

KONGUNADU ARTS AND SCIENCE COLLEGE

(AUTONOMOUS)

COIMBATORE – 641029



DEPARTMENT OF BIOTECHNOLOGY (UG)

CURRICULUM AND SCHEME OF EXAMINATIONS (CBCS)

(2026 – 2027 onwards)

DEPARTMENT OF BIOTECHNOLOGY**Vision**

1. To enable the students to comprehend the tool of Biotechnology so as to attain new vistas in core and applied areas of Biotechnology education and research; such that experiential learning and problem-solving attribute shall continuously contribute to the nation building by maintaining high degree of ethical standard and integrity

Mission

1. Build comprehensive quest for scientific inquiry provide the basic and advanced courses
2. Provide a fundamental knowledge of the various application of Biotechnology and integrate it with cutting edge research in niche areas
3. Pursue an integrative interdisciplinary and cross disciplinary approach in teaching, learning and research
4. Foster industrial national and international institutional collaboration for promotion of research, innovation and entrepreneurship in Biotechnology

Goal

1. Provide a holistic and self-reliant learning environment
2. Promote diversity in teaching, learning and research
3. Empower stakeholders through ample hands-on studies, activity-based learning method, Industry oriented case study and project work which shall make learning experience unique
4. Enrich the teaching and learning process through adequate industry/local community partnership
5. Inculcate high standards of ethic, professionalism and responsibility among the stakeholders

B.Sc. BIOTECHNOLOGY**Programme Outcomes (PO)**

The student will be able to:

PO1: Demonstrate their knowledge and technical skills in core and allied areas of Biotechnology

PO2: Possess adequate theoretical and practical knowledge, Skill and attitude to pursue higher studies/research in biotechnology and allied areas of Biological Science

PO3: Demonstrate application of knowledge through Critical thinking to decipher and devise potential solutions to existing issues in the industry/society

PO4: Employ the various tools of Biotechnology and Bioinformatics to arrive at viable solutions to address problems which require immediate action

PO5: Communicate appropriately and effectively to all stake holders in biotechnology education/industry/research

PO6: Contribute to the growth of Nation's GDP by establishing enterprise/startup/bio business ventures

PO7: Adopt high standards of ethics in all transactions in the field of biotechnology education, research, publication and dissemination of knowledge to all the stake holders

PO8: Develop and sustain Knowledge, Skills and Attitude for a continuous and lifelong learning and Continuous Professional Development

Programme Specific Outcomes (PSO)

- PSO1:** Apply the knowledge and skills gained through the study of basic and advanced courses like Cell Biology and Genetics, Molecular Biology, Recombinant DNA Technology, Immunology, Genomics and Proteomics, Plant and Animal Biotechnology alongside with the practical exposure to succeed in their career/ professional development and/or postgraduate education.
- PSO2:** Create, select and apply appropriate techniques, resources, and modern biotechnological tools along with computational and bioinformatics tools for solving several issues in myriad fields of science and technology
- PSO3:** Will be competent to outshine in various competitive examinations in Life Sciences, with emphasis on Biotechnology and applied sciences, for higher education and research
- PSO4:** Apply contextual knowledge to assess, comprehend and address societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to biotechnology education/research/ entrepreneurship.
- PSO5:** Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary niches like pharmaceutical, food, marine industries and other related areas of employment

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Programme Name: BSc., Biotechnology

Curriculum and Scheme of Examination under CBCS

(Applicable to the students admitted during the Academic Year 2026-2027)

