

Government College(Autonomous) Rajamahendravaram

Accredited“A⁺”Grade by NAAC

Department of Biotechnology



Syllabus for Courses Offered

B.Sc.,Biotechnology and Agro Biotechnology

under CBCS (Choice Based Credit System)

Programs : BBC(2209) and Agro BBC(2211)

Approved by Board Of Studies

(2021-2022)

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- ✓ **Composition of BOS Members**
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- ✓ **Addition/deletion of specific topics from the syllabus in each course(paper) with justification.**
- ✓ **Syllabus for each course (both theory & practicals) followed by model question papers.**

Proceedings of the Principal, Government College (Autonomous), Rajahmundry

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

Re. No: Spl./Acad.Cell-GC[A]-RJY/BOS/2021-1, Dated: 13 September 2021

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

Ref:- UGC Guidelines for Autonomous Colleges - 2018.

ORDER:

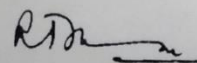
The Principal, Government College (Autonomous), Rajahmundry is pleased to constitute **Board of studies in BIOTECHNOLOGY** for framing the syllabi in Biotechnology subject for all semesters duly following the norms of the UGC Autonomous guidelines.

S. No	Name	Designation
1	Dr. K. Vasudha, Lecturer In- Charge/HoD, Department of Biotechnology, GC[A], Rajahmundry	Chairman
2	All Faculty members in the department	Member
3	Sri K. Suresh Babu, ABN College, Kovuru, WGDt.	Subject Expert
4	Sri G. Sam Babu, Sri Y.N.College [A], Narsapur DNR College, Bheemavaram	Subject Expert
5	Dr. D. Kalyani, Dept. of Zoology, UCST, ANUR	University Nominee
6	Dr. K. Sarala, Principal Scientist, Crop Improvement Division, CTRI, Rajahmundry	Expert from Industry/Corporate Sector
7	Ms. D. Sandhya Devi	Student Nominee

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

- Prepare syllabi for the subject keeping in view the objectives of the college, interest of the stake holders and national requirement for consideration and approval of the Academic Council
- Suggest methodologies for innovate teaching and evaluation techniques
- Suggest panel of names to the Academic council for appointment of examiners
- Coordinate research, teaching, extension and other activities in the department of the college.

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



PRINCIPAL
GOVERNMENT COLLEGE [A]
RAJAHMUNDRY

Department Of Biotechnology: Allocation of credits

Semester	Paper	Title of course	Hrs per week	Marks			Credits	Course code
				CIA	SEE	Total		
1	1	Biomolecules, bioenergetics & Analytical Techniques	4	50	50	100	4	BTL149
1	1	Biomolecules, bioenergetics & Analytical Techniques lab	2	-	50	50	1	BTL149P
2	2	Microbiology, Cell and Molecular Biology	4	50	50	100	4	BTL150
2	2	Microbiology, Cell and Molecular Biology lab	2	-	50	50	1	BTL150P
3	3	Immunology and rDNA technology	4	50	50	100	4	BTL124
3	3	Immunology and rDNA technology lab	2	-	50	50	1	BTL124P
4	4	Plant and animal biotechnology	4	50	50	100	4	BTL123
4	4	Plant and animal biotechnology lab	4	-	50	50	1	BTL123P
4	5	Environment and Industrial biotechnology	4	50	50	100	4	BTL153
4	5	Environment and Industrial biotechnology lab	2	-	50	50	1	BTL153P
5	5	Genetics and Molecular Biology	3	50	50	100	3	BTL125
5	5	Genetics and Molecular Biology lab	3	-	50	50	2	BTL125P
5	6	Gene Expression and rDNA Technology	3	50	50	100	3	BTL 126
5	6	Gene Expression and rDNA Technology lab	3	-	50	50	2	BTL126P
6	7 A	Developmental Biology	4	50	50	100	3	BTL127
6	7 A	Developmental Biology Lab	3	-	50	50	2	BTL127P
6	7 B	Ecology	4	50	50	100	3	BTL128
6	7 B	Ecology Lab	3	-	50	100	2	BTL128P

Semester	Paper	Title of course	Hrs per week	Marks			Credits	Course code
				CIA	SEE	Total		
6	7C	Biostatistics, bioinformatics and IPRS	4	50	50	100	3	BTL118
6	7C	Biostatistics, bioinformatics and IPRS Lab	3	-	50	50	2	BTL118P
6	8A1	Plant Physiology	4	50	50	100	3	BTL117
	8A2	Animal Physiology	4	50	50	100	3	BTL122
	8A3	Inheritance Biology	4	50	50	100	3	BTL131
6	8A1	Plant Physiology Lab	3	-	50	50	2	BTL117P BTL122P BTL131P
	8A2	Animal Physiology Lab	3	-	50	50	2	
	8A3	Project	3	-	50	50	2	
6	8B1	Diversity in Life	4	50	50	100	3	BTL129 BTL130 BTL131
	8B2	Evolution	4	50	50	100	3	
	8B3	Project	4	50	50	100	3	
6	8B1	Diversity in LifeLab	3	-	50	50	2	BTL129P BTL130P BTL131P
	8B2	Evolution Lab	3	-	50	50	2	
	8B3	Project	3	-	50	50	2	
6	8C1	Plant Biotechnology and Animal Biotechnology	4	50	50	100	3	BTL132
	8C2	Environmental & Industrial Biotechnology	4	50	50	100	3	BTL145
	8C3	Medical nano biotechnology	4	50	50	100	3	BTL 146
6	8C1	Plant Biotechnology and Animal Biotechnology Lab	3	--	50	50	2	BTL132P
	8C2	Environmental & Industrial Biotechnology Lab	3	--	50	50	2	BTL145P
	8C3	Project	3	--	50	50	2	BTL 131P

Certificate & Diploma Courses offered by College

As per the college Governing Body resolution dated 22 May 2017, Certificate Course is made mandatory for all 1st Year students admitted batch 2017-18 onwards. The Student may join any one of the Skill development /Certificate courses offered by the college

Details of certificate courses offered by various departments

S.No	Name of the Department	Proposed Certificate Course	Duration
1.	Biotechnology	Biophysical and Microbiological Techniques	60Hours
2.	English	Domestic Business Process Outsourcing(BPO)	60Hours
3.	Chemistry	Chemical Lab Technician	60Hours
4.	Microbiology	Clinical Health Science	60Hours
5.	Fine Arts	Kuchupudi (Dance)	60Hours
6.	Commerce	Direct Tax Procedures and Practices	60Hours
7.	Commerce	Financial Education	60Hours
8.	Commerce	Fundament of Management	60Hours
9.	ComputerScience &Applications	Desktop Publishing(DTP)	60Hours
10.	English	Functional English	60Hours
11.	Telugu	Functional Telugu	60Hours
12.	Philosophy	Gandhian Studies	60Hours
13.	Physics	Household writing	60Hours
14.	Politicalscience	Journalism & mass communication	60Hours

S.No	Name of the Department	Proposed Certificate Course	Duration
15.	Fine Arts	Carnatic (Music)	60Hours
16.	Economics	Office Management	60Hours
17.	Physics	Photography	60Hours
18.	Botany	Plant Propagation and Nursery Management	60Hours
19.	History	Tourism and Travel Management	60Hours
20.	Zoology	Vermin Compost	60Hours
20.	Fine Arts	Yoga	60Hours
21.	Telugu	Functional Telugu	60Hours
22.	TISS	Analytical Skills	60Hours
23.	TISS	Communication Skills	60Hours
24.	TISS	Digital Literacy	60Hours
25.	TISS	Youth Leadership and People Skills	60Hours
26.	TISS	Introduction to Entrepreneurship	60Hours
27.	TISS	Financial Literacy	60Hours

Government College (Autonomous), Rajahmundry

Department Of Biotechnology

Syllabus up gradation meeting 2021 -2022

DATE: 16/09/2021

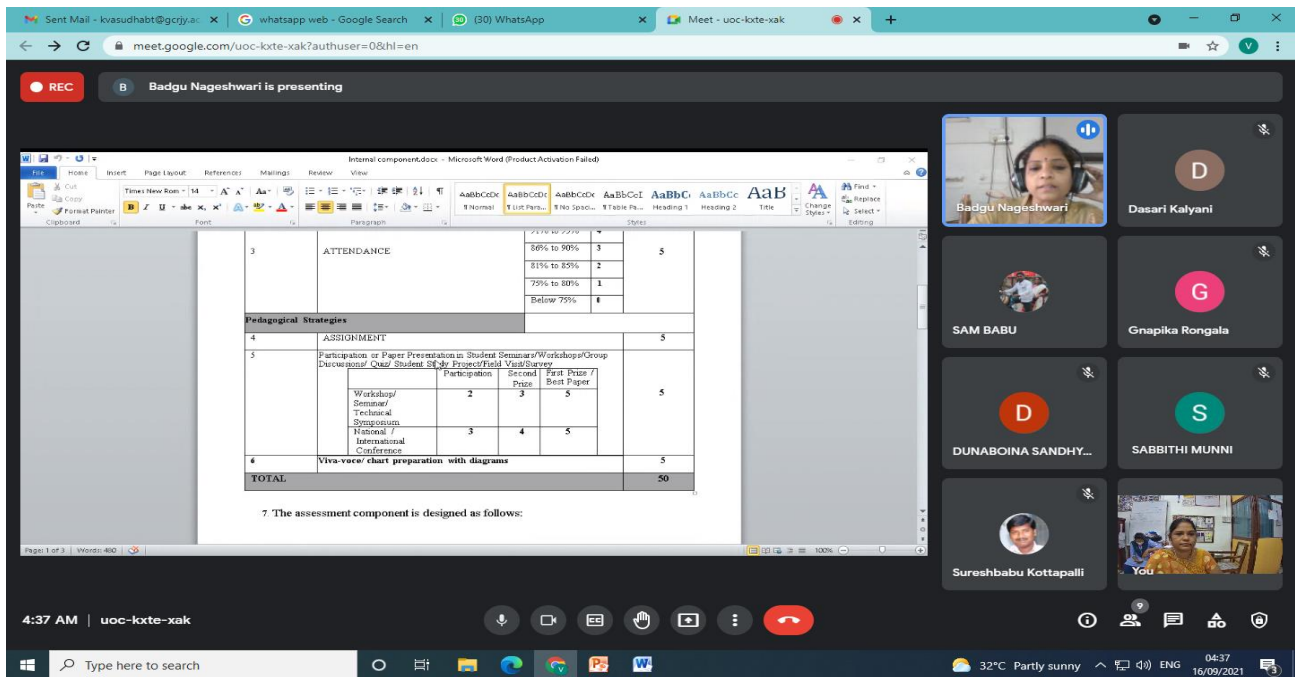
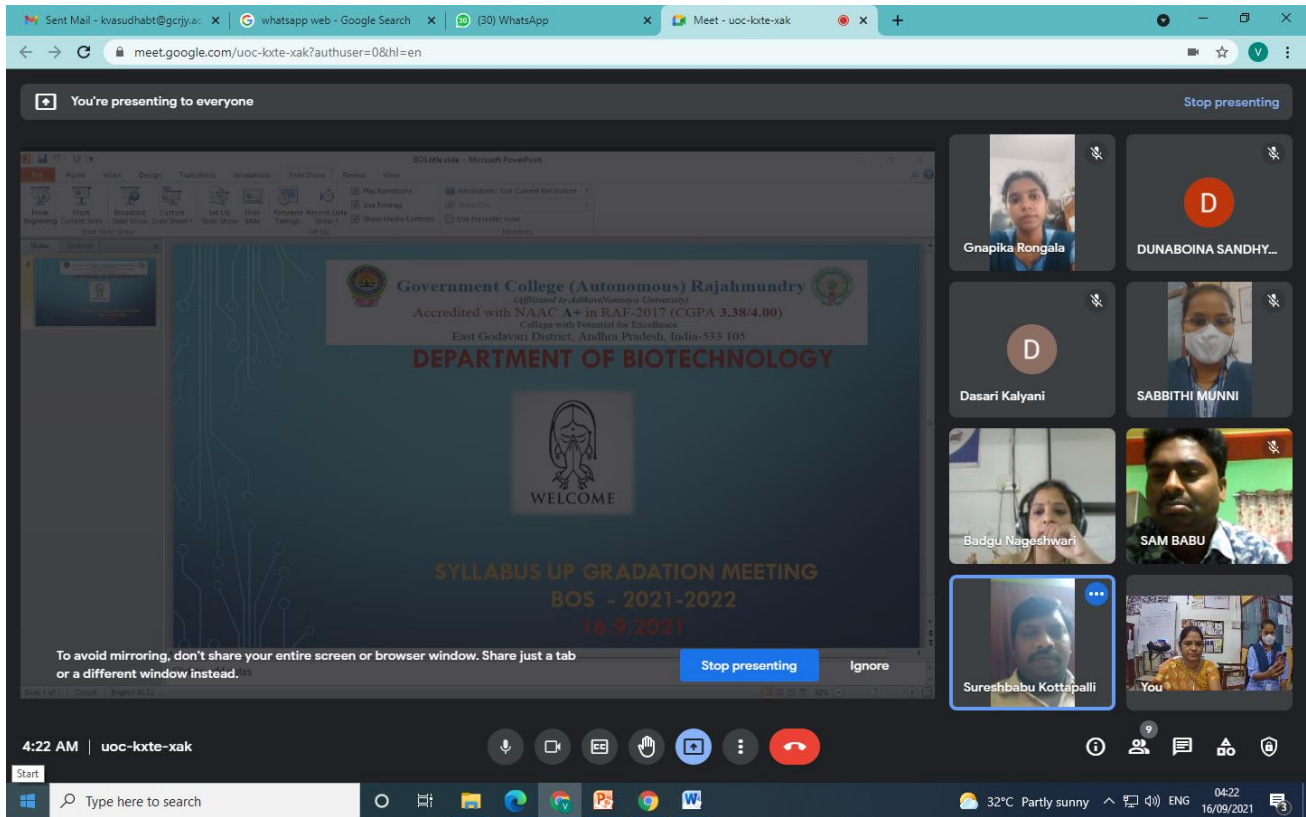
TIME: 04:00 P.M

Agenda

To discuss, consider and approve academic matters i.e.

