isolation of bacteria from soil(serial dilution)
11. Isolation of Pure cultures(Streakplate, spreadplate and pourplate)
12. Simple staining technique
13. Differential staining technique
14. Study of stages of mitotic cell division
15. Study of stages of meiotic cell division
16. Extraction and isolation of DNA from bacteria.
17. Determination of Blood Groups
18. Pregnancy test
19. Widal test
20. Ouchterlonyimmunodiffusion
21. Radial immune diffusion
22. ELISA
23. Isolation of plasmid DNA (alkaline lysis method)
24. Analysis of plasmid DNA by Agarose gel electrophoresis

## References:

1. An Introduction to Practical Biochemistry, 3rd Edition, (2001), David Plummer; Tata McGraw Hill Edu.Pvt.Ltd. New Delhi, India
2. Biochemical Methods, 1st Edition, (1995), S.Sadashivam, A.Manickam; New Age International Publishers, India
3. David A. Thompson. 2011. Cell and Molecular Biology Lab. Manual.
4. P.Gunasekaran. 2007. Laboratory Manual in Microbiology. New Age International
5. Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press.
6. 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://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>

<https://www.understandingnano.com/medicine.html>


[http://cfl.iuims.ac.ir/uploads/my\\_nano\\_ref.pdf](http://cfl.iuims.ac.ir/uploads/my_nano_ref.pdf)

<https://vlab.amrita.edu/?sub=3&brch=63> <http://biotech01.vlabs.ac.in/>

<https://www.asbmb.org/education/online-teaching/online-lab-work>


<https://teach.its.uiowa.edu/remote-and-virtual-labs-online-nanotechnology-course>

[https://www.teachengineering.org/lessons/view/van\\_nanoparticles\\_lesson03](https://www.teachengineering.org/lessons/view/van_nanoparticles_lesson03)

	<b>Government College (Autonomous) Rajahmundry</b> <b>Department Of Biotechnology</b>	<b>Group : AGROBBC</b>
<b>B.Sc.-I</b> <b>Sem-1</b> <b>Paper- 1</b>	<b>Title of the practical course</b> <b>Elements Of Biotechnology</b>	
<b>Time : 3Hrs</b>	<b>Model Question Paper</b>	<b>Marks : 50</b>

1. Estimate the concentration of DNA in the given sample by Diphenyl amine method 15M
  
2. Write principle of paper chromatography and separate amino acids . 10M
  
3. Spotter(3x 5) 15M
  
4. Record 5M
  
5. Viva– voce 5M

**TOTAL = 50 M**

	<b>Government College (Autonomous) Rajahmundry</b>					
<b>Theory Syllabus Paper - 2</b>	<b>Subject : Biotechnology</b>		<b>Stream: B. Sc.</b>			
	<b>Title of the Course “ Advanced Biotechnology ”</b>		<b>Program: AGROBBC</b>			
	<b>Course Code: BTL202</b>		<b>Year -1</b>			
	<b>Total Hours Allocated - 60 ; Per Week -4 hrs</b>		<b>Semester : 2</b>			
<b>Pre-requisites</b>	<ul style="list-style-type: none"> <li>➤ Knowledge about nanobiology</li> <li>➤ Basics in cellular and molecular biology</li> <li>➤ Analytical techniques</li> </ul>		L	T	P	C
			4	2	-	4

**Objectives :**  
the pupil  
latest

**Course**  
To make  
aware of

technology that nanotechnology.

To make the pupil understand the practical applications of plant and animal biotechnology

To make the pupil aware of ethical issues related to biotechnology.

To enable the pupil to analyze data through statistical methods

On Completion of the course, the students will be able to-	
CO1	The course instructs about basics of biostatistics like mean, median and mode to calculate the biological the biological data with the help of statistics.
CO2	Students should be able to learn the basics fundamentals of bioinformatics
CO3	Students will understand the basics of intellectual property rights.
CO4	Students will have basic knowledge of bioinformatics.
CO5	Students will be able to use tools of bioinformatics like for research purpose.



Focus on Skill Development modules / employability / entrepreneurship /

Skill Development	Collection, Classification and Tabulation of data, Normal distribution and their application to biology	Employability	Concept of sampling and sampling distribution Simple regression and correlation. Concept of analysis of variance (one-way classification)	Entrepreneurship	Introduction to Intellectual property Introduction to copyright Importance of intellectual property rights.
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## Syllabus

### Unit –I Biomedical Nanotechnology :

Biomaterials sciences: Nanoparticles target cancer cell in vivo, drug carriers, dendrimers as drug carriers, Bio responsive hydrogels, biomaterials in tissue regeneration/engineering, other applications of materials In medicine, plant and microbes as nano factories, bacteria, yeast and fungi in Nanoparticle synthesis

### Unit 2: Plant biotechnology & Animal Technology :

Plant tissue culture: totipotency, media - composition, preparation and sterilization, ; 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. Transgenic plants

Animal cell culture: cell culture media composition and preparation, culture of mammalian cells, tissues and organs; primary culture, secondary culture, cell lines, stem cell cultures; Tests: cell viability and cytotoxicity, Cryopreservation.

### Unit 3 : Environment biotechnology & Industrial biotechnology :

Pollution types and control through Biofilters, Bioscrubbers, Biotrickling filter.

Sources of Water pollution, Measurement of water pollution, Waste water treatment, aerobic processes and.

Anaerobic processes:

Industrially important microbes, fermentation - fermenter - Production of Microbial products:

dairy products,

#### Unit 4: Bioethics & Biosafety & IPR:

Bioethics in cloning and stem cell research, Human and animal experimentation, animal rights/welfare

Biosafety -Introduction to biological safety cabinets; primary containment for biohazards; biosafety levels; GLP,GMP,

IPR: Introduction to IP-Types of IP: patents, patent law , trademarks & copyright

#### Unit 5 : Biostatistics& Bioinformatics.

Collection, Classification and Tabulation of data, bar diagrams and Pie diagrams, Histogram, Frequency curve and frequency polygon. Mean, median, mode, Standard deviation.

Biological Databases – Introduction to Biological Databases, their utilization in Biotechnology (PubMed, NCBI, EMBL, EXPASY, PIR, Pfam. Concept of World Wide Web: HTML, HTTP).

U	Additional input:	Deletion	Justification
1	Additional : Routes of nanomaterials entry in to the body- gastrointestinal tract, skin, lungs, toxic mechanisms, health and environmental implications of nanoparticles		
2	<b>.Additional Input :</b> cryopreservation, Plant secondary metabolites-concept and their importance, and Molecular markers: Transfection methods (calcium phosphate precipitation, electroporation, Microinjection) and applications. & Gene Therapy: Recombinant DNA products , IVF, Concept of Gene therapy, Concept of transgenic animals -Ethical issues in animal biotechnology.	46	
3	Biodegradation and Bioremediation: Degradation of pesticides and other toxic chemicals. Genetically Engineered microbes, Phytoremediation, , environmental safety guidelines. Biofuels, Biofertilizers, Vermiculture		
4	international organizations, agencies and treaties. Infringement of intellectual property rights.		
5	nucleotide and protein BLAST analysis, CLustal W and phylogenetic tree construction.Introduction to omics (proteomics, genomics and transcriptomics).		

#### References

11. Fundamentals of Biostatistics by Khan and Khanum, Ukaaz Publishers
12. A text book of Bioinformatics by Sharma, Munjal, Shankar
13. Elements of Biotechnology by PK.Gupta.
14. Dutta, N. K. (2004). Fundamentals of Biostatistics, Kanishka Publishers.
15. Gurumani N. (2005) . An Introduction to Biostatistics, MJP Publishers.
16. Daniel, W. W. (2007). Biostatistics- A Foundation for Analysis in the Health Sciences,Wiley.
17. Rao, K. V. (2007). Biostatistics – A Manual of Statistical Methods for use in Health Nutrition and Anthropology.
18. Rao, K. V. (2007). Biostatistics – A Manual of Statistical Methods for use in Health Nutrition and Anthropology.
19. Nutrition and Anthropology.
20. Pagano, M.& Gauvreau, K. (2007). Principles of Biostatistics.