Semester	Part	Subject Code	Title of the Paper	Instruction hours/cycle	Exam. Marks			Duration of Exam	Credits
					CIA	ESE	TOTAL		
I	I	26TML101	Language I@	6	25	75	100	3	3
	II	26ENG101	English –I	6	25	75	100	3	3
	III	26UBT101	Core Paper 1 – Cell Biology and Genetics	5	25	75	100	3	4
	III		Core Practical 1 – Lab in Cell biology, Genetics and Microbiology	5	-	-	-	-	-
	III	26UCH1A1	Allied Paper 1 – Chemistry	4	20	55	75	3	4
	III	26UCH2AL	Allied Practical 1- Chemistry	2	-	-	-	-	-
	IV	26EVS101	Environmental Studies **	2	-	50	50	3	2
	Total			30	-	-	425	-	16
II	I	26TML202	Language II@	6	25	75	100	3	3
	II	26ENG202	English –II	6	25	75	100	3	3
	III	26UBT202	Core Paper 2 –Bioinstrumentation	4	25	75	100	3	4
	III	26UBT203	Core Paper 3 – Microbiology	4	25	75	100	3	4
	III	26UBT2CL	Core Practical 1 - Lab in Cell biology, Genetics and Microbiology	2	40	60	100	6	4
	III	26UCH2A2	Allied Paper 2 – Chemistry	4	20	55	75	3	4
	III	26UCH2AL	Allied Practical 1 – Chemistry	2	20	30	50	-	2
	IV	26VED201	Value Education- Moral and Ethics**	2	-	50	50	3	2
	Total			30	-	-	675	-	26
III	I	26TML303	Language III@	6	25	75	100	3	3
	II	26ENG303	English –III	6	25	75	100	3	3
	III	26UBT304	Core Paper 4 – Enzymology and Metabolism	3	25	75	100	3	3
	III	26UBT305	Core Paper 5 – Molecular Biology	3	25	75	100	3	3
	III		Core Practical 2 - Lab in Enzymology, Molecular Biology and rDNA Technology	2	-	-	-	-	-
	III	26UBT3A3	Allied Paper 3 – Fundamentals of Mathematics	6	20	55	75	3	4

	IV	26UGC3S1	Skill Based subject 1- Basics of Cyber Security	2	100	-	100	-	3
	IV	26TBT301/ 26TAT301/ 26UHR3N1	Basic Tamil* / Advanced Tamil**/Non-Major Elective- I**	2	-	75	75	3	2
	Total			30	-	-	650	-	21
IV	I	26TML404	Language IV@	6	25	75	100	3	3
	II	26ENG404	English –IV	6	25	75	100	3	3
	III	26UBT406	Core Paper 6 – rDNA Technology	4	25	75	100	3	3
	III	26UBT4CM	Core Practical 2 - Lab in Enzymology, Molecular Biology and rDNA Technology	4	40	60	100	6	3
	III	26UBT4A4	Allied Paper 4 – Bio Statistics	4	20	55	75	3	4
		26UBT4AL	Allied Practical 2- Bio Statistics Practical	2	20	30	50	3	2
	IV	26UBT4S2	Skill based Subject 2 - Traditional Indian Technology and Bio Business	2	25	75	100	3	3
	IV	26TBT402/ 26TAT402/ 26UWR4N2	Basic Tamil* / Advanced Tamil**/Non-Major Elective- II**	2	-	75	75	3	2
	Total			30	-	-	700	-	23
V	III	26UBT507	Core Paper 7 – Immunology	5	25	75	100	3	4
	III	26UBT508	Core Paper 8 – Plant and Animal Biotechnology	4	20	55	75	3	4
	III	26UBT509	Core Paper 9 – Genomics and Proteomics	4	25	75	100	3	4
	III	26UBT5CN	Core Practical 3 – Lab in Immunology, Plant and Animal Biotechnology	6	40	60	100	6	3
	III	26UBT5E1	Major Elective 1	5	25	75	100	3	5
	III	26UBT5OP	Applications of Modern Biotechnology [∞]	1	25	-	25	2	1
	IV	-	EDC	2	100	-	100	-	3
	-	26UBT5IT	Internship Training ****	Grade					
	III	-	Case Study analysis, Report and Viva Voce***	3#	-	-	-	-	-
	Total			30	-	-	600	-	24
	III	26UBT610	Core Paper 10 – Bioprocess Technology	5	25	75	100	3	4
VI	III	26UBT611	Core Paper 11 – Biopharmaceuticals	5	25	75	100	3	5
	III	26UBT612	Core Paper 12 - Bioinformatics	5	100	-	100	3	4
	III	26UBT6E2	Major Elective 2	5	25	75	100	3	5
	III	26UBT6CO	Core Practical 4 - Lab in Bioprocess Technology & Biopharmaceuticals	6	40	60	100	6	3

III	26UBT6Z1	Case Study analysis, Report and viva***	2#	20	80	100	-	5
IV	26UBI6S3	Skill Based Subject 3 – Basics of Intellectual Property Rights	2	100	-	100	3	3
Total			30	-	-	700	-	29
V	26NCC ^{\$} /NSS /YRC/PYE/ ECC/RRC / WEC101 [#]	Co-curricular Activities *	-	50	-	50	-	1
Grand Total			-	-	-	3800	-	140