- To review and adopt the new curricular framework suggested by APSICHE
- To review and revise I,II, III & IV Semesters syllabus as per APSICHE Guidelines
- To review, update and approve the content of courses for all the Semesters.
 - (a) Semester - 1 : Theory and lab
 - (b) Semester – 2 : Theory and lab
 - (c) Semester – 3 : Theory and lab
 - (d) Semester – 4 : Theory and lab
 - (e) Semester – 5 : Theory and lab
 - (f) Semester – 6 : Theory and lab
- Regarding approval of model question papers and blue print
- **About blended learning:** Consideration to deliver 40 % of syllabus content Online and 60 % of syllabus content to be delivered offline in view of pandemic conditions.
- About internal and external assessments
- Projects to be carried out in semester 5 and 6. Work Presentation and thesis submission during practical examination in the 6th semester.
- Compulsory online internal assessment for 10 marks
- Other Pedagogy techniques for internal assessment (power point presentation / attendance / written test / assignment)
- To invite suggestions / recommendations by the statutory body pertaining to research, teaching, extension and other academic activities in the Department / College.
- Any other inputs invited by the statutory body that needs to be incorporated for strengthening the curricular, co curricular and extracurricular activities.

Members of BOS attended for virtual syllabus up gradation meeting through Google meet on 16.09.2021at 4PM



Syllabus up gradation meeting proceedings: Presentation of agenda, syllabus, blueprint and Model question papers on 16.09.2021at 4PM

Allocation of Internal component to I and II yrs.

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

7. The assessment component is designed as follows:

For III year students (CBCS pattern) Theory examination:

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

For I and II year students (CBCS pattern) Theory examination:

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

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

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

➤ External practical exam at the end of 2th, 4th, and 6th semester each for - 50marks.

9. 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** from 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.

Pedagogical Techniques

- 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
- P_T – 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.**

Government College (Autonomous), Rajamahendravaram

Department of Biotechnology

Resolutions approved by Board of Studies (2021-22)

Due to pandemic conditions of corona infection, with the orders of Principal, the syllabus up gradation meeting was held in virtual mode through Google meet on 16.03.2021 at 4PM. The members present discussed various aspects of the UG Biotechnology Syllabi, Model Question Papers of both Theory and Practical for three year B.Sc., degree program in Biotechnology that is to be implemented for the academic year 2021-2022 and resolved the following.

RESOLUTIONS

1. It is resolved to implement the new CBCS CURRICULAR FRAMEWORK (2021-22 ONWARDS) for the I and II year students. The teaching, learning and evaluation procedure was designed according to the frame work.
2. It is resolved to design the new curriculum for I, II and III year B.Sc., Biotechnology based On
 - Employability opportunities, skill development component, entrepreneurship and feedback from stakeholders.
 - Keeping in view local industry needs / local advantage
 - To encourage research oriented thinking,
 - To enable students to clear entrance exams for pursuing higher studies
3. In view of pandemic condition and as per UGC guidelines it is resolved to conduct the class work in blended learning mode i.e., online : offline learning
4. It is resolved to introduce new courses for IYr from AY 2021-22. The titles of the courses are

For Sem III : Immunology and rDNA technology

For Sem IV : Plant biotechnology and animal Biotechnology (course 4)

Environmental and industrial biotechnology (course 5)

5. The members of BOS has recommended that to complete removal of Biostatistics unit from Sem-I syllabus as it is not sufficient to be fit as unit and suggested that keep it as a skill paper.
6. It is recommended by BOS members that in sem-II the title of unit II is not appropriate hence unit name changed to Bacteria and Viruses.
7. Electives are offered in the 6 semester and the guidelines being followed are:
 - a. Papers 7 and 8 will be electives for any domain subject and both these papers will be offered in the same semester (6) of the final year.
 - b. Paper –7, a student will choose any one from three electives offered by each domain subject. The student of program BBC will study one Elective each from Biotechnology, Botany and Chemistry as individual Elective paper.
8. It has been resolved that IPR is a general topic and hence it is included in biostatistics paper.
9. Cluster electives are offered as Paper–8, the student will study all the three papers of an elective as a cluster from only one of the three domain subjects. For example, as paper-8, a student of program BBC may pursue all the three papers belonging to either Biotechnology alone or Botany alone or Chemistry alone. 3 Alternate clusters of Electives for each domain subject are offered, i.e., if the student chooses Biotechnology for cluster the student has the choice to elect cluster -1(8A1, 8A2, 8A3) Or cluster -2 (8B1, 8B2, 8B3) or cluster-3 (8C1, C2, C3). The list of Electives and cluster Electives for the domain subject Biotechnology, along with their syllabi (i.e., for papers 7 & 8) have been enclosed in this book.
10. It is resolved to submit a project report at the end of the 6th semester for Final year students and the marks allocated for project are 50M and total credits: 02.
11. It is resolved to include important topics as additional input in each course for I, II and III- B.Sc., biotechnology syllabus.

12. It is resolved to approve the list of paper setters and examiners given in the format.

13. It is resolved to adapt new pattern of weightage of marks in theory for B.Sc.- I and II YEAR as recommended by Autonomous Committee, as shown below

Allocation of Internal component to I, II and III yrs.

S.No.	Component			Distribution of Marks
1 CIE I	Q No	Learning Objective	Marks	CIE I (after completion of 50% of syllabus)
	1	Memory based (Remember)	2	
	2	Understand (Comprehension)	2	
	3	Application	3	
	4	Analysis	3	
	5	Evaluation	5	
	6	Creativity	5	
		TOTAL		
2	CIE II (Online Exam)			10
3	ATTENDANCE		Above 95%	5
			91% to 95%	
			86% to 90%	
			81% to 85%	
			75% to 80%	
			Below 75%	
Pedagogical Strategies				
4	ASSIGNMENT			5

5	Participation or Paper Presentation in Student Seminars/Workshops/Group Discussions/ Quiz/ Student Study Project/Field Visit/Survey				5
		Participation	Second Prize	First Prize / Best Paper	
	Workshop/Seminar/Technical Symposium	2	3	5	
	National / International Conference	3	4	5	
6	Viva-voce/ chart preparation with diagrams				5
TOTAL					50

7. The assessment component is designed as follows:

For III year students (CBCS pattern) Theory examination:

Internal - 50 marks Assessment through new pedagogical methods

External exam - 50marks

Total -100 M

For I and II year students (CBCS pattern) Theory examination:

Internal - 50 marks Assessment through new pedagogical methods

External exam - 50marks

Total -100 M

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

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

- External practical exam at the end of 2nd, 4th, and 6th semester each for - 50marks.

9. 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 for better future opportunities**

*It is mandatory to pursue a **certificate course** from semester-2 (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.

Pedagogical Techniques

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

Department Best Practices for CIA:

5. **1. Weekly wall magazine : Poster
Presentation on notice board.**
7. **Extension service: Awareness
programme/ rally.**
8. **MOOCs : Enrolment and
completion of one course**
9. **Internship / summer project.**

Px16 -3-D Models,

Px17 -Drawing (maps)/charts

P_T - Test,

***Google classroom**

***Project based teaching**

Government College(Autonomous),Rajamahendravaram

Concept document on CIA: SEE as 50:50(April2021)

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 throughout 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), Rajahmundry 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 Courses/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	Above 95%	5	5
		91% to 95%	4	
		86% to 90%	3	
		81% to 85%	2	
		75% to 80%	1	
		Below 75%	0	
Pedagogical Strategies				
4	ASSIGNMENT			5
5	Participation or Paper Presentation in Student Seminars/Workshops/Group Discussions/ Quiz/ Student Study Project/ Field Visit/Survey			5
6	Viva-voce			5
TOTAL				50

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

Two Internal Examinations, out of which one is Mandatorily Online examination,for each Course shall be conducted for assessment. These examinations will be conducted during August/September (CIE –I) and January/February (CIE-II). CIE-I carries 20 marks and CIE-IIcarries10marks. CIE-I will be conducted after completion of 50% of syllabus. These second internal examination, i.e., CIE–II, which is **mandatorily online examination** will cover the entire syllabus and consists of 20 multiple 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,a genera and suggestive model for question paper is given below based on Blooms Taxonomy.

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

✓ 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

CIE 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(5Marks)

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

Above95%	5
91%to 95%	4
86%to 90%	3
81%to 85%	2
75%to 80%	1
Below75%	0

Component IV: Assignment(5Marks)

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 7days 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(PedagogicalStrategies):Participation/PaperPresentationinStudentSeminars/Workshops/GroupDiscussions/Quiz/StudentStudyProject/FieldVisit/Survey(5Marks)

For this component, the marks will be provided to student, if he/she participate / winin 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/otherdepartmentsin the college.

Name of the event	Participatio n	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 100questions 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 Semester -1 (2019-20 batch on wards), the question paper will be of 2 ½ hrs duration for 50marks.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)

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

Subjects		SEMI I		SEM II		SEM III		SEMIV		SEM V		SEMVI		Credits
		Hrs / V	Credits	Hrs / V	Credits	Hrs / V	Credits	Hrs / V	Credits	Hrs / V	Credits	Hrs / V	Credits	
Languages														
English		4	3	4	3	4	3							
Language (H/T/S)		4	3	4	3	4	3							
Life Skill Courses		2	2	2	2	2	2							
Skill Development Courses		2	2	2	2	2	2							
Major 1	Core 1,2,3,&4	4+2	4+1	4+2	4+1	4+2	4+1	4+2	4+1					
Major 2	Core 1,2,3,&4	4+2	4+1	4+2	4+1	4+2	4+1	4+2	4+1					
Major 3	Core 1,2,3,&4	4+2	4+1	4+2	4+1	4+2	4+1	4+2	4+1					
Major 1	Core-5							4+2	4+1					
Major 2	Core-5							4+2	4+1					
Major 3	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			
	Skill									4+2	4+1			

THIRD PHASE of APPRENTICESHIP Entire 5th /6th Semester

FIRST and SECOND PHASES(2 spells) of APPRENTICESHIP between 1st and 2nd year and between 2nd and 3rd year (two summer vacations).

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

List of colleges for engaging Examiners/ Paper setters

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

Government College (Autonomous), Rajahmundry

Department of Biotechnology

Program code	Name of the program	Sem	Course code	Course title	Total number of units/modules in the course	% of addition	Date of revision
2209	BBC	3 rd Sem	BTL151	Immunology & rDNA technology	5	100%	16.09.2021
2211	BBC A g r o	4th Sem	BTL152	Plant biotechnology and Animal biotechnology	5	100%	16.09.2021

New courses introduced (2021-22)

**Government College(A), Rajamahendravaram.
Department Of Biotechnology**

B.Sc., Biotechnology: Choice based Credit System Additional

Inputs into Syllabus 2021-22

(Addition/ deletion of specific topics from the syllabus in each course(paper)with justification.)

The topics which are related to the prescribed syllabus, which are of importance either as academic or application are selected and included in the syllabi as Additional inputs. The information regarding the research activities and achievements of various Local / Regional organizations, like CTRI, SIFT, CIFE is collected and considered as a part of the curriculum of B.Sc. Biotechnology course so as to encourage the students to opt for research in this vast field of science.