21. Rohatgi, V.K.& Saleh, A.K.Md. (2001). An Introduction to Probability and Statistics,
22. John Wiley & Sons.
23. Sundaram, K.R.(2010) Medical Statistics-Principles & Methods, BI Publications,NewDelhi


**Weblinks**

3. <https://www.yourgenome.org/facts/what-is-gene-expression>
4. <https://microbenotes.com/gene-expression/>

**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

	<b>Government College (Autonomous) Rajahmundry Department Of Biotechnology</b>	<b>Group : AGROBBC</b>
<b>B.Sc.-I Sem-2 Paper- 2</b>	<b>Title of the course  Advanced Biotechnology</b>	
<b>Time : 2 1/2 Hrs</b>	<b>Blue Print o Question Paper</b>	<b>Marks : 50</b>

**Part-A**

**I. Essay questions:                      answer any THREE    3x10=30M .**


- Question1 from Unit I
- Question2from Unit II
- Question3 from Unit III
- Question4 from Unit IV
- Question5 from Unit V
- Question6 from additional input

**Part-B**

**II. Short answer questions:                      Answer any FOUR    4 X 5= 20 M**

- Question7:fromUnit I
- Question8:fromUnit I

- Question9:fromUnit II
- Question10:fromUnit II
- Question11:fromUnit III
- Question12:fromUnit III
- Question13:fromUnit IV
- Question14:fromUnit V

	<b>Government College (Autonomous) Rajahmundry</b> <b>Department Of Biotechnology</b>	<b>Group : AGROBBC</b>
<b>B.Sc.-I</b> <b>Sem-2</b> <b>Paper- 2</b>	<b>Title of the course</b> <b>Advanced Biotechnology</b>	
<b>Time : 2 1/2 Hrs</b>	<b>Model Question Paper</b>	<b>Marks : 50</b>

**PART-A**


**I. Answer any THREE questions. 3X 10=30M**

1. Describe the concept of living cells acting as nanofactories. (I)
2. Write some applications of transgenic plants. (II)
3. Write an essay on industrially important micorbes . (III)
4. What is replication and explain the process of replication in *E.coli*
5. Write a detailed note on biosafety levels . (IV)
6. Write an essay on biological databases.(V)

**PART-B**

**II. Answer any FOUR questions. 4X5= 20M**

7. Biomaterials (I)
8. Hydrogels (I)
9. Callus culture (II)
10. Plant cell culture media composition ( II)
11. Biofilters (III)
12. Dairy products. (III)

		<b>Government College (Autonomous) Rajahmundry</b>			
<b>Course Code:</b>  <b>BTL202P</b>	<b>SUBJECT :    Biotechnology</b>	<b>Stream : B.Sc</b>			
	<b>Title of the course</b>  <b>Advanced Biotechnology Lab</b>	<b>Program : AGROBBC</b>			
		<b>Yr : I</b>			
		<b>Semester : 2</b>			
		<b>Paper -2</b>			
Teaching	Total Hours Allocated : 30	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:	Handling of pipettes. Handling of Biological samples.	0	0	2	1

13. Copy right (IV)

14. Explain standard deviation (V)

#### **Objectives:**

The students should be able to understand the principle behind the tests.

The students should be able to understand the concept behind the microbiological work.

#### **List of Experiments/Syllabus:**


- Induction of callus from different explants, cytology of callus
- Establishing a plant cell culture (both in solid and liquid media)
- Cell count by hemocytometer.
- Maintenance of established cell lines.
- Estimation of cell viability by dye exclusion (Trypan blue).
- Detection of coliforms for determination of the purity of potable water.
- Determination of total dissolved solids of water
- Determination of Hardness and alkalinity of water sample.
- Determination of dissolved oxygen concentration of water sample
- Determination of biological oxygen demand of sewage sample
- Determination of chemical oxygen demand (COD) of sewage sample.
- Isolation of industrially important microorganisms from soil.
- Isolation of amylase producing organisms from soil.
- Production of  $\alpha$  – amylase from Bacillus Spp. by shake flask culture.
- Production of alcohol or wine using different substrates.
- Production of citric acid by submerged fermentation
- Estimation of citric acid by titrimetry.

### 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>

	<p style="text-align: center;"><b>Government College (Autonomous) Rajahmundry Department Of Biotechnology</b></p>	<p style="text-align: center;"><b>Group : AGROBBC</b></p>
<p style="text-align: center;"><b>B.Sc.-Iyr Sem-2 Paper- 2</b></p>	<p><b>Title of the practical course</b></p> <p><b>Advanced Biotechnology</b></p>	
<p><b>Time : 3Hrs</b></p>	<p><b>Model Question Paper</b></p>	<p><b>Marks : 50</b></p>

3. Major Question	15M
2,Minor question	10M
3 . Spotter(3x 5)	15M
4. Record	5M
5. Viva– voce	5M
-----	50M



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

<b>Theory Paper - 3</b>	<b>Subject : AgroBiotechnology</b>	<b>Stream : B.Sc</b>				
	<b>Title of the Course “ Hydroponics cultivation ”</b>		<b>Program : AGROBBC</b>			
	<b>Course Code: BTL203</b>		<b>Year -II</b>			
	Total Hours Allocated - 60 ; Per Week -4 hrs	<b>L</b> Lecture	<b>T</b> Tutorial	<b>P</b> Practical	<b>C</b> 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	

**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, CO<sub>2</sub>, 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 hydroponics

Passive sub-irrigation, Ebb and flow or flood and drain 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.		

### References


1. Keith Roberto, *How to Hydroponics*. The future Garden Press New York. 4<sup>th</sup> 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

	<b>Government College (Autonomous) Rajahmundry</b> <b>Department Of Biotechnology</b>	
	<b>Subject : AgroBiotechnology</b>	
	<b>Program : AGROBBC</b>	
<b>B.Sc.-IYr</b> <b>Semester-3</b> <b>Paper- 3</b>	<b>Title of Course</b> <b>“ Hydroponics cultivation ”</b>  <b>Course Code: BTL203</b>  <b>Semester End Exam (2022-23)</b>	
<b>Time : 2 1/2 Hrs</b>	<b>Blue Print of Question Paper</b>	<b>Marks : 50</b>

**Part – A**

**I. Essay questions: answer any 4 :**


**4 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 : Answer any 4 Questions 5 X 2 = 10 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
  
- Question 12: from Unit I
- Question 13: from Unit II
- Question 14: from Unit III

	<b>Government College (Autonomous) Rajahmundry</b> <b>Department Of Biotechnology</b>	
	<b>Subject : AgroBiotechnology</b>	<b>Stream : AGROBBC</b>
<b>B.Sc.-II yr</b> <b>Semester-3</b> <b>Paper- 3</b>	<b>Title of Course</b> <b>“ Hydroponics cultivation ”</b> <b>Course Code: BTL203</b> <b>Semester End Exam (2022-23)</b>	
<b>Time : 2 1/2 Hrs</b>	<b>Model Question Paper</b>	<b>Marks : 50</b>

**Part – A**

**I. Essay questions: answer any 4 :**

**4 X 10 = 40 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)
6. Write the applications and future developments of soilless culture.(Additional Input)

**Part-B**

**II. Short answer questions : Answer any 4 Questions 5 X 2 = 10 M**

7. Write about soil based (I)
8. Write about functions of macronutrients in plants(II)
9. Describe about photoperiodism(II)
10. Static solution culture(IV)
11. Disease and pest control(III)
12. Deep water culture protocols for tomato cultivation(V)
13. Write about chilly cultivation through NFT system(V)
14. Inorganic salts (Additional Input).