Note: CBCS – Choice Based Credit system CIA – Continuous Internal Assessment
ESE – End of Semester Examinations

\$ For those students who opt NCC under Co-curricular activities will be studying the prescribed syllabi of the UGC which will include Theory, Practical & Camp components. Such students who qualify the prescribed requirements will earn an additional 24 credits

@Hindi/Malayalam/ French/ Sanskrit – 26HIN/MLM/FRN/SAN101 – 404

* - No End-of-Semester Examinations. Only Continuous Internal Assessment (CIA)

** - No Continuous Internal Assessment (CIA). Only End-of-Semester Examinations (ESE)

*** Case study: Report – 60 marks; Viva voce – 20 marks; Internal-20 marks

[∞] 1 Credit Point Self Study Paper

5 hours allotted for project will not be allocated to staff work load.

**** The students shall undergo an Internship training /field work for a minimum period of 14 working days at the end of the fourth semester during summer vacation and submit the report in the fifth semester which will be evaluated for 100 marks by the concerned guide and followed by an Internal Viva voce by the respective faculty or HOD as decided by the department. According to their marks, the grades will be awarded as given below.

Marks %	Grade
85 – 100	O
70 – 84	D
60 – 69	A
50 – 59	B
40 – 49	C
< 40	U (Reappear)

Major Elective Papers (2 papers are to be chosen from the following 6 papers)

1. Stem cell and Neuroscience
2. Nanotechnology
3. Biosafety, Bioethics and Industrial process ethics
4. Research Methodology
5. Molecular Diagnostics
6. Food and Dairy Technology

Non-Major Elective Papers

1. Human Rights
2. Women's Rights
3. Consumer Affairs

Skill Based Subjects

1. Basics of Cyber Security
2. Traditional Indian Technology and Bio Business
3. Basics of Intellectual Property Rights

Sub. Code & Title of the Extra Departmental Course (EDC) :

26UBT5X1 – Bioentrepreneurship

List of Cocurricular Activities:

1. National Cadet Corps (NCC)
2. National Service Scheme (NSS)
3. Youth Red Cross (YRC)
4. Physical Education (PYE)
5. Eco Club (ECC)
6. Red Ribbon Club (RRC)
7. Women Empowerment Cell (WEC)

Note: In core/ allied subjects, no. of papers both theory and practical are included wherever applicable.

However, the total credits and marks for core/allied subjects remain the same as stated below

Job Oriented Courses (JOC)

Semester	Subject Code	Title of the paper	Instruction hours/cycle	Exam. marks			Duration of Exam (hours)	Credits
				CIA	ESE	Total		
VI	26UBT0J1	Clinical Research and Medical Coding	2	-	100	100	3	2
VI	26UBT0J2	Agro Industrial biotechnology	2	-	100	100	3	2

Note: JOC which are offered at present will be applicable for the students admitted during the academic year 2026-2027 and will be considered as extra credit courses.

Tally Table:

S. No.	Part	Subject	Marks	Credits
1.	I	Language – Tamil/Hindi/Malayalam/ French/ Sanskrit	400	12
2.	II	English	400	12
3.	III	Core – Theory/Practical	1600	60
	III	Allied	400	20
		Electives/Project	300	15
4.	IV	Basic Tamil / Advanced Tamil (OR) Non-major electives	150	4
		Skill Based subject	300	9
		EDC	100	3
		Environmental Studies	50	2
		Value Education	50	2
5.	V	Cocurricular Activities	50	1
		Total	3800	140

- 25 % CIA is applicable to all subjects except JOC, COP and SWAYAM courses which are considered as extra credit courses.
- 100 % CIA for Bioinformatics, Basics of Cyber Security, EDC paper and Basics of IPR.
- The students should complete **Health and Wellness Programme (26UHW401)###** in the 4th semester and the completion marks should be submitted through the HOD to the Controller of Examinations. Extra credits will be given to the candidates who have successfully completed.
- The students should complete any **MOOC course available for Online learning platforms like SWAYAM, NPTEL, Coursera^{\$\$}, IIT Bombay Spoken Tutorial, e-Pathshala etc.,** before the completion of the 5th semester and the course completion certificate should be submitted through the HoD to the Controller of Examinations. Appropriate credits will be given to the candidates who have successfully completed.