S.No	Name of the course	Course code	Semester	Additional input	Percentage of addition
1.	Biomolecules, bioenergetics & Analytical Techniques	BTL149	I	Applications of radio isotopes in biology	10%
2.	Microbiology, Cell and Molecular Biology	BTL150	II	Role of antibiotics in regulating the transcription and translation	10%
3.	Plant biotechnology And animal Biotechnolog	BTL124	III	Phyto hormones and edible vaccines	10%

	y				
4.	Immunology and rDNA technology	BTL123	IV	New generation vaccines	10%
5.	Genetics and Molecular biology	BTL125	V(Paper-5)	Inhibitors of Protein Synthesis	10%
6.	Gene expression and rDNA technology	BTL126	V(Paper-6)	Recombinant products – production & advantages	10%
BBCELECTIVE&CLUSTERS					
7.	Biostatistics, bioinformatics And IPR	BTL118	VI (Elective)	Infringement–overuse or misuse of IPR	10%
8.	Plant biotechnology And animal Biotechnology	BTL132	VI (Cluster8C 1)	Phyto hormones and edible vaccines	10%

Additional Inputs into Syllabus 2021-22

S.No	Name of the course	Course code	Sem ester	Additional input	Percentage of addition
9.	Environmental & Industrial Biotechnology	BTL145	VI Clust er8 C2	SuperBug&VitaminB 12production	10%
10.	Medical nano biotechnology	BTL146	VI Clust er8C 3	Toxicological health effects caused by nano particles	10%
BBCAGROELECTIVE&CLUSTERS					
11.	Biostatistics ,bioinformatics And IPR	BTL118	VI Elective	Infringement– over use or Misuse of IPR	10%
12.	Crop Improvement technology	BTL143P	VI (Cluster8C 1)	: Transgenic plants for crop improvement	10%

13.	Organic farming	BTL139P	VICluster 8C2	Multiple cropping	10%
14.	Vegetable Science	BTL143P	VICluster 8C3	Methods and practices of storage-ventilated, refrigerated, storage, hypobaric storage, pre-cooling and cold storage, zero energy cool chamber; Storage disorders	10%

Program Specific Outcomes

B.Sc., B.B.C.(Biotechnology, Botany and Chemistry)

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

In this program the study of botany offers the understanding about origin of life and the scope to manipulate the knowledge for better society through catering to the needs and growing demands of food and clothing to population.

In this program the knowledge about the subject chemistry comes in to play when structures of biomolecules and their interactive relations to the environment are to be understood.

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

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.



Skill Development Component;



Employability Component;



Entrepreneurship component

1. Study project	Internship	Field trip
1. Charts	Project work	
1. Quiz		
2. Assignments		
3. Debates / Group discussions		
4. Paper presentations		
5. Poster presentations		



Government College (Autonomous) Rajahmundry

Course Code:	SUBJECT : Biotechnology	Program & Semester I B.Sc. (I Sem)			
BTL149	TITLE OF THE COURSE Biomolecules, Bioenergetics and Analytical techniques				
Teaching	Total Hours Allocated : 60 (Theory)	L	T	P	C
Pre-requisites:	<ul style="list-style-type: none">➤ Knowledge about biomolecules such as carbohydrates, amino acids, proteins, nucleic acids.➤ Knowledge on basic techniques like centrifugation, chromatography, electrophoresis, spectroscopy, laser techniques and radio isotopes	4	1	-	4

L-Lecture; T-Tutorial; P- Practicals; C- Credits

Course Objectives:

- To ensure students gain knowledge about the structure, properties and functions of biomolecules and characterization of biomolecular using analytical techniques

On Completion of the course, the students will be able to-	
CO1	The students will have maximum knowledge on biomolecules.
CO2	Students will be able to handle biophysical and biochemical techniques .
CO3	Students gains knowledge about structure, properties and functions of biomolecules.
CO4	Students will be able to characterize biomolecules using analytical techniques.
CO5	Students are able to validate biological samples

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development	Carbohydrates, Classification, structure, properties of carbohydrates Classification, structure (primary, secondary, tertiary, quaternary) and functions of proteins Denaturation and Renaturation Of proteins.	Employability	Basic Principles Of Sedimentation And Types Of centrifugations. Principles And Types Of electrophoresis ,factors affecting electrophoretic migration. PAGE	Entrepreneurship	Beer-Lambert law, light absorption Introduction to radioisotopes, measurement of radioactivity
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Syllabus:

Unit-I- Biomolecules

Classification, structure, properties of carbohydrates. Classification, structure and properties of amino acids, peptide bond and peptides. Classification, structure (primary, secondary, tertiary, quaternary) and functions of proteins. Denaturation and Renaturation of proteins. Classification structure and properties of saturated and unsaturated fatty acids. Structure and functions of glycolipids, phospholipids, and cholesterol.

Unit-II-Biomolecules and Bioenergetics

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

Unit-III-Centrifugation, Chromatography

Basic principles of sedimentation and types of centrifugations.

Principle, instrumentation and application of partition, absorption, paper, TLC, ion exchange, gel permeation, affinity chromatography.

Unit –IV- Electrophoresis

Basic principles and types of electrophoresis, factors affecting electrophoretic migration. PAGE (Native, SDS-PAGE). Introduction to 2D & Isoelectric Focusing.

Unit-V-Spectroscopy, and Laser Techniques

Beer-Lambert law, light absorption and transmission. Design and application of photoelectric calorimeter and UV-visible spectrophotometer. Introduction to crystallography and application. Introduction to radioisotopes, measurement of radioactivity (scintillation counter and autoradiography).

- **Additional Input: Applications of radioisotopes in biology**

References:

1. Outlines of Biochemistry, 5th Edition, (2009), Eric Conn & Paul Stumpf; John Wiley and Sons, USA
2. Principles of Biochemistry, 4th edition, (1997), Jeffery Zubey; McGraw-Hill College, USA
3. Principles of Biochemistry, 5th Edition (2008), Lehninger, David Nelson & Michael Cox; W.H. Freeman and Company, NY
4. Fundamentals of Biochemistry, 3rd Edition (2008), Donald Voet & Judith Voet; John Wiley and Sons, Inc. USA
5. Biochemistry, 7th Edition, (2012), Jeremy Berg & Lubert Stryer; W.H. Freeman and Company, NY
6. Textbook of Biochemistry with Clinical Correlations, 7th Edition, (2010), Thomas M. Devlin; John Wiley and Sons, USA
7. Proteins: biotechnology and biochemistry, 1st edition, (2001), Gary Walsch; Wiley, USA
8. Biochemical Calculations, 2nd Ed., (1997), Segel Irvin H; John Wiley and Sons, NY
9. Biophysical Chemistry Principles & Techniques Handbook, (2003), A. Upadhyay, K. Upadhyay, and N. Nath
10. Enzymes: Biochemistry, Biotechnology & Clinical Chemistry, (2001), Palmer Trevor, Publisher: Harwood Pub. Co., England.
11. Analytical Biochemistry, 3rd edition, (1998), David Holmes, H. Peck, Prentice-Hall, UK
12. Biochemistry, 5th Edition, 2020 U. Satyanarayana, Elsevier India.

WebLinks:

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

CO-PO Mapping:

(1: Slight [Low];

2: Moderate [Medium];

3: Substantial [High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS O1	PS O2	PS O3
CO1	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 (A), Rajamahendravaram
Department Of Biotechnology
I B.Sc., Biotechnology; Semester -1;2021-22
Paper 1: Biomolecules, bioenergetics & Analytical Techniques
Course code: BTL149
Blue print for Semester end theory examinations -2021 -22

Time:2½Hours

Max.Marks:50

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

Government College(Autonomous),Rajamahendravaram
Department Of Biotechnology
IB.Sc., Biotechnology;Semester- 1;2021-22
Model question paper
Paper1:Bio-molecules&AnalyticalTechniques
Coursecode:BTL149

Time:2½hours

MaxMarks:50M

PART-A

I. Answer any THREE questions.

3X10 =30M

Each answer carries TEN marks.

1. Write about classification, structure and properties of amino acid.
2. Write about structure and classification of saturated and unsaturated fatty acids
3. Explain biological role and deficiency manifestations of vitamin–A,C,D and K
4. Explain Glycolysis process with a flowchart
5. Explain gel filtration chromatographic technique
6. Describe the applications of radioisotopes in biology


PART-B

II. Answer any FOUR questions.

4X5=20M

Each answer carries FIVEmarks.

1. Denaturation and Renaturation of Proteins
2. Structure of cholesterol
3. Entropy and Enthalpy
4. Beer-Lambert' slaw
5. Extinction coefficient
6. Epimers
7. Antioxidants
8. Mitochondria

	Government College (Autonomous) Rajahmundry						
Course Code:	SUBJECT : Biotechnology			Program & Semester			
PTL149P	TITLE OF THE COURSE						
	Biomolecules, bioenergetics & Analytical Techniques I			B.Sc. (I Sem)			
Teaching	Total Hours Allocated : 30 LAB			L	T	P	C
Pre-requisites:	Handling of pipettes. 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. Introduction to basic instruments (Principle standard operation procedure) demonstration and record
2. Calculation of molarity, normality and molecular weight of compounds.
3. Qualitative analysis of carbohydrates (sugars)
4. Quantitative analysis of carbohydrates by using DNS reagent
5. Quantitative estimation of protein –Lowry's method
6. Estimation of DNA by diphenylamine reagent
7. Estimation of RNA by orcinol reagent
8. Preparation of standard buffer and pH determination
9. Separation of amino acids by paper chromatography

Referencebooks:

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

Virtual LabLinks:

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

Government College(A), Rajamahendravaram
Department Of Biotechnology
IB.Sc., Biotechnology; Semester -1;
Practical syllabus 2021-22
Paper1: Biomolecules, bioenergetics & Analytical Techniques
Coursecode: PTL149P

Total Hours:30

Credits:1

1. Introduction to basic instruments (Principles and operation procedure) demonstration and record
2. Calculation of molarity, normality and molecular weight of compounds.
3. Qualitative analysis of carbohydrates (sugars)
4. Quantitative analysis of carbohydrates by using DNS reagent
5. Quantitative estimation of protein– Lowry’s method
6. Estimation of DNA by diphenyl amine reagent
7. Estimation of RNA by orcinol reagent
8. Preparation of standard buffer and p^H determination
9. Separation of amino acids by paper chromatography

Coursecode: PTL149P


Model Question Paper for Semester End Examinations

Time: 3 hours

Max Marks: 50M

- | | |
|---|-----|
| 1. Estimation of DNA 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 = 50M

	Government College (Autonomous) Rajahmundry						
Course Code: BTL150	SUBJECT : Biotechnology			Program & Semester I B.Sc. (II Sem)			
	TITLE OF THE COURSE Microbiology, Cell and Molecular Biology						
Teaching	Total Hours Allocated : 60 (Theory)			L	T	P	C
Pre-requisites:	<ul style="list-style-type: none"> ➤ knowledge about microbiology basics ➤ should know about structure of cell and its functions ➤ knowledge on molecular biology basics 			4	1	-	4

L-Lecture; T-Tutorial; P- Practicals; C- Credits

Course Objectives:

- To ensure students gain knowledge about the microbiology, cell and molecular biology aspects

On Completion of the course, the students will be able to-	
CO1	Students acquire knowledge on concepts of microbiology, cell and molecular biology.
CO2	This course give an understanding of the basics of microbiology
CO3	This course also gives knowledge to deal with types of microbes, classification and their characterization,
CO4	structure and function of prokaryotic and eukaryotic cell organelles, cell division can be understand
CO5	Students have basic knowledge on basics of molecular biology including DNA replication, transcription, translation and regulation of gene expression

Course with focus on employability / entrepreneurship / Skill Development modules

<p>Skill Development</p>	<p>Concepts of microbial species and strains</p> <p>Microbial of penicillin. General characteristics, transmission and cultivation of viruses.</p> <p>Structure, properties and functions of cellular organelles</p>	<p>Employability</p>	<p>Genetic code, prokaryotic and eukaryotic transcription, enzymes involved in transcription. Post-transcriptional modification (Capping, Polyadenylation) and splicing.</p> <p>Role of antibiotics in regulating the transcription and translation</p>	<p>Entrepreneurship</p> <p>Types and design of microscope s- compound, phase contrast, fluorescent electron microscopy (TEM, SEM). Ultrastructure of bacteria and growth curve. Pure culture techniques. Sterilization techniques,</p>
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Syllabus

Unit-I-Scope and Techniques of Microbiology

History and contribution of Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister and Alexander Fleming. Types and design of microscopes- compound, phase contrast, fluorescent electron microscopy (TEM, SEM). Ultrastructure of bacteria and growth curve. Pure culture techniques. Sterilization techniques, principles and application of physical methods (autoclave, hot air oven, incineration), chemical methods and radiation methods. Simple, gram and acid-fast staining.

Unit-II-Bacteria and Viruses

Concepts of microbial species and strains. Classification of bacteria based on morphology, nutrition and environment. Bacterial toxins, tuberculosis, typhoid. Microbial production of penicillin.