	<b>Government College (Autonomous) Rajahmundry Department Of Biotechnology</b>				
<b>Practical Syllabus  Paper-3</b>	<b>Subject : AgroBiotechnology</b>	<b>Stream : B.Sc</b>			
	<b>Title of Course “ Hydroponics cultivation ”  Course Code: BTL203</b>	<b>Program : AGROBBC  Year-II  Semester : 3</b>			
	Total Hours – 30hrs ; Per Week -2hrs	<b>L</b> Lect ures	<b>T</b> Tuto rial	<b>P</b> Practical	<b>C</b> Credits
Pre-requisites:	Handling of pipettes. Preparation of Solutions Handling of analytical instruments.	0	0	2	1

**Objectives:**


3. The students should be able to understand the principle behind the estimations.
4. 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:

	<b>Government College (Autonomous) Rajahmundry</b> <b>Department Of Biotechnology</b>		
	<b>Subject : AgroBiotechnology</b>		<b>Group :AGROBBC</b>
<b>B.Sc.-IIyr</b> <b>Semester-3</b> <b>Paper- 3</b>	<b>Title of Course</b> <b>“ Hydroponics cultivation ”</b>  <b>Course Code: BTL203</b>  <b>Semester End Exam (2022-23)</b>		
<b>Time : 3Hrs</b>	<b>Practical - Model Question Paper</b>	<b>Credits : 1</b>	<b>Marks : 50</b>

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

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Total 50

	<b>Government College (Autonomous) Rajahmundry Department Of Biotechnology</b>				
<b>Theory Paper - 4</b>	<b>Subject : AgroBiotechnology</b>		<b>Stream : B.Sc</b>		
	<b>Title of the Course “ Techniques in Nursery Development ” Course Code: BTL204</b>		<b>Program: AGROBBC Year -II Semester : 4</b>		
	<b>Total Hours Allocated - 60 ; Per Week -4 hrs</b>		<b>L</b> Lect ure	<b>T</b> Tutori al	<b>P</b> Pract ical

Pre-requisites:	<ul style="list-style-type: none"> <li>➤ Basic knowledge about planting trees</li> <li>➤ Basic knowledge about seasonal changes in plants</li> <li>➤ Natural manures</li> </ul>	4	1	-	4
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### 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	

### 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.

	<b>Additional input:</b>	<b>Deletion</b>	<b>Justification</b>
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		

### **Recommended Books:**

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

### **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

	<b>Government College (Autonomous) Rajahmundry</b> <b>Department Of Biotechnology</b>	
	<b>Subject : AgroBiotechnology</b>	<b>Program : AGROBBC</b>
<b>B.Sc.-Ilyr Semester-4 Paper- 4</b>	<b>Title of Course</b> <b>“ Techniques in Nursery Development ”</b> <b>Course Code :BTL204</b> <b>Semester End Exam (2022-23)</b>	
<b>Time : 2 1/2 Hrs</b>	<b>Blue Print of Question Paper</b>	<b>Marks : 50</b>

**Part – A**

**I. Essay questions: answer any 4 : 3 X 10 =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
- Question 6 from additional input

**Part-B**

**II. Short answer questions : Answer any 4 Questions 4x5 =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
- Question 12 paper setters choice
- Question 13paper setters choice
- Question 14paper setters choice



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

**Subject : AgroBiotechnology**

**Program:AGRO BBC**

**B.Sc.-Ilyr  
Semester-4  
Paper- 4**

**Title of Course**

**“ Techniques in Nursery Development ”**

**Course Code : BTL204**

**Semester End Exam (2022-23)**

**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)
6. Describe famous nurseries present locally near our place.(Additional Input)

**Part-B**

**Answer All the five of the following short answer questions**

**4x 5 = 20M**

- 7..Importance of nursery
- 8.Nursery media
- 9.selection of seeds for nursery
- 10.prevention of pests
- 11.grafting
- 12.paper setters choice
- 13.paper setters choice
- 14.paper setters choice



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

<b>Practical Syllabus  Paper-4</b>	<b>Subject : AgroBiotechnology</b>	Stream : B.Sc			
	<b>Title of Course</b>  “ Techniques in Nursery Development ”-Lab  Course Code: BTL204 P	Program : AGROBBC  Year-II  Semester : 4			
	Total Hours – 30hrs ; Per Week -2hrs	<b>L</b> Lectures	<b>T</b> Tutorial	<b>P</b> Practical	<b>C</b> 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/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**

**Program :AGROBBC**

<b>B.Sc.-II yr Semester-4 Paper- 4</b>	<b>Title of Course</b> <b>“ Techniques in Nursery Development ”-Lab</b> <b>Course code: BTL204 P</b> <b>Semester End Exam (2022-23)</b>		
<b>Time : 3Hrs</b>	<b>Practical - Model Question Paper</b>	<b>Credits : 1</b>	<b>Marks : 50</b>

- |   |      |
|---|------|
| 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  |

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**Total 50 M**  
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**Government College (Autonomous) Rajahmundry  
Department Of Biotechnology**

<b>Theory Paper - 5</b>	<b>Subject : AgroBiotechnology</b>	<b>Stream : B.Sc</b>			
	<b>Title of the Course “ Crop Improvement Technology ”</b>	Program: AGROBBC			
	<b>Course Code: BTL148</b>	<b>Year -II</b> <b>Semester : 4</b>			
	Total Hours Allocated - 60 ; Per Week -4 hrs	<b>L</b> Lecture	<b>T</b> Tutorial	<b>P</b> Practical	<b>C</b> Credits
Pre-requisites:	➤ 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/gene 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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## 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

	<b>Additional input:</b>	<b>Deletion</b>	<b>Justification</b>
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.		



**Additional Input:** Transgenic plants for crop improvement .

**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

	<b>Government College (Autonomous) Rajahmundry</b> <b>Department Of Biotechnology</b>	
	<b>Subject : AgroBiotechnology</b>	<b>Program : AGROBBC</b>
<b>B.Sc.-Ilyr Semester-4 Paper- 5</b>	<b>Title of Course “ Crop Improvement Technology ” Course Code :BTL148 Semester End Exam (2022-23)</b>	
<b>Time : 2 1/2 Hrs</b>	<b>Blue Print of Question Paper</b>	<b>Marks : 50</b>

**Part – A**


**I. Essay questions: answer any 4 : 3 X 10 = 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
- Question 6 from additional input

**Part-B**

**II. Short answer questions : Answer all the 5 Questions 4x 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
- Question 12 :Paper setters choice
- Question 13 : Paper setters choice
- Question 14 : Paper setters choice

	<b>Government College (Autonomous) Rajahmundry</b> <b>Department Of Biotechnology</b>	
	<b>Subject : AgroBiotechnology</b>	<b>Program : AGROBBC</b>
<b>B.Sc.-IIIyr</b> <b>Semester-4</b> <b>Paper- 5</b>	<b>Title of Course</b> <b>“ Crop Improvement Technology ”</b>  <b>Course Code : BTL148</b>  <b>Semester End Exam (2022-23)</b>	
<b>Time : 2 1/2 Hrs</b>	<b>Model Question Paper</b>	<b>Marks : 50</b>

**Part – A**

**Answer any three essay questions**

**3 X 10 = 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)
6. Write the method of Marker assisted selection for crop improvement (Additional Input).