Viruses: General characteristics, transmission and cultivation of viruses. Structure and properties of plant (tobacco mosaic virus, TMV), animal (Newcastle disease virus, NDV), human (Human immunodeficiency virus, HIV) and bacterial viruses (T4 phage). Emerging and re-emerging viruses (dengue virus), zoonotic viruses (rabies, SARS-CoV-2).

Unit-III-Cell Structure and Functions

Structure, properties and functions of cellular organelles (E.R, Golgi bodies, Mitochondria, Ribosomes and Vacuoles) of eukaryotic cells. Cell cycle and cell division (mitosis and meiosis). Chemical composition and dynamic nature of the membrane, cell signaling and communication, endocytic pathways.

Unit-IV-DNA Replication, Repair and Regulation of Gene Expression

DNA replication in prokaryotes (semiconservative, dispersive, conservative, uni and bi-direction, rolling circle). Mechanism of DNA replication, enzymes and proteins involved in DNA replication. DNA damage and repair. Regulation of gene expression in prokaryotes Lac and Trp operon concept.

Unit-V-Central Dogma of Molecular Biology

Genome organization of prokaryotic and eukaryotic organisms. Genetic code, prokaryotic and eukaryotic transcription, enzymes involved in transcription. Post-transcriptional modification (Capping, Polyadenylation) and splicing. Translation: mechanism of translation in prokaryotic and eukaryotic cells (initiation, elongation, termination). Post-translational modification (glycosylation and phosphorylation).

Additional input: Role of antibiotics in regulating the transcription and translation

References:

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

WebLinks:

1. <https://micro.magnet.fsu.edu/cells/bacteriacell.html>
2. <https://micro.magnet.fsu.edu/cells/virus.html>
3. <https://www.britannica.com/science/virus>
4. https://en.wikipedia.org/wiki/DNA_replication
5. <https://www.biointeractive.org/classroom-resources/central-dogma-and-genetic-medicine>

CO-POMapping:

(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(A), Rajamahendravaram
Department Of Biotechnology
IB.Sc., Biotechnology; Semester -2
Paper 2: Microbiology, Cell and Molecular Biology
Course code: BTL150

Blueprint for Semester end theory examinations-2021-22

Time: 2½ Hours

Max. Marks: 50

Part-A

I. Essay questions: answer any THREE

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

Part-B

II. Short answer questions: answer any FOUR

4 X 5 = 20 M

Each answer carries FIVE marks.

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

Government College(A), Rajamahendravaram
Department Of Biotechnology
IB.Sc., Biotechnology; Semester -2; 2021-22
Model question paper
Coursecode: BTL150

Paper2: Microbiology, Cell and Molecular Biology

Time: 2^{1/2} hours

Max Marks: 50M

PART-A

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

Each answer carries TEN marks.


1. Give the ultra-structure of Bacteria with neat labeled diagram
2. Explain the cell cycle and cell division
3. Explain the process of transcription in eukaryotes
4. What is replication and explain the process of replication in *E.coli*
5. Write a note on post-translational modifications in prokaryotes
6. Role of antibiotics in regulation of Gene expression

PART-B

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

Each answer carries FIVE marks.

7. Contributions of Leeuwenhoek
8. Simple staining
9. General characteristics of virus
10. Mitochondria
11. SOS repair
12. Bacteria growth curve
13. Capping
14. Ribosomes

		Government College (Autonomous) Rajahmundry			
Course Code: PTL150P	SUBJECT : Biotechnology	Program & Semester I B.Sc. (II Sem)			
	TITLE OF THE COURSE Microbiology, Cell and Molecular Biology Lab				
Teaching	Total Hours Allocated : 30 LAB	L	T	P	C
Pre-requisites:	Handling of pipettes. Handling of Biological samples.	0	0	2	1

Objectives:

1. The students should be able to understand the principle behind the tests.
2. The students should be able to understand the concept behind the microbiological work.

List of Experiments/Syllabus:

1. Cleaning and preparation of glassware Sterilization techniques(autoclave,hotairoven,filter)
2. Preparation of nutrient agar medium for bacteria
3. Preparation of PDA medium for fungi
4. Isolation of bacteria from soil(serial dilution)
5. Isolation of Pure cultures(Streakplate, spreadplate and pourplate)
6. Simple staining technique
7. Differential staining technique
8. Study of stages of mitotic cell division
9. Study of stages of meiotic cell division
10. Extraction and isolation of DNA from bacteria.

Referencebooks:

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

Virtual LabLinks:

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

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

Government College(A), Rajamahendravaram
Department Of Biotechnology
IB.Sc., Biotechnology; Semester -2
Theory syllabus 2021-22

Coursecode: PTL150P

Paper II: Microbiology, Cell and Molecular Biology Lab

TotalHours:30

Credits:1

11. Cleaning and preparation of glassware Sterilization techniques (autoclave, hot air oven, filter)
12. Preparation of nutrient agar medium for bacteria
13. Preparation of PDA medium for fungi
14. Isolation of bacteria from soil (serial dilution)
15. Isolation of Pure cultures (Streak plate, spread plate and pour plate)
16. Simple staining technique
17. Differential staining technique
18. Study of stages of mitotic cell division
19. Study of stages of meiotic cell division
20. Extraction and isolation of DNA from bacteria.

Coursecode: PTL150P: Model Question Paper for Semester End Examinations

TotalHours: 3hours

Credits:1

- | | |
|---|-----|
| 1. Write procedure for isolation of bacteria from soil and carry out the experiment | 15M |
| 2. Write principle and procedure of simple staining and perform the Experiment | 10M |
| 3. Identify given potters | 15M |
| 4. Record | 5M |
| 5. Viva-Voce | 5M |

TOTAL: 50M



Government College (Autonomous) Rajahmundry

Course Code: BTL151	SUBJECT : Biotechnology	Program & Semester II B.Sc. (III Sem)			
	TITLE OF THE COURSE Paper-3: Immunology and rDNA Technology				
Teaching	Total Hours Allocated : 60 (Theory)	Lec tur es	Tuto rials	Pra cs	Credits
Pre-requisites:	<ul style="list-style-type: none">➤ Knowledge of organs of human system.➤ Types of cells in the human body.➤ Immunity and resistance in general.	4	1	-	3

Course Objectives:

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

Course Outcomes

On Completion of the course, the students will be able to-	
CO1	➤ Immunology is a branch of biology that encompasses the study of host defence mechanisms and resistance towards pathogens.
CO2	➤ This course enables the pupil to understand the basics of immune system functioning through study of organs and cells involved in immune response.
CO3	➤ Apart from understanding ⁵² the mounting of immune responses, the pupil will now acknowledge the applications of immunology

	in numerous disciplines like medicine, organ transplantation, oncology, rheumatology, virology, bacteriology, parasitology.
CO4	➤ The cutting edge Recombinant DNA technology, which is about bringing together useful genes from across species and producing genetically modified organisms is sure to make the pupil understand the processes involved thoroughly .
CO5	➤ Overall the interesting course design is likely to instil a research tempo in the pupil and ultimately contribute to the welfare of humankind.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development	Databases (PubMed, NCBI, EMBL and ExPASy), nucleotide and protein BLAST analysis, CLustal W and phylogenetic tree construction. Introduction to omics (proteomics, genomics and transcriptomics). Introduction to nanotechnology.	Employability	Live, killed, attenuated, subunit and recombinant vaccines Principles and application of PCR. Southern, Northern and Western Blotting. Introduction to DNA sequencing	Entrepreneurship	Hybridoma technology, Monoclonal antibodies and their application in immunodiagnosis Applications of rDNA technology in agriculture (transgenic plants, edible vaccines and antibodies) and medicine (disease diagnosis and DNA fingerprinting) ..
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Syllabus :

UNIT-I : Concepts, Cells and Organs of the Immune System

Terminology, antigen, hapten, antibody (types), antigenicity, immunogenicity and types of immunity. Innate and adaptive immunity. Hematopoiesis, organs, tissues, cells and mediators of the immune system (primary and secondary lymphoid organs, lymphocytes and cytokines). Introduction to complement components, MHC. Basic concepts of humoral and cell-mediated immune response.

UNIT-II : Vaccinology and Clinical Immunology:

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

UNIT-III : Introduction, Tools and Techniques of rDNA Technology:

Introduction to rDNA technology, steps involved in cloning, tools of genetic engineering (Genes, Cloning vectors - plasmids and cosmids, Enzymes - restriction endonucleases and DNA Ligase, Hosts - bacteria and yeast). Principles and application of PCR. Southern, Northern and Western Blotting. Introduction to DNA sequencing (Sanger Sequencing) and Site-directed Mutagenesis.

UNIT-IV : Cloning Strategies and Application of rDNA Technology:

rDNA library, construction, methods of transformation, recombinant selection and screening methods. Applications of rDNA technology in agriculture (transgenic plants, edible vaccines and antibodies) and medicine (disease diagnosis and DNA fingerprinting).

UNIT-V :Bioinformatics:

Databases (PubMed, NCBI, EMBL and ExPASy), nucleotide and protein BLAST analysis, CLustal W and phylogenetic tree construction. Introduction to omics (proteomics, genomics and transcriptomics). Introduction to nanotechnology.

Additional Inputs:

Transplant rejection, Recombinant insulin

Textbooks:

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

Referencebooks:

3. Kuby immunology, Judy Owen, Jenni Punt, Sharon Stranford., 7th edition (2012), Freeman and Co., NY
1. Immunology, 7th edition (2006), David Male, Jonathan Brostoff, David Roth, IvanRoitt, Mosby, USA.
2. Principles of Gene Manipulation - 7 th edition, 2006, By R.W. Old & S.B. Primrose, Publ: Blackwell
3. Molecular Biotechnology - 4 th edition, 2010, G.R. Click and J.J. Pasternak, Publ:Panima
4. Genes and Genomes – 1991, By Maxine Singer and Paul Berg
5. Genes VII- 2000, By B. Lewin - Oxford Univ. Press
6. Molecular Biology - 4 th Edition, 2008, By D. Freifelder, Publ: NarosaPublishinghouse New York, Delhi
7. Brown TA. (2006). Gene Cloning and DNA Analysis. 5th edition. BlackwellPublishing, Oxford, U.K. 14.Clark DP and Pazdernik NJ. (2009). Biotechnology-Appling the Genetic Revolution. Elsevier Academic Press, USA.
8. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles andApplications of recombinant DNA. ASM Press, Washington
9. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation andGenomics, 7 thedition. Blackwell Publishing, Oxford, U.K.
10. Introduction to Bioinformatics – 2013, By Arthur M. Lesk
11. Bioinformatics: 2001, Sequence and Genome Analysis by David W. Mount, Cold Spring Harbor Laboratory Press

12. Biological Sequence Analysis: 1 st Edition, 1998, Probabilistic Models of Proteins and Nucleic Acids by Richard Durbin, Sean R. Eddy, Anders Krogh, Graeme Mitchison, Cambridge University Press

WebLinks:

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

CO-POMapping:

(1:Slight[Low];

2:Moderate[Medium];

3:Substantial[High], 4:No Correlation

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

Government College (Autonomous), Rajamahendravaram
Department of Biotechnology
II B.Sc. - Biotechnology; Semester -3;
Course code: BTL151
Paper-3: Immunology and rDNA Technology
Blue print for Semester end theory examinations 2021- 2022

Time: 2 ½ Hours

Max.Marks: 50

Part – A

I. Essay questions: answer any THREE

3 X 10 = 30 M

Each answer carries TEN marks.

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

Part-B

II. Short answer questions: answer any FOUR

4 X 5= 20 M

Each answer carries FIVE marks.

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

Government College (Autonomous), Rajamahendravaram
Department of Biotechnology
II B.Sc., - Biotechnology; Semester -3
Course code: BTL151
Paper-3: Immunology and rDNA Technology
Model question paper for Semester end theory examinations. 2021-22

Time: 2 ^{1/2} Hours

Max.Marks: 50M

Part – A

Answer any THREE questions. Each carries TEN marks.

3 X 10= 30M

1. Explain the different organs of immune system (Unit 1)
2. What is vaccine? Explain the different types of vaccines? (Unit 2)
3. Write about tools and steps involved in genetic engineering (Unit 3)
4. Write about applications of r-DNA technology in agricultural field (Unit 4)
5. Explain about nanotechnology and its importance (Unit 5)
6. Write an essay on production of recombinant insulin . (Additional input)

Part-B

Answer any FOUR questions. Each carries FIVE marks.