**Part – B**

**II. Answer any 4 of the following questions**

**4 x 5 = 20M**

- 7.Pollen culture (I)
- 8.Organogenesis (II)
- 9.Protoplast .(III)
- 10.Gene gun method (IV)
- 11.Molecular markers. (V)
- 12.Papers setters choice
- 13.Paper setters choice
- 14.Paper setters choice



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

<b>Practical Syllabus  Paper-5</b>	<b>Subject : AgroBiotechnology</b>	<b>Stream: B.Sc</b>			
	<b>Title of Course  “ Crop Improvement Technology ”-Lab  Course Code: BTL148P</b>	<b>Program: AGROBBC  Year-II  Semester : 4</b>			
	<b>Total Hours – 30hrs ; Per Week -2hrs</b>	<b>L Lect ures</b>	<b>T Tuto rial</b>	<b>P Practical</b>	<b>C Credits</b>
<b>Pre-requisites:</b>	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:**

1. Preparation of Plant tissue culture medium
2. Callus culture
3. Regeneration from callus cells
4. Cytology of callus
5. Suspension culture.
6. Isolation of Protoplast
7. Anther culture
8. Preparation of synthetic seeds

**Referencebooks:**

**Virtual LabLinks:**



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

**Subject : AgroBiotechnology**

**Program :AgroBBC**

<b>B.Sc.-IIyr Semester-4 Paper- 5</b>	<b>Title of Course</b> <b>“ Crop Improvement Technology “ - Lab ”</b> <b>Course code: BTL148P</b> <b>Semester End Exam (2022-23)</b>		
<b>Time : 3Hrs</b>	<b>Practical - Model Question Paper</b>	<b>Credits : 1</b>	<b>Marks : 50</b>

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
	----- <b>Total 50 M</b> -----



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

<b>Theory Paper - 6A</b>	<b>Domain Subject : AgroBiotechnology</b>	<b>Stream : B.Sc</b>			
	<b>Title of the Course “ Apiculture ”  Course Code: BTL206  ( Skill Enhancement Course (Elective), 05 Credits)</b>	<b>Program : AGROBBC  Year -III  Semester : 5 / 6</b>			
	Total Hours Allocated - 60 ; Per Week -4 hrs	<b>L Lecture</b>	<b>T Tutorial</b>	<b>P Practical</b>	<b>C Credits</b>
Pre-requisites:	➤ Basic knowledge of plant nutrients and gardening	4	1	-	4

Semester-wise Revised Syllabus under CBCS, 2020-21

### I. Learning outcomes

Students after successful completion of the course will be able to

1. Understand the basic concepts of Apiculture.
2. Obtain the elementary knowledge of different species and races of honey bees
3. Appreciate the importance of health and hygiene in Bee keeping
4. Maintain the Bee hives in a scientific way

### II. Syllabus: (Total Hours: 90 including Teaching, Lab, Field Training and unit tests etc.)

#### Unit 1: Biology of Bees

History, Classification and Life Cycle of Honey Bees. Social Organization of Bee Colony.

#### Unit 2: Rearing of Bees

Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth. Methods of Extraction of Honey (Indigenous and Modern).

#### Unit 3: Diseases and Enemies

Bee Diseases and Enemies. Control and Preventive measures.

#### Unit 4: Economy and Entrepreneurship

Products of Apiculture Industry and its Uses (Honey, Bee Wax, Propolis) and Pollen.

#### Unit 5. Entrepreneurship in Apiculture

Bee Keeping Industry: Present and future, Role of Bees in cross pollination in horticulture and agriculture. Prospects of apiculture as self-employment venture.

## Practical Syllabus: Course 6C

### Apiculture

#### III. Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. Maintain the Bee hives in a scientific way.
2. Clean & Maintain Bee Boxes
3. Use of other tools required in Bee Keeping
4. Building and division of colony
5. Understand the methodologies of extracting, preservation and marketing of honey and other products of honey bee

#### IV. Practical syllabus

1. Handling of tools and techniques for Apiculture
2. To study the morphological and anatomical characteristics of queen and worker bees
3. Identification of different species of honey bees
4. Preparation of honey bee trays for beekeeping, maintenance and colony inspection
5. Extraction of honey and bee wax
6. Processing of honey, packing and storing
7. Identification of honey adulteration

#### V. References:

1. Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.
2. Graham, J M (1992) The hive and the honey bee. Dadant and Sons, Hamilton, Illinois.
3. Mishra R.C. (1995) Honey bees and their management in India. ICAR Publication New Delhi.
4. Singh, S. (1971) Beekeeping in India, ICAR publication..
5. Bisht, D.S. (2004). Agricultural Development in India, Anmol Pub. Pvt. Ltd.
6. Singh S.(1964). Beekeeping in India, Indian council of Agricultural Research, NewDelhi
7. Mehrotra, K.N. Bisht, D.S. (1981). Twenty-five years of apiculture research at IARI. Apiculture in relation to agriculture.

#### VI. Co-Curricular Activities

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

1. For Teacher: Training of students by teacher in laboratory and field for a total of 15 hours in Preparation of honey bee trays for beekeeping, maintenance and colony inspection. Extraction, processing, packing and storing of honey and bee wax
2. For Student: Individual visit to an Apiculture facility or related field or to a laboratory in a university/research organization/private sector and study of Apiculture practices. Submission of a hand-written Fieldwork Report not exceeding 10 pages in the given format.
3. Max marks for Field Work Report: 05.
4. Suggested Format for Field work: Title page, student details, content page, introduction, work done, findings, conclusions and acknowledgements.
5. Unit tests (IE).

**b) Suggested Co-Curricular Activities**

1. Training of students by related industrial experts.
2. Assignments (including technical assignments like Identification of flora and location of site, procurement of bee box and other tools, building & division of comb and colony, manage insects and diseases and nuisance in bee hives, knowledge of the scientific methods of bee keeping)
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on tools and techniques on bee keeping.
5. Collection of material/figures/photos related to products of Apiculture, writing and organizing them in a systematic way in a file.
6. Visits to Apiculture facilities, firms, research organizations etc.
7. Invited lectures and presentations on related topics by field/industrial experts.

**Suggested Question Paper Model for Practical Examination**  
Semester – V/ Biotechnology **Course – 6C** (Skill Enhancement Course)  
**Apiculture**

Max. Time: 3 Hrs.

Max. Marks: 50

1. Identification of different species of honey bees ‘A’
2. Demonstration of use of different boxes and other tools in Bee Keeping ‘B’
3. Methods of harvesting, processing and preservation of honey ‘C’
4. Scientific observation and data analysis
  - A. Identify tools for Apiculture /photograph
  - B. Identification of morphological and anatomical characteristics of queen and worker bees / photograph
  - C. Identify Common pests that attack honey bees and hives / photograph
  - D. Building of comb and colony /photograph

Record + Viva-voce



# Question Paper

Max. Marks:

Time: 3 hrs

## SECTION A

- 1) Apiculture
- 2) Drones
- 3) Langstroth
- 4) Modern bee keeping
- 5) Propolis
- 6) Bee wax
- 7) Role of bees in agriculture
- 8) Bee pollination

## SECTION B

- 9)a) Write about history, classification and Life Cycle of Honey Bees?  
Or  
b) Discuss in detail about Social Organization of Bee Colony?
- 10)a) What is apiary? Write about different types of beehives?  
Or  
b) Discuss about indigenous and modern methods of Extraction of Honey?
- 11)a) Write in detail about bee diseases, control and preventive measures?  
Or  
b) Write about Products of Apiculture Industry and their Uses?
- 12)a) Write about harvesting and processing of bee products?  
Or  
b) Discuss about bee keeping industry: present and future
- 13) a) Write about role of bees in cross pollination in horticulture and agriculture?  
Or  
b) Discuss about prospects of apiculture as self-employment venture?



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

<b>Theory Paper - 7A</b>	<b>Domain Subject : AgroBiotechnology</b>	Stream : B.Sc (4yr)			
	<b>Title of the Course “ Pearl culture”  Course Code: BTL207</b>	Program : AGROBBC  Year -III  Semester : 5			
	(Skill Enhancement Course (Elective), 05 Credits)				
	Total Hours Allocated - 60 ; Per Week -4 hrs	<b>L</b> Lect ure	<b>T</b> Tutori al	<b>P</b> Pract ical	<b>C</b> Credits
Pre-requisites:	➤ Basic knowledge of plant nutrients and gardening	4	1	-	4

Semester-wise Revised Syllabus under CBCS, 2020-21  
Four-year B.Sc.