5 X4 = 20 M

7. MHC (I)
8. Hematopoiesis (I)
9. Properties of Adjuvants (II)
10. Monoclonal Antibodies Applications (II)
11. Sanger Sequencing (III)
12. Principle of PCR (III)
13. DNA Fingerprinting (IV)
14. Proteomics (V)



Government College (Autonomous) Rajahmundry

Course Code: BTL151P	SUBJECT : Biotechnology	Program & Semester II B.Sc. (III Sem)			
	TITLE OF THE COURSE Paper-3: Immunology and rDNA Technology Lab				
Teaching	Total Hours Allocated for lab : 30	L	T	P	C
Pre-requisites:	Handling of pipettes. Handling and Disposal of bio hazardous material.	0	0	2	1

Objectives:

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

List of Experiments/Syllabus:

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

Referencebooks:

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

Weblinks

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

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

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

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

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

virtual lab links

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

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

Government College (Autonomous), Rajamahendravaram.
II B.Sc.; Biotechnology; Semester -3
Course code: BTL151P
Paper-3: IMMUNOLOGY AND rDNA TECHNOLOGY
Practical syllabus

Model question paper for Semester end practical examinations. 2021-22

TIME: 3 hour

Max. Marks: 50m

1. Major 20 M

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

2. Minor 10M

Determine the blood group of the given blood sample ?

3. Spotters (5x2) 10 M

a) Lymphoid organs

b) Cosmids

c) ELISA

d) BLAST

e) RIA

4. Record 05M

5. Viva-voce 05M

Total = 50M



Government College (Autonomous) Rajahmundry

Course Code: BTL152	SUBJECT : Biotechnology	Program & Semester II B.Sc. (IVSem)			
	TITLE OF THE COURSE Paper 4: Plant and Animal Biotechnology				
Teaching	Total Hours Allocated : 60(Theory)	L	T	P	C
Pre-requisites:	<ul style="list-style-type: none"> ➤ Knowledge about plant and animal physiology. ➤ Knowledge about structure and functions of both plant and animal cells. 	4	1	-	3

Course Objectives:

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

Course Outcomes:

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

Course with focus on employability / entrepreneurship / Skill Development modules

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

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), hairy root features of Ri plasmid, Transgenic plants as bioreactors. Herbicide resistance – glyphosate, Insect resistance- Bt cotton, Molecular markers - RAPD, RFLP and DNA fingerprinting- principles and applications.

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

UNIT IV: Transgenic animals & Gene Therapy:

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

UNIT V: Bioethics, Biosafety and IPR:

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

Additional Inputs: Advantages of tissue culture, 3-D bioprinting

Textbooks:

Recommended Books :

1. Introduction to Plant Tissue Culture..M.K. Razdan ,2003, Science Publishers
2. Plant Tissue Culture, kalyan Kumar De, 199 M7, New Central Book Agency

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

Referencebooks:

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

Weblinks

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

Virtual lab Links

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

CO-POMapping:

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

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

Government College (Autonomous), Rajamahendravaram
Department Of Biotechnology
II B.Sc., Biotechnology; Semester - 4; W.E.F. 2021-22
Paper 4: PLANT AND ANIMAL BIOTECHNOLOGY
Course code: BTL152

Blue print for Semester end theory examinations 2021– 2022

Time: 2 ½ Hours

Max.Marks: 50

Part – A

I. Essay questions: answer any THREE

3 X 10 = 30 M

Each answer carries TEN marks.

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

Part-B

II. Short answer questions: answer any FOUR

4 X 5= 20 M

Each answer carries FIVE marks.

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

Government College (Autonomous), Rajamahendravaram
Department Of Biotechnology
II B.Sc., Biotechnology; Semester - 4; W.E.F. 2021-22
Model Question paper
Paper 4: PLANT AND ANIMAL BIOTECHNOLOGY
Course code: BTL152

Time: 2 ½ Hours

Max.Marks: 50

PART –A

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

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

PART –B

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

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



Government College (Autonomous) Rajahmundry

Course Code: BTL152P	SUBJECT : Biotechnology	Program & Semester II B.Sc. (III Sem)			
	TITLE OF THE COURSE Paper-4 : Plant and Animal Biotechnology Lab				
Teaching	Total Hours Allocated for lab : 30	Lec tur es	Tuto rials	Pra cs	Credi ts
Pre-requisites:	<ul style="list-style-type: none"> ➤ Aseptic techniques. ➤ Preparation and sterilization of solutions. 	0	0	2	1

Objectives:

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

List of Experiments/Syllabus:

List of Practical:

1. Plant culture media and composition of MS media
2. Raising of aseptic seedlings
3. Induction of callus from different explants, cytology of callus
4. Plant propagation through Tissue culture (shoot tip and Nodal culture)
5. Establishing a plant cell culture (both in solid and liquid media)
6. Suspension cell culture
7. Cell count by hemocytometer.
8. Establishing primary cell culture of chicken embryo fibroblasts.
9. Animal tissue culture – maintenance of established cell lines.
10. Animal tissue culture – virus cultivation.
11. Estimation of cell viability by dye exclusion (Trypan blue).
12. ELISA – Demonstration

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>

Model Question Paper for Semester End Examinations

Time: 3 hours

Max Marks: 50M

1. Use the given explant sample to induce callus ? 20M
2. Determine the number of cells in given sample using haemocytometer 10M
3. Spotters 2 x 5 = 10M
 - a) RFLP
 - b) Bt-Cotton
 - c) Bioreactor
 - d) Plasmid
 - e) Chick embryo fibroblast
4. Record 5M
 4. Viva 5M

	Government College (Autonomous) Rajahmundry						
Course Code: BTL153	SUBJECT : Biotechnology			Program & Semester II B.Sc. (IVSem)			
	TITLE OF THE COURSE Paper 5 : Environment and Industrial Biotechnology						
Teaching	Total Hours Allocated : 60			L	T	P	C
Pre-requisites:	<ul style="list-style-type: none"> ➤ Various Causes of Environmental pollution ➤ Knowledge about General features of microbes 			4	1	-	3

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.

<p>Skill Development</p>	<p>Measurement of water pollution, sources of water pollution. Microbiology of waste water treatment, aerobic processes, activated sludge, oxidation ponds, trickling filters, and rotating biological contactors. Anaerobic processes: Anaerobic digesters, upward flow anaerobic sludge blanket reactors.</p> <p>microbial groups involved in biogas production & interactions, factors affecting biogas production,</p> <p>Industrially important microbes, its screening,</p>	<p>Employability</p>	<p>air pollution & its control through Biotechnology, Biofilters, Bioscrubbers, Biotrickling filter. Bioremediation of Hydrocarbons and its applications Degradation of pesticides and other toxic chemicals by microorganism</p> <p>Maintenance and preservation of industrially important microbial cultures.</p> <p>Microbial production of Organic acids (Lactic acid, citric acid), Amino acids (Glutamicacid, Aspartic acid</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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	selection and identification		and Lysine).		
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Syllabus:

UNIT I: Pollution Types and Control:

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

Water pollution and its management: 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.

UNIT II: Bioremediation:

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

UNIT III: Biofuels:

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

UNIT IV: Basic principles of Microbial technology:

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

UNIT V: Commercial Production of Microbial products:

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

Additional Inputs: Biodegradable products.

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

3. Introduction to Environmental Sciences, Y. Anjaneyulu ,2004, BS Publications
4. 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/
2. <https://www.biotechnologynotes.com/environment/environmental-biotechnology-with-meaning/735>
3. https://issuu.com/brainkart.com/docs/environmental_biotechnology
4. <https://www.edx.org/learn/biotechnology>

Virtual lab links

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

CO-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

Government College (Autonomous), Rajamahendravaram
Department Of Biotechnology
II B.Sc., Biotechnology; Semester - 4; W.E.F. 2021-22
Paper 5: ENVIRONMENT AND INDUSTRIAL BIOTECHNOLOGY
Course code: BTL153
Blue print for Semester end theory examinations 2021 - 2022

Time: 2 ½ Hours

Max.Marks: 50

Part – A

I. Essay questions: answer any THREE

3 X 10 = 30 M

Each answer carries TEN marks.

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

Part-B

II. Short answer questions: answer any FOUR

4 X 5= 20 M

Each answer carries FIVE marks.

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

Government College (Autonomous), Rajamahendravaram
Department Of Biotechnology
II B.Sc., Biotechnology; Semester - 4; W.E.F. 2021-22
Model Question paper
Paper 5: ENVIRONMENT AND INDUSTRIAL BIOTECHNOLOGY
Course code: BTL153

Time: 2Hours

Max.Marks: 50

PART –A

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

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

PART –B

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

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



Government College (Autonomous) Rajahmundry

Course Code: BTL153P	SUBJECT : Biotechnology	Program & Semester II B.Sc(IVSem)			
	TITLE OF THE COURSE Paper 5: Environment and Industrial Biotechnology Lab				
Teaching	Total Hours Allocated for lab : 30	Lec	Tuto	Pra	Cre
Pre-requisites:	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 α – amylase from Bacillus Spp. by shake flask culture.
10. Production of alcohol or wine using different substrates.
11. Production of citric acid by submerged fermentation
12. Estimation of citric acid by titrimetry.


Model Question Paper for Semester End Examinations
Course code: PTL153P:

Time:3hours

Max Marks:50M

- | | |
|---|-------------|
| 1. Determine the BOD of given water sample | 20M |
| 2. Determination the hardness of given water sample | 10M |
| 3. Spotters | 2 x 5 = 10M |
| 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 | |

TOTAL: 50M

	Government College (Autonomous) Rajahmundry						
Course Code: BTL125	SUBJECT : Biotechnology			Program & Semester III B.Sc. (VSem)			
	TITLE OF THE COURSE Paper 5 : Genetics and Molecular Biology						
Teaching	Total Hours Allocated : 60 (Theory)			L	T	P	C
Pre-requisites:	➤ Genetic mechanisms and basics of molecular biology			3	1	-	4

Course Objectives:

➤ This course aims to teach genetics and molecular biology both basics and advanced knowledge.

On Completion of the course, the students will be able to-	
CO1	The students will be able to understand genetics and molecular biology.
CO2	The people will learn about various genetic mechanisms in nature.
CO3	The various genetic mechanisms like replication, transcription and translation can be easily understood by students.
CO4	The pupil will understand and apply the idea of artificial induction of good characteristics in progeny for the welfare of human kind.
CO5	This course will develop observation skills and research oriented think in the pupil.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development	Incomplete dominance and Codominance, Penetration and pleiotropic	Employability	Enzymatic synthesis of RNA Basic features of transcription structure of prokaryotic RNA polymerase	Entrepreneurship Enzymology of replication(detailed treatment of DNA polymerase I, brief treatment of pol II and III, helicases, topoisomerases, single strand binding proteins Use of DNA replication mutants in the study of replication.
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Syllabus :

UNIT I

Mendel's Laws and Inheritance:

Mendel experiment, Mendel Laws and Deviations: Incomplete dominance and Codominance, Penetration and pleiotropic, Recessive and Dominant epistatic gene interaction, Concept of multiple alleles

UNIT II

Genes and their variations:

Penetration and pleiotropic, gene copies and heterogeneity, Meiotic nondisjunction of chromosomes, chromosome abnormalities in animals and plants, Linkage, recombination, gene maps, interference and coincidence, Sex determination, genetic population studies and Hardy Weinberg Equations.

UNIT III

DNA Replication:

Enzymology of replication (detailed treatment of DNA polymerase I, brief treatment of pol II and III, helicases, topoisomerases, single strand binding proteins, DNA melting proteins, primase and RNA primers, distributive and processive properties of DNA polymerase I and III, importance of the β -subunit in polymerase III). Proof for semi conservative replication, discontinuous replication and Okazaki fragments, Replication origins, initiation, primer formation, elongation and termination. Use of DNA replication mutants in the study of replication.

UNIT IV

Mutations and DNA Repair:

Gene mutations: Induced and Spontaneous, Missense, non-sense and frame shift mutations, Mutagens: Physical and Chemical mutagens.
Repair: Mismatch repair, light induced repair, SOS repair, Rec gene and its role in DNA repair, post replication repair.

UNIT V

Transcription

Enzymatic synthesis of RNA: Basic features of transcription, structure of prokaryotic RNA polymerase (core enzyme and holoenzyme, significance of σ factor 0 concept of promoter (Pribnow box, -10 and -35 sequences and their significance).

Four steps of transcription (promoter binding and activation, RNA chain initiation and promoter escape.

Additional input –Translation definition and Inhibitors of Protein Synthesis.