### I. Learning outcomes

Students after successful completion of the course will be able to

1. Understand the basic concept of pearl culture.
2. Obtain the elementary knowledge regarding the Anatomical and Physiological aspects of fresh water oysters.
3. Acquaint with the various types of implantation methods and pearl culture surgery techniques.
4. Acquire skill on production of pearl and its marketing for economic gain

**II. Syllabus:** (Total Hours: 90 including Teaching, Lab, Field Training and unit tests etc.)

### Unit 1: Overview of Pearl oyster

Biology of Pearl oyster: Pearl producing molluscs. Morphology and anatomy of Pearl oyster, Life cycle of pearl oyster.

### Unit 2: Process of Pearl formation

Structure and Histology of mantle. Natural Process of Pearl formation. Chemical composition of Pearls. Economic importance of pearls.

### Unit 3: Pearl oyster culture

**Pearl oyster culture** Techniques of pearl oyster culture (Fresh water and Marine water) for artificial production of pearls. Pearl culture techniques -Rafts, long lines, Pearls oyster baskets, under water platforms, mother oyster culture/Collection of oysters, rearing of oysters, Environmental parameters.

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### Unit 4: Pearl Oyster surgery

Selection of Oyster, Graft tissue preparation, Nucleus insertion, Conditioning for surgery, Post-operative culture, harvesting of pearl, clearing of pearl.

## Unit 5: Pearl culture Economy

Diseases and Predators of Pearl oysters' Present status, prospects and problems of pearl industry in India.

### Practical Syllabus: Course 7C Pearl Culture

#### III. Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. Execute pre- pearl culture activities
2. **Learn the technique of surgical operation**
3. **Develop skill of Post operation activities**
4. Implement culture activities
5. Perform pearl harvesting

#### IV. Practical syllabus

1. Technique for measurement of soil and water
2. Culture technique of microorganism for pond maintenance. Surgical techniques
3. Graft tissue preparation, implantation techniques, post operation care
4. Designed pearl culture techniques, bleaching, collection of pearls, cleaning of pearls
5. Sorting of pearls, marketing of pearls.

#### V. References:

1. Haws Maria (2002). The basics of pearl farming: a Layman's manual: (U.S.A). CTSA publications.
2. Alexander E .Farn (1986) pearls :(U.S.A.).Butterworth Heinemann publications.
3. Le Jia Li (2014) new technologies to promote freshwater pearl culture (China) Ocean Press publications.
4. Bardach, J.E.W (1972) Aquaculture farming and husbandry of freshwater and Sorting of Pearl. Marketing and economics concerned with Pearl Culture. Generation marine organisms
5. David Dobilet (1995) Pearl farming (Australia) Nat Geographic Mag publication
6. Yuan Cha Da (2014) Environmental effects Pearl farming (China) Jiangxi People publishing house.

#### VI. Co-Curricular Activities

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

1. **For Teacher:** Training of students by teacher in laboratory and field for a total of 15 hours on construction of pearl farm, collecting oysters, seeding, caring the oyster and harvesting
2. **For Student:** Individual visit to a pearl culture facility or related field or to a laboratory in a university/research organization/private sector and study of pearl culture practices. Submission of a hand-written Fieldwork Report not exceeding 10 pages in the given format.
3. Max marks for Field Work Report: 05.
4. Suggested Format for Field work: Title page, student details, content page, introduction, work done, findings, conclusions and acknowledgements.
5. Unit tests (IE).

b) **Suggested Co-Curricular Activities**

1. Training of students by related industrial experts.<sup>54</sup>
2. Assignments (including technical assignments like identifying tools in pearl culture and their handling, operational techniques with safety and security, IPR)
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).

4. Preparation of videos on tools and techniques in pearl culture.
5. Collection of material/figures/photos related to products of pearl culture, writing and organizing them in a systematic way in a file.
6. Visits to pearl culture facilities, firms, research organizations etc.
7. Invited lectures and presentations on related topics by field/industrial experts.

## VII. Suggested Question Paper

Max. Marks:

Time:

### SECTION A

- 1) Pearl oyster
- 2) Mantle histology
- 3) Chemical composition of pearl
- 4) Artificial production of pearl
- 5) Rafts
- 6) Selection of oyster
- 7) Post operative culture
- 8) Diseases of pearl oysters

### SECTION B


- 9) a) Write in detail about biology of pearl producing molluscs?  
or  
b) Write about life cycle of pearl oyster?
- 10) a) Discuss about natural process of pearl formation?  
or  
b) Write about economic importance of pearls?
- 11) a) Discuss in detail about pearl oyster culture techniques?  
or  
b) Write about collection and rearing of oysters and also discuss about environmental parameters involved in pearl oyster culture?
- 12) a) Discuss in detail about various aspects of pearl oyster surgery?  
or  
b) Write in detail about harvesting and cleaning of pearls?
- 13) a) Write in detail about diseases and predators of pearl oysters?  
or  
b) Discuss about present status, prospects and problems of pearl industry in India?

**Suggested Question Paper Model for Practical Examination Semester – V/  
Biotechnology Course – 7C (Skill Enhancement Course) Pearl Culture**

Max. Time: 3 Hrs.

Max. Marks: 50

- |  |              |
|--|--------------|
| 1. Identify pearl producing oyster, preparation of nuclei 'A'      | 8 M          |
| 2. Prepare graft tissue, perform surgical implantations. 'B'       | 8 M          |
| 3. Implantation of live graft pieces into the mantle of mussel 'C' | 12 M         |
| 4. Scientific observation and data analysis                        | 4 x 3 = 12 M |
| A. Pearl culture surgical instruments /photograph                  |              |
| B. Identification of Pearl/ photograph                             |              |
| C. Classification of pearls / photograph                           |              |
| D. Biomineralisation of pearls /photograph                         |              |
| 5. Record + Viva-voce  | 6+4 = 10 M   |

	<b>Government College (Autonomous) Rajahmundry Department Of Biotechnology</b>					
<b>Theory Paper - 6B</b>	<b>Subject : AgroBiotechnology</b>		<b>Stream : B.Sc</b>			
	<b>Title of the Course “ Organic farming ”  Course Code: BTL156</b>		<b>Program : AgroBBC  Group : BBC  Year -III  Semster : 5/6</b>			
	<b>Total Hours Allocated - 60 ; Per Week - 4 hrs</b>		<b>L Lect ure</b>	<b>T Tutori al</b>	<b>P Pract ical</b>	<b>C Credits</b>
<b>Pre-requisites:</b>	➤ Basic knowledge about farming technique and natural products used in farming.		4	1	-	4

**CourseObjectives:**

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

<b>On Completion of the course, the students will be able to-</b>	
<b>CO1</b>	The students have basic knowledge of organic farming. Understand the soil profile and nutrients in soil
<b>CO2</b>	The students will be able to understand about eco-friendly farming systems. Appreciate the importance of organic manure and bio fertilizers
<b>CO3</b>	The students will have knowledge about organic nutrient sources and green manures. Produce vermi compost, farmyard manure from bio waste
<b>CO4</b>	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**

Skill Development	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	Employability	Different eco-friendly farming systems- biological farming, natural farming, regenerative agriculture – permaculture - biodynamic farming	Entrepreneurship	Green manures- bio fertilisers – types, methods of application – benefits and limitations. Nutrient use in organic farming- scope and limitations
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## Syllabus: “ **Organic farming** ”

**Unit 1:-** Organic farming – definition – need – scope – principles – characteristics relevance to modern agriculture. Effects of chemical dependent farming on yield and soil health.

**Unit 2:-** Different eco-friendly farming systems- biological farming, natural farming, regenerative agriculture – permaculture - biodynamic farming.

**Unit 3:-** - Composting: Definition, types of compost, farm yard compost, green leaf compost, vermi composting material, species of earthworms,. Vermicompostings, harvesting, processing and drying. Nutrient content of vermicompost. Field application methods.