Recommended Books:

1. Cell and Molecular Biology – By Roberties&Roberties
2. Molecular Biology & Biotechnology – By H.D.Kumar
3. Molecular Biotechnology – By G.R.Glick
4. Molecular Biology of Gene – By Watson Microbial Genetics – By S.R.Maloy
5. Molecular Biology – By David Freifelder
6. Cell and Molecular Biology – ByS.C.Rastogi

Weblinks

1. <https://www.wadsworth.k12.oh.us/userfiles16/my%20files/genetics%20complete%20notes.pdf?id=480>
2. <https://www.austincc.edu/rohde/noteref.htm>
3. <https://nios.ac.in/media/documents/SrSec314NewE/Lesson-22.pdf>

virtual lab links

1. <https://learn.genetics.utah.edu/content/lab>

Government College (A), Rajamahendravaram
Department Of Biotechnology
III B.Sc., Biotechnology; Semester - 5; Theory syllabus 2021-22
Paper 5: Genetics and Molecular Biology
Course code: BTL125

Blue print for question Paper – 2021-22

Time: 2^{1/2} hours

Max. Marks: 50

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 all the 5 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

Government College (A), Rajamahendravaram
Department Of Biotechnology
III B.Sc., Biotechnology; Semester - 5; Theory syllabus 2021-22
Paper 5: Genetics and Molecular Biology
Course code: BTL125

Model question paper for Semester end theory examinations. 2020-2021

Time: 2 ½ Hours Max.Marks:50M

Part – A

Answer any 4 of the following essay question **4 X 10= 40M**


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

1. Describe Mendel's Laws and deviations
2. Describe chromosome abnormalities in plants and animals
3. Describe the semiconservative mode of replication with proof
4. Describe the various DNA repair mechanisms.
5. Describe in detail the process of transcription.
6. Write about inhibitors of protein synthesis.

Part-B

Answer all five of the following short questions **5 X2 = 10M**

7. Multiple alleles
8. Hardy Weinberg law and equation
9. Discontinuous replication
10. Mutagen with examples
11. Core enzyme

	Government College (Autonomous) Rajahmundry						
Course Code: BTL125P	SUBJECT : Biotechnology			Program & Semester III B.Sc. (VSem)			
	TITLE OF THE COURSE Paper 5 : Genetics and Molecular Biology						
Teaching	Total Hours Allocated : 60 (Lab)			L	T	P	C
Pre-requisites:	➤ Genetic mechanisms and basics of molecular biology					2	2

List of experiments:


1. Isolation of plasmid DNA from bacteria
2. Purity analysis of the Nucleic acids
3. Study of different phases of mitosis in onion root tips and meiosis in *Allium cape* flower buds.
4. Karyotyping in *Allium* or *Drosophila*
5. Problems and assignments in Mendelian genetics
6. Isolation of auxotrophic mutants (plants or insects).
7. Mutation of bacteria by UV
8. Chemical induced mutation in bacteria

Model question paper for Semester end practical examinations. 2021-22

TIME: 3 hours

Max. Marks: 50

1. Major experiment.	15 M
2. Minor Experiment.	10 M
3. Identify the given spotter and a brief note on it	15M
4. Record	05M
5. Viva-voce	05M
Total	----- 50M -----

	Government College (Autonomous) Rajahmundry						
Course Code: BTL126	SUBJECT : Biotechnology			Program & Semester III B.Sc. (VISem)			
	TITLE OF THE COURSE Paper 6 : Gene Expression & r DNA technology						
Teaching	Total Hours Allocated : 60 (Theory)			L	T	P	C
Pre-requisites:	<ul style="list-style-type: none"> ➤ Basics of rDNA technology ➤ And transcription, translation and replication mechanisms. 			3	1	-	4

Course Objectives:

- The students will have knowledge on replication, transcription and translation mechanisms.
- The students will have knowledge on r DNA technology.

Course Outcomes:

- The course instructs about basic gene concept, gene functions and how genes could be regulated *in vivo*
- Students should be able to gain fundamental knowledge in basic tools employed in gene cloning or genetic engineering experiments
- Able to imply techniques and strategies for gene modifications *in vitro*
- Able to understand different applications of genetic engineering in diversified fields like agriculture, medicine, industrial and environment

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

CO1	The course imparts basic and advanced knowledge in the field of Gene Expression & r DNA technology
CO2	The pupil will learn about the various gene expression mechanisms happening in the nature
CO3	The pupil will understand and apply the idea of artificially constructed genes by r DNA technology
CO4	This course will develop research oriented thinking in the pupil.
CO5	This course will develop students to be able to understand different

applications of genetic engineering in diversified fields like agriculture, medicine, industrial and environment

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development	<p>Codon and its characteristics</p> <p>: amino acyl synthetizes , the adaptor hypothesis, attachment of amino acids to tRNA. Codon - anticodon interaction – the wobble hypothesis</p>	Employability	<p>Basic idea of lac-and trp-operons. Negative and positive control of lac opern. General features of an expression vector</p>	Entrepreneurship	<p>Basics of genetic engineering, Vectors: Plasmid vectors (pBR322 and pUC 18/19)</p>
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Syllabus:

UNIT I : Genetic code

Genetic code : Codon and its characteristics, experimental elucidation of codons, identification of start and stop codons, Universality, degeneracy and comma less nature of codons.

The decoding system: amino acyl synthetizes, the adaptor hypothesis, attachment of amino acids to tRNA. Codon -anticodon interaction –the wobble hypothesis. Selection of initiation codon-Shine and Dalgarno sequence and the 16S rRNA.

UNIT II : Protein Synthesis:

Initiation, elongation, termination and post translational modification.

Regulation of translation: phage T4 protein p32 translational regulation. Antibiotics affecting translation.

UNIT III : Gene Expression and regulation

Details of initiation, elongation, and termination (intrinsic and rho factor mediated termination). Regulation of transcription in prokaryotes: Basic idea of lac-and trp-operons. Negative and positive control of lac operon.

Eukaryotic Gene Regulation: Gal operon

UNIT IV :rDNA Technology

DNA cloning: Basics of genetic engineering, restriction endonucleases, other enzymes of DNA manipulation. Vectors: Plasmid vectors (pBR322 and pUC 18/19)

Phage vector, Lambda replacement and insertion vectors, Cosmids, Plasmids, and YAC.Cutting and Joining DNA (cohesive end ligation, methods of blunt end ligated).Transfection and transformation, Selection of transformed cells.Screening methods.

UNIT V :Genomic DNA library and cDNA library-concept and methods of creating these libraries.

Advantages and disadvantages of cDNA library over genomic DNA library.

General consideration of polymerase chain reaction, designing of primers for PCR. Expression

of cloned genes: General features of an expression vector. Expression of a eukaryotic gene in prokaryotes –advantages and problems.Applications of recombinant DNA technology.

Additional inputs: Recombinant products – production & advantages

Recommended Books:

1. Gene cloning – By T.A.Brown
2. Gene Biotechnology – By Jogdand
3. Molecular Biology of Gene – By Watson
4. Molecular Biotechnology – By G.R.Glick
5. Elements of Biotechnology – By P.K.Gupta

6. Molecular Biology – By David Freifelder
7. Cell and Molecular Biology – By Roberties&Roberties Molecular Biology & Biotechnology – By H.D.Kumar
8. Microbial Genetics – By S.R.Maloy Cell and Molecular Biology – ByS.C.Rastogi

Weblinks

1. <https://www.yourgenome.org/facts/what-is-gene-expression>
2. <https://microbenotes.com/gene-expression/>
3. https://en.wikipedia.org/wiki/Gene_expression
4. <https://microbenotes.com/recombinant-dna-technology-steps-applications-and-limitations/>

Government College (A), Rajamahendravaram
Department Of Biotechnology
III B.Sc., Biotechnology; Semester - 5; Theory syllabus 2021-22
Paper-6 Gene Expression & r DNA technology
Course code: BTL125
Blue print for question Paper – 2021-22

Time: 2^{1/2} hours

Max. Marks: 50

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 all the 5 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

Government College (A), Rajamahendravaram
Department Of Biotechnology
III B.Sc., Biotechnology; Semester - 5; Theory syllabus 2021-22
Paper-6 Gene Expression & r DNA technology
Course code: BTL125

Model question paper for Semester end theory examinations. 2021-22

Time: 2 ½ Hours

Max.Marks:50

Part – A

Answer any 4 of the following essay questions

4 X 10= 40M

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


1. Describe Genetic Code characteristics in detail
2. Describe the process of translation in detail.
3. Describe the regulation of Lac operon in detail
4. Describe the various vectors used in genetic engineering
5. Describe different types of cloning vectors
6. Describe construction, advantages and applications of Cdna library.

Part-B

Answer All the five of the following short answer questions

5 X 2= 10M

7. Shine Dalgarno sequence
8. Post translational modification
9. Rho factor mediate determination
10. Transfection
11. Primer

	Government College (Autonomous) Rajahmundry					
Course Code: BTL126P	SUBJECT : Biotechnology		Program & Semester III B.Sc. (VISem)			
	TITLE OF THE COURSE Paper 6 : Gene Expression & r DNA technology					
Teaching	Total Hours Allocated : 60 (Lab)		L	T	P	C
Pre-requisites:	<ul style="list-style-type: none"> ➤ Basics of rDNA technology ➤ And transcription, translation and replication mechanisms. 				2	2

List of experiments:

1. To measure concentration of DNA & RNA by UVspectrophotometry
2. Estimation of proteins by Brad ford method
3. Isolation of genomic DNA
4. Isolation of Plasmid DNA
5. Restriction digestion of DNA
6. Demonstration of Replica plating technique
7. Identification of Lac+ bacteria by blue white screening using IPTG
8. Ligation of DNA
9. Chemical mutagenesis and production of microbial mutants


Model question paper for Semester end practical examinations. 2021-2022

TIME: 3 hours

Max. Marks: 50

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

	Total 50

	Government College (Autonomous) Rajahmundry	Program & Semester III B.Sc (VI Sem)			
CourseCode BTL118	SUBJECT: Biotechnology				
	TITLE OF THE COURSE Elective 7C : Biostatistics, bioinformatics, IPRS				
Teaching	Hours Allocated:60(THEORY)	L	T	P	C
Pre-requisites:	<ul style="list-style-type: none"> ➤ Should know basics of biostatistics like mean. ➤ Should have basic knowledge about computer. 	2	1	-	3

CourseObjectives:

- This course aims students to learn combination of statistics with science a biostatistics.
- This course also teaches computer applications in biological science as bioinformatics.

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.

Course with focus on employability / entrepreneurship / Skill Development modules

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 :

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

Concept of probability, basic laws and its application to Mendelian segregation. Concept of probability distribution. Binomial and Poisson distributions, Normal distribution and their application to biology.

Unit II:

Concept of sampling and sampling distribution. Concept of test of hypothesis. Applications of t-test statistics to biological problems/data: Chi-square, statistic applications in biology.

Simple regression and correlation. Concept of analysis of variance (one-way classification).

Unit III: Introduction to Bioinformatics

Biological Databases – Nucleotide sequence and Protein databases, their utilization in Biotechnology (NCBI, EMBL, EXPASY, PIR, Pfam. Concept of World Wide Web: HTML, HTTP).

Unit IV

Storage of biological data in databanks, data retrieval from databases and their utilization. Searching sequence databases using BLAST.

Unit V: Introduction to Intellectual property

Introduction to Intellectual property: Introduction to copyrights, patent law, trade mark, (any other type of intellectual property), international organizations, agencies and treaties. Importance of intellectual property rights.

Additional Input: Infringement – Overuse or Misuse of Intellectual Property Rights.

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

Weblinks

1. <https://www.yourgenome.org/facts/what-is-gene-expression>
2. <https://microbenotes.com/gene-expression/>
3. https://en.wikipedia.org/wiki/Gene_expression

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

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

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

Government College (Autonomous), Rajamahendravaram.

Department of Biotechnology

III B.Sc.-Agro Biotechnology: 2021- 2022

Semester –6

Course BTL118: Elective 7C : Biostatistics, bioinformatics and IPRS

Blue print for question Paper – 2021-22

Time: 2 ½ hours

Max. Marks: 50

Part – A

I. Essay questions: answer any4 :

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 all the 5 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

	Government College (Autonomous) Rajahmundry		Program & Semester III B.Sc (VI Sem)			
CourseCode BTL118P	SUBJECT: Biotechnology					
	TITLE OF THE COURSE Elective 7C : Biostatistics, bioinformatics, IPRS					
Teaching	Hours Allocated:60(Lab)		L	T	P	C
Pre-requisites:	<ul style="list-style-type: none"> ➤ Should know basics of biostatistics like mean. ➤ Should have basic knowledge about computer 				3	2

Government College (Autonomous), Rajamahendravaram.
Department of Biotechnology:
III B.Sc Agro Biotechnology Syllabus: 2021- 2022
Semester –6
Course BTL118 : Elective 7C : Biostatistics, bioinformatics and IPRS
Model Question Paper – 2021-22

Time: 2 ½ hrs
50M

Max. Marks:

Part –A

Answer any Four of the following.

4X10=40M

1. Write in detail the applications of statistics in biology.
2. Write in detail about probability and probability distribution.
3. Write in detail about biological databases.
4. Write an essay on applications of bioinformatics.
5. Write an essay on intellectual property rights.
6. Write an essay on overuse and misuse of IPR.

Part -B

Answer all FIVE of the following.

5X2=10M

7. Calculate the mean for individual series 9, 7, 6,10,12,11.
8. In F₂ generation, Mendel obtained 621 tall plants and 187 dwarf plants out of the total of 808. Test whether these two types of plants are in accordance with the Mendelian monohybrid ratio 3:1 or do they deviate from this ratio.
9. HTML
10. Write about Databank.
11. Write about trade mark.

List of experiments:

- Calculation of Mean of given data
- Draw pie chart of the following data
- Align the given sequences and calculate genetic similarity of the sequences
- Calculate median and mode of the following given data
- Arrange the given data in continuous and discrete form
- Calculate standard deviation of the given following data
- Identify the sequence of the given gene through blast
- Align the sequences using multiple alignment tool.
- Write the complete procedure for obtaining a Patent


Note: perform all practical's

Model Question Paper for Semester End Practical Examinations

TIME: 3 hours

Max. Marks: 50 M

1. Major experiment.	15 M
2. Minor experiment.	10 M
3. Identify the given spotter (3x5M)	15 M
3. Record	05 M
4. Viva-voce	05 M
Total	----- 50 M -----

	Government College (Autonomous) Rajahmundry				
	Course Code: BTL132	SUBJECT : Biotechnology TITLE OF THE COURSE Cluster elective 3 : 8C1: Plant and Animal Biotechnology	Program & Semester III B.Sc. (VISem)		
Teaching	Total Hours Allocated : 60(Theory)	L	T	P	C
Pre-requisites:	<ul style="list-style-type: none"> ➤ Knowledge about plant and animal physiology. ➤ Knowledge about structure and functions of both plant and animal cells. 	2	1	-	3

CourseObjectives:

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

CourseOutcomes:

- Plant biotechnology encompasses and enables the pupil to understand tissue culture

techniques and various applications like production and propagation of hybrids which are of superior quality.

- Animal biotechnology encompasses the growing of animal cells *invitro* and its study enables in understanding the secrets of life and the requirements & mechanisms of genetic corrections
- The course provides thorough understanding of techniques involved in making the life of human kind easier.
- This very interesting course not only encourages the pupil to further go for higher studies but also induces a quest to learn more and more and also to pursue research
- The pupil will understand nutritional requirements of plants and animal cells , which
- enables the student to grow the cells on artificial medium *invitro*. Also the course confers understanding and application of cellular mechanisms to produce industrially important products.

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

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

Syllabus:

UNITI: Cell and tissue culture:

Introduction to cell and Tissue culture Laboratory facilities, Explant. Tissue culture media (composition and preparation) Callus and suspension cultures: initiation and maintenance of callus and suspension cultures; single cell clones.

UNITII: Tissue and micro propagation:

Direct and indirect regeneration, production of haploids, protoplast culture and Somatic hybridization.

UNITIII:

Cloning in plants -Ti plasmid organization. Concept of transgenic plants Bt-cotton and other plant applications.

UNITIV: Various techniques of animal cell and tissue culture:

Culture media, growth factors, laboratory facilities for animal cell culture. Characteristics of cells in culture: Contact inhibition, anchorage dependence, cell-cell communication etc.; Cell senescence; cell and tissue response to trophic factors. Primary culture, immortal cells, cell lines. Maintenance of cell lines in the laboratory.

UNIT V: rDNA products:

Brief idea about recombinant DNA products in medicine (insulin, somatostatin, vaccines), Concept of Gene therapy, Production of recombinant vaccines–hepatitis. Concept of transgenic animals In-vitro fertilization and embryo transfer in humans and farm animals.

Additional input – Phyto hormones and edible vaccines

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

RECOMMENDED BOOKS:

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, 199

Weblink

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

Virtual lab Links

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

Government College (Autonomous), Rajamahendravaram.
Department of Biotechnology :
III B.Sc.- , Biotechnology : 2021- 22
Semester –6
Cluster elective 3 : 8C1 : Plant and Animal Biotechnology :
Course code BTL 132

Blue print for question Paper — 2021-22

Time: 2½ hours

Max. Marks: 50

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 all the 5 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

Government College (Autonomous), Rajamahendravaram.
Department of Biotechnology
III B.Sc.- , Biotechnology : 2021- 2022
Semester –6
Cluster elective 3 : 8C1 : Plant and Animal Biotechnology
Course code BTL 132

Model Question Paper

Time : 2 ½ hrs.

Max .Marks : 50M

Part- A

Answer Any 4 essay questions.

4 X 10 = 40M

Note: Draw Diagrams wherever necessary.

1. Write in detail the principles of animal cell culture.
2. Write the Culture of Stem cells and their application, classification of proteins.
3. Write the characteristics of cells in invitro culture.
4. Describe about recombinant DNA products in medicine.
5. Write an essay intellectual property rights.
6. Write an essay on Phytohormones and edible vaccines

Part-B

Answer all five short answer questions.

5 X 2= 10 M

7. Explants and cell disaggregation
- .
8. Gene therapy
9. Microinjection
- .
10. Copy right.
11. Patent



Government College (Autonomous) Rajahmundry

Course Code: BTL132P	SUBJECT : Biotechnology	Program & Semester III B.Sc. (VI Sem)			
	TITLE OF THE COURSE Cluster elective 3 : 8C1: Plant and Animal Biotechnology Lab				
Teaching	Total Hours Allocated for lab : 30	Lec tur es	Tuto rials	Pra cs	Credi ts
Pre-requisites:	<ul style="list-style-type: none">➤ Aseptic techniques.➤ Preparation and sterilization of solutions.	0	0	2	2

List of experiments:

1. Establishing a plant cell culture (both in solid and liquid media)–seed germination, callus culture, suspension cell culture, regeneration from callus cells.
2. Suspension culture.
3. Cell count by hem cytometer.
4. Cytology of callus.
5. Establishing primary cell culture of chicken embryo fibroblasts.
6. Animal tissue culture –maintenance of established cell lines.
7. Animal tissue culture –virus cultivation.
8. Measurement of cell size.
9. Microphotography.
10. IMVIC test.
11. Determination of seed viability.

Model Question Paper for Semester End Practical Examinations

TIME: 3 hours

Max. Marks: 50M

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

Total	50 M



Government College (Autonomous) Rajahmundry

Course Code: BTL145	SUBJECT : Biotechnology	Program & Semester III B.Sc. (VISem)			
	TITLE OF THE COURSE Cluster elective 3: 8C2 : Environment and Industrial Biotechnology				
Teaching	Total Hours Allocated : 60 (THEORY)	L	T	P	C
Pre-requisites:	<ul style="list-style-type: none"> ➤ Various Causes of Environmental pollution ➤ Knowledge about General features of microbes 	4	1	-	3

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.

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.

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

Unit I: Principles of Ecology:

Water and terrestrial ecosystems, Bio-geo chemical cycles - Carbon, Nitrogen cycles. **Inorganic and Organic pollutants** of air, land and water; maintenance of standards, Environmental monitoring. Biological indicators

Unit II: Biocides,

Refuse disposal - Treatment methods, effluent from pulp and paper industry.

Bioremediation, Biodegradation of recalcitrant compounds and the role of genetically engineered microbes in the environmental management.

Unit III: Isolation, Screening,

Preservation of industrially Important Microorganisms. Synthetic and Natural Medium, Precursors, Antifoams, Sterilization Methods and Inoculum Preparation.

Definition of bioreactor, basic principles of bioreactor. Types of bioreactors

Unit IV:

Ethanol Production by Fermentation using Molasses. Production of Citric Acid by Submerged and Solid State Fermentations. **Waste water management** - Aerobic and anaerobic treatment, primary, secondary and tertiary treatment of municipal wastes.

Unit V: Sources of Industrial Enzymes,

Production of Microbial Enzymes like Amylase and SCP Production. Production of Antibiotics: Penicillin. **Biotechnology Products**- Production of recombinant proteins having therapeutic and diagnostic applications (Insulin, Growth Hormone, Recombinant vaccines, Monoclonal Antibody).

Additional Input : Super Bug & Vitamin B12

Reference books:

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. & Creueger A. A Text of Industrial Microbiology, 2000, 2nd Edition, Panima Publishers

Government College (Autonomous), Rajamahendravaram.
Department of Biotechnology
III B.Sc.,Biotechnology: 2021-2022
Semester –6
Cluster elective 3: 8C2
Environmental and Industrial Biotechnology: Course code BTL 145

Blue print for question Paper — 2021-22

Time: 2 ½ hours

Max. Marks: 50

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 all the 5 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

Government College (Autonomous), Rajamahendravaram.
Department of Biotechnology:
III B.Sc.-,Biotechnology Syllabus: 2021- 2022
Semester –6
Cluster elective 3: 8C2
Environmental and Industrial Biotechnology: Course code BTL 145

Model Question Paper

Time: 2 ½ hrs.

Max. Marks: 50M

Part- A

Answer Any 4 essay questions

4 X 10 = 40M

Note: Draw Diagrams wherever necessary.

1. Describe in detail about Bio-geo chemical cycles.
2. Write in detail about effluent from pulp and paper industry.
3. Isolation, Screening, Preservation of industrially Important Microorganisms
4. Write about the production of citric acid.
5. Production of recombinant proteins, Insulin
6. Describe the Super Bug & Vit B12

Part-B

Answer any five short answer questions.

5 X 2 = 10 M

7. Antifoams.
8. Bio-Geo chemical cycle
9. Bioremediation
10. Growth hormone
11. Fermentation



Government College (Autonomous) Rajahmundry

Course Code: BTL145P	SUBJECT : Biotechnology	Program & Semester III B.Sc(VISem)			
	TITLE OF THE COURSE Cluster elective 3 : 8C2 : Environment and Industrial Biotechnology Lab				
Teaching	Total Hours Allocated for lab : 30	Lec	Tuto	Pra	Cre
Pre-requisites:	<ul style="list-style-type: none"> ➤ Volumetric Titrations ➤ Knowledge about handling and growing microbes 	0	0	2	2

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:

Practicals: Environmental Biotechnology

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 xenobiotic degrading bacteria by selective enrichment technique
8. Estimation of heavy metals in water/soil
9. Estimation of nitrate in drinking water.
10. Preparation and formulation of microbial bio pesticide (bacteria, fungi and viruses)
11. In vitro evaluation of medicinal plants against pathogenic microbes.
12. Effect of mycorrhizal fungi on growth promotion of plants.
13. Production of microbial fertilizers (Rhizobium, Azotobacter and AMF).

Practicals: Industrial biotechnology

1. Isolation of industrially important microorganisms from soil.
2. Isolation of amylase producing organisms from soil.
3. Production of α – amylase from *Bacillus Spp.* by shake flask culture.
4. Production of alcohol or wine using different substrates.
5. Estimation of alcohol by titrimetric.
6. Estimation of alcohol by calorimetric method.
7. Production of citric acid.
8. Citric acid production by submerged fermentation. 9. Estimation of citric acid by titrimetry.

Model Question Paper for Semester End Practical Examinations

TIME: 3 hours

Max. Marks: 50M

1. Major experiment.	15 M
2 Minor experiment.	10 M
3. Identify the given spotter (3x5M)	15 M
4. Record	05 M
5. Viva-voce	05 M
TOTAL	50M



Government College (Autonomous) Rajahmundry

Course Code: BTL146	SUBJECT : Biotechnology	Program & Semester III B.Sc. (VISem)			
	TITLE OF THE COURSE Cluster elective 3: 8C3: Medical Nano biotechnology				
Teaching	Total Hours Allocated : 60 (THEORY)	L	T	P	C
Pre-requisites:	➤ Basic knowledge about nanotechnology	4	1	-	3

Course Objectives:

1. This course teaches about nanotechnology in biomedical applications
2. This course gives basic knowledge about drug delivery systems using nanotechnology.
3. This course provides basic idea about health and environment impact of nanotechnology.

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

CO1	The students will have basic idea of nanotechnology in science.
CO2	The students will be able to understand how medicinal drugs are delivered using nanotechnology.
CO3	This students will understand the working of biosensors.
CO4	This course gives idea about biomaterial sciences.
CO5	Students will be able understand the impact in health and environment by nanotechnology.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development	<p>Applications of micro and Nano-electromechanical devices to drug delivery</p> <p>Photo dynamic therapy in target drug</p> <p>Photo dynamic therapy in target drug</p> <p>Introduction, engineered Nanomaterials of relevance to human health</p>		Employability	<p>Applications of biosensors</p> <p>Biosensors types, Biosensor development, biomedical sensors</p>		<p>Entrepreneurship</p> <p>Introduction, drug delivery systems, polymer-therapeutics</p> <p>Nanomaterials for drug delivery</p> <p>Bioresponsive hydrogels</p>
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Syllabus:

Unit 1. Nanobiotechnology in biomedical applications:

Introduction, Applications of micro and Nano-electromechanical devices to drug delivery, Biological sciences , Regulatory dimensions, Implantable devices, Reservoirs for controlled release, Stents.