**Unit 4:-** Green manures- bio fertilisers – types, methods of application – benefits and limitations.. Structure and characteristic features of bacterial bio fertilizers- *Azospirillum*, *Azotobacter*, *Bacillus*, *Pseudomonas*, *Rhizobium* and *Frankia*. Cyanobacterial biofertilizers- *Anabaena*, *Nostoc*, *Hapalosiphon* and fungal biofertilizers- AM mycorrhiza and ectomycorrhiza.

**Unit 5:-**Choice of crops and varieties in organic farming – crop rotations – need and 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. Organic farming process. Organic fertilizers, crop nutrients and effective microorganisms in Organic farming.

<b>Unit No:</b>	<b>Additional input:</b>	<b>Deletion</b>	<b>Justification</b>
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		



## 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

	<b>Government College (Autonomous) Rajahmundry</b> <b>Department Of Biotechnology</b>	
	<b>Subject : AgroBiotechnology</b>	<b>Program : AgroBBC</b>
<b>B.Sc.-IIIyr</b> <b>Semester-5/6</b> <b>Paper- 6B</b>	<b>Title of Course</b> <b>“ Organic farming ”</b> <b>Course Code :BTL156</b> <b>Semester End Exam (2022-23)</b>	
<b>Time : 2 1/2 Hrs</b>	<b>Blue Print of Question Paper</b>	<b>Marks : 50</b>

**Part – A**

**I. Essay questions: answer any 3 : 3 X 10 = 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
- Question 6 from additional input

**Part-B**

**II. Short answer questions : Answer 4 Questions 4x5 = 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**
- **Question 12: Paper setter's choice**
- **Question 13: Paper setter's choice**
- **Question 14: Paper setter's choice**



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

**Subject :AgroBiotechnology**

**Program:AgroBBC**

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

**Title of Course  
“ Organic farming ”  
Course Code : BTL156  
Semester End Exam (2022-23)**

**Time : 2 1/2 Hrs**

**Model Question Paper**

**Marks : 50**

**Part – A**

**Essay questions:**

**answer any 3**

**3X 10 = 30 M**

1. Write about effects of chemical farming on yield and soil health. (I)
2. Write an essay on regenerative agriculture.(II)
3. Write an essay on vermicomposting. (III)
4. Write the benefits and limitations of using biofertilizers.(IV)
5. Write about needs and benefits of organic farming.(V)
6. Write in detail about mechanism of nitrogen fixation and phosphate solubilisation (Additional Input)

**Part- B**

**Answer any 4 questions**

**4x 5 = 20 M**

7. Organic farming
8. Regenerative agriculture
9. Fortification
10. Green manures
11. Nutrient management in organic farming.
12. Paper Setters Choice
13. Paper Setters Choice
14. Paper Setting Choice



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

<b>Practical Syllabus  Paper-6B</b>	<b>Subject : AgroBiotechnology</b>	<b>Stream : B.Sc.</b>			
	<b>Title of Course  “ Organic farming ”-Lab  Course Code: BTL156P</b>	<b>Program : AgroBBC  Year-III  Semester : 5 / 6</b>			
	Total Hours – 30hrs ; Per Week -2hrs	<b>L</b> Lect ures	<b>T</b> Tuto rial	<b>P</b> Practical	<b>C</b> Credits
Pre-requisites:	Basic knowledge about organic farming technique.	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 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**

**Program : AgroBBC**

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

**Title of Course**  
**“ Organic Farming - Lab ”**  
**Course code: BTL156P**

**Semester End Exam (2022-23)**

**Time : 3Hrs**

**Practical - Model Question Paper**

**Credits : 1**

**Marks : 50**

- |   |      |
|---|------|
| 1.Major experiment.<br>Estimate the pH of soil in given sample ‘A’            | 15M  |
| 2.Minor experiment.<br>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**

<b>Theory Paper - 7B</b>	<b>Subject : AgroBiotechnology</b>	<b>Stream : B.Sc .</b>			
	<b>Title of the Course</b>  Bio fertilizers and Bio pesticides production  <b>Course Code: BTL205</b>	<b>Program :AgroBBC</b>  <b>Year -III</b>  <b>Semester : 5 /6</b>			
	Total Hours Allocated - 60 ; Per Week -4 hrs	<b>L</b> Lect ure	<b>T</b> Tutori al	<b>P</b> Pract ical	<b>C</b> 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 &amp; interactions, factors affecting biogas production,</p> <p>Industrially important microbes, its screening, selection and identification</p>	<p>Employability</p>	<p>air pollution &amp; 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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## Syllabus : Bio fertilizers and Bio pesticides production

### 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* as 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		

## 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 K. Sharma
4. Advances In Plant Biopesticides 2021, by Dwijendra Singh, Springer India
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**

**Program :AgroBBC**

**B.Sc.-IIIyr**  
**Semester-5/6**  
**Paper- 7B**

**Title of Course**  
**“ Bio fertilizers and Bio pesticides production”**  
**Course Code :BTL205**  
**Semester End Exam (2022-23)**

**Time : 2 1/2 Hrs**

**Blue Print of Question Paper**

**Marks : 50**

**Part – A**

**I. Essay questions : answer any 3 : 3 X 10 =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**

➤ **Question 6 from additional input**

**Part-B**

**II. Short answer questions : Answer any 4 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**

➤ **Question 12 : Paper setter's choice**

➤ **Question 13 : Paper setter's choice**

➤ **Question 14 :Paper setter's choice**



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

**Subject : AgroBiotechnology**

**Program : AgroBBC**

**B.Sc.-IIIyr  
Semester-5/6  
Paper- 7B**

**Title of Course  
“ Bio fertilizers and Bio pesticides production ”  
Course Code : BTL205  
Semester End Exam (2022-23)**

**Time : 2 1/2 Hrs**

**Model Question Paper**

**Marks : 50**

**Part – A**

**I. Essay questions : answer any 3 : 3 X 10 = 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* biocontrol agents (III)
4. Discuss in detail about mass production and packing techniques(IV)
5. Write about different field application techniques(V)
6. Write an essay on storage and maintenance of inoculum (Additional Input)

**Part-B**

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

7. Bacterial biofertilizers-I
8. Micorrhiza-II
9. *Bacillus thuringiensis*-III
10. Microbiological media -IV
11. Storage of inoculum-V
12. Paper setter's choice
13. Paper setter's choice
14. Paper setter's choice



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

<b>Practical Syllabus Paper-7B</b>	<b>Subject : AgroBiotechnology</b>	<b>Stream: B.Sc</b>			
	<b>Title of Course “ Bio fertilizers and Bio pesticides production ”-Lab Course Code: BTL205 P</b>	<b>Program : AgroBBC Year-III Semster : 5 / 6</b>			
	Total Hours – 30hrs ; Per Week -2hrs	<b>L</b> Lect ures	<b>T</b> Tuto rial	<b>P</b> Practical	<b>C</b> Credits
<b>Pre-requisites:</b>	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

Referencebooks:  
Virtual LabLinks:



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

**Subject : AgroBiotechnology**

**Program : AgroBBC**

**B.Sc.-IIIyr  
Semester-5/6  
Paper- 7B**

**Title of Course  
“ Bio fertilizers and Bio pesticides production ”-Lab  
Course code: BTL205P  
Semester End Exam (2022-23)**

**Time : 3Hrs**

**Practical - Model Question Paper**

**Credits : 1 Marks : 50**

Major Question :

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

Minor Question :

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

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Total = 50M  
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**Government College (Autonomous) Rajahmundry  
Department Of Biotechnology**

<b>Theory Paper - 6C</b>	<b>Domain Subject : AgroBiotechnology</b>	<b>Stream : B.Sc</b>			
	<p align="center"><b>Title of the Course</b>  <b>“ Vegetable Science ”</b></p> <p align="center"><b>Course Code: BTL143</b></p> <p align="center">( Skill Enhancement Course (Elective), 05 Credits)</p>	<b>Program : AGROBBC</b>  <b>Year -III</b>  <b>Semester : 5</b>			
	Total Hours Allocated - 60 ; Per Week -4 hrs	<b>L</b> Lect ure	<b>T</b> Tutori al	<b>P</b> Pract ical	<b>C</b> Credits
<b>Pre-requisites:</b>	➤ 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-