Photo dynamic therapy in target drug: Administration, combination therapy, targeting specific cellular functions sensitive linkages

Enhancement of photo dynamic therapy by the photo sensitizer: conjugation to carrier molecules, synthetic peptides, polymers, composite targeting.

Unit 2. Advances in manufacturing Biosensors:

Applications of biosensors, Biosensors types, Biosensor development, biomedical sensors and Biosensors: sensors in modern medicine, physical vs chemical sensors, effects of sensors in body, biosensors Quantum dot technology: quantum dots in early diagnosis of cancer, quantum dot technology, and synthesis of quantum dot, properties and applications of quantum dots

DNA based artificial nanostructures and their applications: fundamentals of DNA, attachment of DNA to surface, DNA based Nanomaterials as biosensors.

Unit 3: Biomaterials sciences:

Introduction about biomaterials, First generation

Biomaterials, second generation biomaterials, third generation biomaterials, biomaterials in Tissue engineering, micro/ nanotechnology and biomaterial sciences

Unit 4: Nano medicine and novel drug delivery systems:

Introduction, drug delivery systems, polymer-therapeutics, Nanomaterials for drug delivery, Nanoparticles target cancer cell in vivo, drug carriers , dendrimers as drug carriers,

Bioresponsive hydrogels, tissue regeneration/engineering, applications of materials In medicine

Unit 5: Health and environmental impacts of nanotechnology:

Introduction, engineered Nanomaterials of relevance to human health, engineered Nanomaterials in the body, routes of entry- gastrointestinal tract, skin, lungs, toxic

Mechanisms, environmental implications of nanoparticles, plant and microbes as

Nanofactories, bacteria in nanoparticle synthesis, yeast in nanoparticle synthesis, fungi in Nanoparticle synthesis

Additional Input: toxicological health effects caused by nanoparticles,

References:

1. Nano biotechnology by Subbiah Balaji, MJP Publishers.
2. Hand book of Materials for Nano medicine by Torchilin V, PAN STANFORD publishers
3. Nanotechnology for biomedical applications by Thomas Varghese

Weblink

1. <https://www.understandingnano.com/medicine.html>
2. http://cfl.iuims.ac.ir/uploads/my_nano_ref.pdf

Virtual links

1. <https://teach.its.uiowa.edu/remote-and-virtual-labs-online-nanotechnology-course>
2. https://www.teachengineering.org/lessons/view/van_nanoparticles_lesson03

Government College (Autonomous), Rajamahendravaram.
Department of Biotechnology
III B.Sc.-,Biotechnology: 2021- 2022
Semester –6
Cluster elective 3: 8C3
Medical Nano biotechnology: Course code BTL 146

Blue print for question Paper — 2021-22

Time: 2 ½ hours

Max. Marks: 50

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 4
- Question 5 from Unit V
- Question 6 from additional input

Part-B

II. Short answer questions : Answer all the 5 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

Government College (Autonomous), Rajamahendravaram.
Department of Biotechnology
III B.Sc.-,Biotechnology Syllabus: 2021- 2022
Semester –6
Cluster elective 3: 8C3
Medical Nano biotechnology: Course code BTL 146

Time: 2 ½ Hours

Max.Marks: 50M

Part – A

Essay questions: answer any 4

4 X 10 = 40 M

1. Write about photodynamic therapy in targeted drug administration.
2. Write an essay on biomedical sensors
3. Write in detail about the three generations of Biomaterials
4. Write in detail about dendrimers as Nanoparticulate drug carriers
5. Describe the process of nanoparticle synthesis by bacteria.
6. Write in detail about toxicological health effects caused by nanoparticles

Part-B

Answer all 5 questions

5 x 2 = 10 M

7. Write any two applications of biomaterials in medicine
8. Biomaterials in tissue engineering.
9. Advances in quantum dot technology for the diagnosis of cancer.
10. Implantable devices
11. Uses of yeast in Nano particle synthesis



Government College (Autonomous) Rajahmundry

Course Code: BTL146P	SUBJECT : Biotechnology	Program & Semester III B.Sc. (VISem)			
	TITLE OF THE COURSE Cluster elective 3: 8C3: Medical Nano biotechnology				
Teaching	Total Hours Allocated :30(Lab)	L	T	P	C
Pre-requisites:	<ul style="list-style-type: none">➤ Basic knowledge about nanoparticles➤ Handling of nanoparticles			3	2

List of experiments:

1. Ultrasonic production of Nano sized dispersion emulsion.
2. Synthesis of copper nanoparticles
3. Synthesis of copper sulphate nanoparticles using ultrasonication
4. Synthesis of copper chitasonenano particles using ultra sonication
5. Synthesis of copper Nano particles using wet chemical method
6. Synthesis of copper Nano particles using Hibiscus bark by wet chemical method.
7. Synthesis of copper herbal extract nanoparticle using ultrasonication and heat
8. Synthesis of copper herbal extract glucose nanoparticles by ultrasonication and heat.
9. Synthesis of copper particle using wet chemical method.

* Depending on the availability of chemicals and equipment any 6 of the above practicals Should be performed.


Model Question Paper for Semester End Practical Examinations

TIME: 3 hours

Max. Marks: 50M

- | | |
|--------------------------------------|------|
| 1. Major experiment. | 15 M |
| 2. Minor experiment. | 10 M |
| 3. Identify the given spotter (3x5M) | 15 M |
| 4. Record | 05 M |
| 5. Viva-voce | 05 M |

Total 50 M

	Government College (Autonomous) Rajahmundry				
Course Code: BTL148	SUBJECT : Biotechnology	Program & Semester III B.Sc.Agro(VISem)			
	TITLE OF THE COURSE Cluster elective 3: 8C1: Crop improvement technology				
Teaching	Total Hours Allocated :45(Theory)	L	T	P	C
Pre-requisites:	➤ Basic knowledge about crop improvement technology	3	1	-	3

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 have 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 understands the concept of transgenic plants
CO5	The students understands how transgenic plants are use 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 – 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

Unit II:

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

Unit III:

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

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 – 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>

Government College(Autonomous), Rajamahendravaram

Department of Biotechnology

III B.Sc., Agro biotechnology syllabus

Semester –VI (2021-2022)

Cluster elective –8C1:Course code: BTL148

COURSE TITLE:CROP IMPROVEMENT TECHNOLOGY

Question Paper Design and Guidelines to Paper setter – 2021-22

Time: 2 ½ hours

Max. Marks: 50

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 all the 5 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

Government College (Autonomous), Rajamahendravaram

Department of Biotechnology

III B.Sc., Agro biotechnology syllabus

Semester –VI (2021-2022)

Cluster elective –8C1: Course code: BTL148

COURSE TITLE: CROP IMPROVEMENT TECHNOLOGY

Time: 2 ½ Hours

Max. Marks : 50M

Part – A


I. Answer any four essay questions 4 X 10 = 40M

1. Write an essay on preparation of plant tissue culture media.
2. What is micro propagation? Write in detail about somatic embryogenesis and its applications.
3. Write in detail about cybrids.
4. Write about Agrobacterium mediated gene transfer method in plants.
5. Write an essay on molecular markers used for crop improvement.
6. Write an essay on applications of transgenic plants in crop improvement

Part – B

II. Answer all the questions 5 x 2 = 10M

7. Pollen culture
8. Synthetic seeds
9. Cryopreservation.
10. Gene gun method
11. Applications of Molecular markers.

	Government College (Autonomous) Rajahmundry				
Course Code: BTL148P	SUBJECT : Biotechnology	Program & Semester III B.Sc.Agro(VISem)			
	TITLE OF THE COURSE Cluster elective 3: 8C1: Crop improvement technology				
Teaching	Total Hours Allocated :30(Lab)	L	T	P	C
Pre-requisites:	➤ Basic knowledge about crop improvement technology			2	2

List of experiments:

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

MODEL QUESTION PAPER FOR SEMESTER END PRACTICAL EXAMINATIONS

TIME: 3 hours

Max. Marks: 50 M

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

	Total 50 M



Government College (Autonomous) Rajahmundry

Course Code: BTL139	SUBJECT : Biotechnology	Program & Semester III B.Sc.Agro(VISem)			
	TITLE OF THE COURSE Cluster elective 3: 8C1: Organic farming				
Teaching	Total Hours Allocated :45(Theory)	L	T	P	C
Pre-requisites:	➤ Basic knowledge about organic farming technique.	3	1	-	3

Course Objectives:

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

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

CO1	The students have basic knowledge of organic farming.
CO2	The students will be able to understand about eco-friendly farming systems.
CO3	The students will have knowledge about organic nutrient sources and green manures.
CO4	The students will be able to know about nutrient management in organic farming.
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:

Unit 1:- Organic farming – definition – need – scope – principles – characteristics relevance to modern agriculture

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

Unit 3:- Organic nutrient sources and their fortification – organic manures- methods of composting

Unit 4:- Green manures- bio fertilisers – types, methods of application – benefits and limitations. Nutrient use in organic farming-scope and limitations.

Unit 5:- Nutrient management in organic farming. Choice of crops and varieties in organic farming – crop rotations – need and benefits

Additional Input: Multiple cropping.

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>

Government College (Autonomous), Rajamahendravaram
Department of Biotechnology
III B.Sc., Agro biotechnology syllabus
Semester –VI (2021-2022)
Course title: Organic Farming-Course code: BTL139
Cluster – 8C2

Question Paper Design and Guidelines to Paper setter – 2021-22

Time: 2 ½ hours

Max. Marks: 50

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 all the 5 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**

Government College (Autonomous), Rajamahendravaram
Department of Biotechnology
III B.Sc., Agro biotechnology syllabus
Semester –VI (.2021-2022)
Course title: Organic Farming-Course code: BTL139

Cluster – 8C2

Time: 2 ½ Hours

Max. Marks: 50M

Part – A

Essay questions: answer any 4 4 X 10 = 40 M

1. Write an essay on principles and characteristics relevance to modern agriculture.
2. Write an essay on different eco-friendly farming systems.
3. Write in detail about methods of composting.
4. Write about nutrients used in organic farming its scope and limitations.
5. Write an essay on crop rotation and its benefits.
6. Write an essay on multiple cropping.

Part- B

Answer all 5 questions 5 x 2 = 10 M

7. Organic farming
8. Regenerative agriculture
9. Fortification
10. Green manures
11. Nutrient management in organic farming.



Government College (Autonomous) Rajahmundry

Course Code: BTL139P	SUBJECT : Biotechnology	Program & Semester III B.Sc.Agro(VISem)			
	TITLE OF THE COURSE Cluster elective 3: 8C1: Organic farming				
Teaching	Total Hours Allocated :30(Lab)	L	T	P	C
Pre-requisites:	➤ Basic knowledge about organic farming technique.			3	2

List of experiments:

1. Visit to organic farm to study the various components, identification and Utilisation of organic products.
2. Compost making- aerobic and anaerobic methods
3. Vermicompost preparation
4. Preparation of enriched farm yard manure
5. Visit to organic clusters and bio control lab to study the maintenance of Biofertilizers/bio-inoculant cultures
6. Biological nitrogen fixers.
7. Methods of application of Bio-pesticides (Trichocards, BT, NPV)
8. Preparation of neem products and other botanicals for pest and disease Control
9. Preparation of green pesticides (panchagavya, beezamrutam, jeevamrutam, ghanajeevamrutam, dravajeevamrutam).
10. Different methods of bio fertiliser applications.

MODEL QUESTION PAPER FOR SEMESTER END PRACTICAL EXAMINATIONS

TIME: 3 hours

Max. Marks: 50M

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

Course Code: BTL143	SUBJECT : Biotechnology	Program & Semester III B.Sc.Agro(VISem)			
	TITLE OF THE COURSE Cluster elective 3: 8C3: Vegetable Science				
Teaching	Total Hours Allocated :45(Theory)	L	T	P	C
Pre-requisites:	➤ Basic knowledge about vegetable science	3	1	-	3

Course Objectives:

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

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

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

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 –VI (2021-2022)

Cluster elective –8C3

Course title: Vegetable Science - Course code: BTL143

Question Paper Design and Guidelines to Paper setter — 2021-22

Time: 2 ½ hours

Max. Marks: 50

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 all the 5 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

Government College (Autonomous), Rajamahendravaram

**Department of Biotechnology
III B.Sc., Agro biotechnology syllabus
Semester –VI 2021-2022)
Cluster elective –8C3**

Course title: Vegetable Science - Course code: BTL143

Question Paper Design and Guidelines to Paper setter –2021-22

Time: 2 ½ Hours

Max. Marks: 50M

Part – A

Essay question : answer any 4

4 X 10 =40M


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

5 x 2 = 10 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.

	Government College (Autonomous) Rajahmundry					
Course Code: BTL143P	SUBJECT : Biotechnology		Program & Semester III B.Sc.Agro(VISem)			
	TITLE OF THE COURSE Cluster elective 3: 8C3: Vegetable Science					
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