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

**Course with focus on employability / entrepreneurship / Skill Development modules**

Skill Development	<p><b>Breeding of vegetable crops</b> breeding methods (introduction, selection, hybridization, mutation), varieties and varietal characterization, biotechnology and their use in breeding in vegetable crops</p>	Employability	<p><b>Production technology of cool season vegetable Crops</b> seed production of: Tomato, eggplant, hot and Okra, beans</p>	Entrepreneurship	<p><b>Seedproduction:</b> 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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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  
Suggested books:

1. Vegetable crops by T.R.GOPALAKRISHNAN

2. **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 syllabus  
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: 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 syllabus  
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: <b>BTL143P</b>	<b>SUBJECT : Biotechnology</b>	<b>Program &amp; Semester</b>  <b>III B.Sc.</b> <b>AgroBBC(VSem)</b>			
	<b>TITLE OF THE COURSE</b> <b>Vegetable Science</b>				
Teaching	Total Hours Allocated :30(Lab)	L	T	P	C
Pre-requisites:	➤ Basic knowledge about vegetable science			2	2

### 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) Rajahmundry  
Department Of Biotechnology**

Theory Paper - 7C	<b>Subject : AgroBiotechnology</b>	<b>Program : B. Sc</b> <b>Group : Agro BBC</b> <b>Year -III</b> <b>Semester : 5</b>			
	<b>Title of the Course</b> <b>“ Plant and Environmental Biotechnology”</b> <b>Course Code: BTL208</b>				
	Total Hours Allocated - 60 ; Per Week -4 hrs	<b>L</b> Lecture	<b>T</b> Tutorial	<b>P</b> Practical	<b>C</b> Credits
Pre-requisites:	<ul style="list-style-type: none"> <li>➤ Various Causes of Environmental pollution</li> <li>➤ Knowledge about General features of microbes</li> </ul>	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.

Skill Development		Employability		Entrepreneurship	
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## Syllabus: “ Plant and Environment Biotechnology”

### 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: 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 IV: 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 V: Biofuels:

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

Additional Input		and Assignment	
UNIT NO:	Additional Input	Deletion	Justification
1	Multipotent Vs Totipotent		
2	Hairy root features of Ri plasmid		
3	Measurement of water pollution		
4	Biodegradable products		
5	Biofertilizers,.		

## 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, Agrabios (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/](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](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](https://www.srmist.edu.in/engineering/departments-of-biotechnology/environmental)

## CO-PO Mapping:

(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



	<b>Government College (Autonomous) Rajahmundry</b> <b>Department Of Biotechnology</b>	
	<b>Subject : AgroBiotechnology</b>	<b>Group : AgroBBC</b>
<b>B.Sc.-IIIyr</b> <b>Semester-5</b> <b>Paper- 7C</b>	<b>Title of Course</b> <b>“Plant and Environmental Biotechnology ”</b> <b>Course Code :BTL208</b> <b>Semester End Exam (2022-23)</b> <small>Max.Marks: 50</small>	
<b>Time : 2 1/2 Hrs</b>	<b>Blue Print of Question Paper</b>	<b>Marks : 50</b>

**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

	<b>Government College (Autonomous) Rajahmundry</b> <b>Department Of Biotechnology</b>	
	<b>Subject : AgroBiotechnology</b>	<b>Group :AgroBBC</b>
<b>B.Sc.-Ilyr</b> <b>Semester-5</b> <b>Paper- 7C</b>	<b>Title of Course .</b> <b>“Plant and Environmental Biotechnology”</b> <b>Course Code : BTL208</b> <b>Semester End Exam (2022-23)</b>	
<b>Time : 2 1/2 Hrs</b>	<b>Model Question Paper</b>	<b>Marks : 50</b>

**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**

<b>Practical Syllabus  Paper-7C</b>	<b>Subject : AgroBiotechnology</b>	<b>Program : B.Sc</b>			
	<b>Title of Course</b>  <b>“ Plant and Environmental Biotechnology ”-Lab</b>  <b>Course Code: BTL208P</b>	<b>Group : AgroBBC</b>  <b>Year-II</b>  <b>Semester : 5</b>			
	<b>Total Hours – 30hrs ; Per Week -2hrs</b>	<b>L</b> Lect ures	<b>T</b> Tuto rial	<b>P</b> Practical	<b>C</b> Credits
<b>Pre-requisites:</b>	Volumetric Titrations  Knowledge about handling and growing microbes .	0	0	2	1

**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  $\alpha$  – 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 : AgroBiotechnology**

**Group : AgroBBC**

**B.Sc.-IIyr  
Semester-5  
Paper- 7C**

**Title of Course  
“ Plant and Environmental Biotechnology ”  
Course code: BTL208P  
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   |

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50M  
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## Course wise -Unit Wise- Assignment questions topics.

**Government College (Autonomous) Rajamahendravaram**

**Department Of Biotechnology**

**Stream : B. Sc. ; Program: AgroBBC ; Subject : AgroBiotechnology**

**Academic Year 2022-2023**

### Paper -1 : Sem-1 ; Elements Of Biotechnology

Unit No:	Additional Input : Topics		
Unit 1	Principle and description of microscopes- compound, phase contrast, fluorescent electron microscopy (TEM, SEM). Classification of bacteria based on morphology, nutrition and environment.,		
Unit 2	<b>.Additional Input :</b> cell signaling and communication, DNA damage and repair , Regulation of gene expression in prokaryotes Lac operon concept.		
Unit 3	<b>Additional Input :</b> Electron-Transport System and Oxidative Phosphorylation , Laser techniques - crystallography and applications in biology. <b>Analytical techniques</b> Spectroscopy-Colorimetry,		
Unit 4	<b>Additional Input :</b> Recessive and Dominant epistatic gene interaction , gene and environment , The Hap Map Project. Mutations and instability of human DNA (From pedigree to molecular pathology) Animal Models for Human Diseases		
Unit 5	<b>Additional Input :</b> MHC., Outlines of Hypersensitivity and Autoimmunity. <b>Additional Input :</b> Introduction to DNA sequencing (Sanger Sequencing) and Site-directed Mutagenesis		

### Paper -2 ; Sem-2 ; Advanced Biotechnology

Unit 1	Additional : Routes of nanomaterials entry in to the body- gastrointestinal tract, skin, lungs, toxic mechanisms, health and environmental implications of nanoparticles		
Unit 2	<b>.Additional Input :</b> cryopreservation, Plant secondary metabolites concept and their importance, and Molecular markers:		

	Transfection methods (calcium phosphate precipitation, electroporation, Microinjection) and applications. & Gene Therapy: Recombinant DNA products , IVF, Concept of Gene therapy, Concept of transgenic animals -Ethical issues in animal biotechnology.		
Unit 3	Biodegradation and Bioremediation: Degradation of pesticides and other toxic chemicals. Genetically Engineered microbes, Phytoremediation, , environmental safety guidelines. Biofuels, Biofertilizers, Vermiculture		
Unit 4	international organizations, agencies and treaties. Infringement of intellectual property rights.		
Unit 5	nucleotide and protein BLAST analysis, CLustal W and phylogenetic tree construction.Introduction to omics (proteomics, genomics and transcriptomics).		
<b>Paper-3 ; Sem -3 ; Hydroponics Cultivation</b>			
Unit 1	Soilless culture Applications & future developments		
Unit 2	pH and TDS Functions and effect on plants		
Unit 3	Weed management		
Unit 4	Hydroponics Vs Aeroponics		
Unit 5	measurements of yield.		
<b>Sem 4 ; Paper 4 ; Techniques in nursery development</b>			
Unit 1	Information on local Nurseries .		
Unit 2	Precautions and maintenance of nursery beds		
Unit 3	Different techniques of vegetative propagation.		
Unit 4	Identification of pests and diseases		
Unit 5	Applications.of grafting		
<b>Sem 4 ; Paper -5 ; Crop Improvement Technology</b>			
Unit 1	History – Scientists of plant tissue culture		
Unit 2	Synthetic seeds and its applications		
Unit 3	Cryo preservation		
Unit 4	Ti Plasmid		
Unit 5	Marker assisted selection for crop improvement.		
<b>Sem 5 ; Paper 6B; Organic farming</b>			

Unit 1	Nutrient use in organic farming-scope and limitations		
Unit 2	Organic nutrient sources and their fortification – organic manures		
Unit 3	Small scale, large scale composting process		
Unit 4	Mechanism of nitrogen fixation and phosphorus solubilization.		
Unit 5	Nutrient management in organic farming		
<b>Sem 5 ; Paper 7B; Bio fertilizers and Bio pesticides production</b>			
Unit 1	History, concept, scope of bio fertilizers in India		
Unit 2	Consortium based inoculums and significance		
Unit 3	Concept, history, scope and importance of biopesticides		
Unit 4	Media, types, preparation. Methods of isolation, streak plate, spread plate and pour plate techniques		
Unit 5	Storage and maintenance of inoculum		

## Course wise -Unit Wise- Addition / Deletion of topics.

Government College (Autonomous) Rajamahendravaram

Department Of Biotechnology

Stream : B. Sc. ; Program: AgroBBC ; Subject : AgroBiotechnology

Academic Year 2022-2023

### Paper -1 : Sem-1 ; Elements Of Biotechnology

Unit No:	Additional Input : Topics	Deleted Topics	Justification
Unit 1	Principle and description of microscopes- compound, phase contrast, fluorescent electron microscopy (TEM, SEM). Classification of bacteria based on morphology, nutrition and environment.,		
Unit 2	<b>.Additional Input :</b> cell signaling and communication, DNA damage and repair , Regulation of gene expression in prokaryotes Lac operon concept.		46
Unit 3	<b>Additional Input :</b> Electron-Transport System and Oxidative Phosphorylation , Laser techniques - crystallography and applications in biology. <b>Analytical techniques</b> Spectroscopy-Colorimetry,		
Unit 4	<b>Additional Input :</b> Recessive and Dominant epispastic gene interaction , gene and environment , The Hap Map Project. Mutations and instability of human DNA (From pedigree to molecular pathology) Animal Models for Human Diseases		
Unit 5	<b>Additional Input :</b> MHC., Outlines of Hypersensitivity and Autoimmunity. <b>Additional Input :</b> Introduction to DNA sequencing (Sanger Sequencing) and Site-directed Mutagenesis		



<b>Paper -2 ; Sem-2 ; Advanced Biotechnology</b>			
Unit 1	Additional : Routes of nanomaterials entry in to the body- gastrointestinal tract, skin, lungs, toxic mechanisms, health and environmental implications of nanoparticles		
Unit 2	<b>.Additional Input :</b> cryopreservation, Plant secondary metabolites-concept and their importance, and Molecular markers: Transfection methods (calcium phosphate precipitation, electroporation, Microinjection) and applications. & Gene Therapy: Recombinant DNA products , IVF, Concept of Gene therapy, Concept of transgenic animals -Ethical issues in animal biotechnology.		46
Unit 3	Biodegradation and Bioremediation: Degradation of pesticides and other toxic chemicals. Genetically Engineered microbes, Phytoremediation, , environmental safety guidelines. Biofuels, Biofertilizers, Vermiculture		
Unit 4	international organizations, agencies and treaties. Infringement of intellectual property rights.		
Unit 5	nucleotide and protein BLAST analysis, CLustal W and phylogenetic tree construction.Introduction to omics (proteomics, genomics and transcriptomics).		
<b>Paper-3 ; Sem -3 ; Hydroponics Cultivation</b>			
Unit 1	Soilless culture Applications & future developments	Terminology	
Unit 2	pH and TDS Functions and effect on plants		
Unit 3	Weed management		
Unit 4	Hydroponics Vs Aeroponics		
Unit 5	measurements of yield.		
<b>Sem 4 ; Paper 4 ; Techniques in nursery development</b>			
Unit 1	Information on local Nurseries .		
Unit 2	Precautions and maintenance of nursery beds		
Unit 3	Different techniques of vegetative propagation.		
Unit 4	Identification of pests and diseases		
Unit 5	Applications.of grafting		

<b>Sem 4 ; Paper -5 ; Crop Improvement Technology</b>			
Unit 1	History – Scientists of plant tissue culture		
Unit 2	Synthetic seeds and its applications		
Unit 3	Cryo preservation		
Unit 4	Ti Plasmid		
Unit 5	Marker assisted selection for crop improvement.		
<b>Sem 5 ; Paper 6B; Organic farming</b>			
Unit 1	Nutrient use in organic farming-scope and limitations		
Unit 2	Organic nutrient sources and their fortification – organic manures		
Unit 3	Small scale, large scale composting process		
Unit 4	Mechanism of nitrogen fixation and phosphorus solubilization.		
Unit 5	Nutrient management in organic farming		
<b>Sem 5 ; Paper 7B; Bio fertilizers and Bio pesticides production</b>			
Unit 1	History, concept, scope of bio fertilizers in India		
Unit 2	Consortium based inoculums and significance		
Unit 3	Concept, history, scope and importance of biopesticides		
Unit 4	Media, types, preparation. Methods of isolation, streak plate, spread plate and pour plate techniques		
Unit 5	Storage and maintenance of inoculum		

**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	
<b>Pedagogical Strategies</b>				
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
<b>TOTAL</b>				<b>50</b>

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
	<b>TOTAL</b>	<b>20marks</b>

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)**



**CBCS CURRICULAR FRAME WORK(2020-21ONWARDS)-BACHELOR OF SCIENCES**

Subjects		SEMI		SEM II		SEM III	SEMIV		SEM V		SEMVI	
		Hrs/W	Credi ts	Hrs/W	Credi ts	Credi ts	Hrs / W	Credi t s	Hrs/W	Credi ts	Hr s/W	Credits
<b>Languages</b>												
English		4	3	4	3	3						
Language (H/T/S)		4	3	4	3	3						
Life Skill Courses		2	2	2	2	2+2						
Skill Development Courses		2	2	2+2	2+2	2						
Major1	Core1,2,3,&4	4+2	4+1	4+2	4+1	4+1	4+2	4+1				
Major2	Core1,2,3,&4	4+2	4+1	4+2	4+1	4+1	4+2	4+1				
Major3	Core1,2,3,&4	4+2	4+1	4+2	4+1	4+1	4+2	4+1				
Major1	Core-5						4+2	4+1				
Major2	Core-5						4+2	4+1				
Major3	Core-5						4+2	4+1				
Major 1	Skill Enhancement Courses(6&7)								4+2	4+1		
									4+2	4+1		
Major 2	Skill Enhancement Courses(6&7)								4+2	4+1		
									4+2	4+1		
Major 3	Skill Skill Enhancement Courses(6&7)								4+2	4+1		
									4+2	4+1		

**THIRD PHASE of APPRENTICESHIP**

Entire 5th / 6<sup>th</sup> Semester

**FIRST and SECONDPHASES (2 spells)**

**of APPRENTICESHIP**

between 1<sup>st</sup> and 2<sup>nd</sup> year

**And**

between 2<sup>nd</sup> and 3<sup>rd</sup> Year

**(two Summer vacations).**



# **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**  
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**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**

<b>UNIT</b>	<b>Essay</b>
Unit – I	2
Unit – II	2
Unit – III	2
Unit – IV	2

**Government College (A), Rajamahendravaram**  
**Department of Biotechnology**  
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**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**

- |   |         |
|---|---------|
| 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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