^{\$\$}**Note:** One course to be taken from coursera for all the under graduate students of self finance stream during the even semester of the I year. **Appropriate extra credits@@@** and certification as applicable shall be awarded to the students who have completed the course.

^{@@@}**Note:** Course Duration :

Duration	Extra Credits
< 10 hours	0
> =10 hours and < = 20 hours	1
> 20 hours	2

An **Onsite Training** preferably relevant to the course may be undertaken as per the discretion of the HOD.

- Extra credits shall be awarded for innovative products/ individual paper presentations and publications in reputed national/ international proceedings and in indexed journals by the UG students for their original research contributions.
- Product development through Technology Readiness Levels:
 - Phase 1 Level (TRL 1-3) : Basic research: 1 credits
 - Phase 2 Level (TRL 4 -6) : Development and validation : 2 credits
 - Phase 3 Level (TRL 7-9) : Deployment : 3 credits
- National / International level paper presentation in conferences and publications of full papers in reputed Scopus/ web of Science indexed journals
 - National Level : 1 credit/ paper
 - International Level : 2 credits/ paper
 - Open access Journals are not included

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- Extra credits shall be awarded to students who prefer to opt any course out of their programme on self learning mode. No internal components. 100% ESE.

Teaching Pedagogy

Smart Classroom/Powerpoint presentation/Seminar/Quiz/Discussion/Flipped Classroom/Peer Learning/Experimental Learning/Blended learning

Flipped Classroom

Preamble:

- Under flipped classroom model, students review foundational content before class, with class time dedicated to practice, discussion, and problem – solving where the role of the teachers will be facilitating discussions and enabling students to embark on a holistic learning perspectives

Work instructions:

- One flipped session / unit is made mandatory and the course In-charge shall identify and specify the topic to be covered in the flipped session in the lesson plan.
- Detailed session plans must be intimated to all students at least one week in advance.
- Curated content such as LORs, video lectures, animations, and other relevant digital content shall be provided to students in advance to facilitate effective preparation for the flipped classroom session.

Peer Learning

Preamble:

- Peer Assisted learning enables students to learn from each other sharing knowledge in a collaborative learning environment.
- Development of leadership skills and student engagement through student to student academic support.
- Reduce drop out/failure rates of the students and create a supportive academic culture where a high performing or trained student assists peers academically.

Work Instructions:

- Course In-charge shall supervise the programme by periodically reviewing its implementation, conducting review meetings, and monitoring the progress reports.
- Course In-charge shall identify 5 to 6 fast learners based on their academic performance in internal and external examinations.
- Course In-charge shall also identify students who require additional academic support and assign 4 to 5 such students to each fast learner to facilitate peer learning.
- This team will operate remedial classes on a peer learning mode as per the following:
 - a) One session / week / course and each session shall be for 30 minutes in duration, with follow-up learning activities.
 - b) The faculty In-charge shall review attendance records and monitor the academic progress of the students.

Blended learning

Preamble:

- Blended learning integrates traditional in class instruction with digital tools exposing students to a myriad options for learning from subject experts across the globe
- It is provided with online learning sessions on recorded videos, lecture captured sessions (included under guided library hours), digital resources, and guided sessions facilitated by internal faculty members and external experts through Zoom meets etc.,

Work Instructions:

- For every course, students will be motivated to attend additional webinar/online courses through any interactive learning tools such as, telepresence systems, podcasts, interactive videos etc. with minimum of 2 sessions/course and maximum of 3 sessions/course.

Components of Continuous Internal Assessment

Components		Marks	Total
Theory			
CIA I	75	(75+75) Converted to 15	25
CIA II	75		
Assignment/Seminar		5	
Attendance		5	
Theory (Allied)			
CIA I	55	(55+55) Converted to 10	20
CIA II	55		
Assignment/Seminar		5	
Attendance		5	
Practical			
CIA Practical		25	40
Observation Notebook		10	
Attendance		5	
Practical			
CIA Practical		10	25
Observation Notebook		10	
Attendance		5	
Practical (Allied) (External : 30 marks)			
CIA Practical		10	20
Observation Notebook		5	
Attendance		5	
Project/Case study			
Review		15	20
Regularity		5	

Components of 100% Continuous Internal Assessment

Components		Marks	Total Mark
Theory			
CIAI	55	(75+75=150/2) 75 Converted to 55	55
CIAII	55		
Assignment/Seminar*		5	10
Attendance		5	
Practical			
CIA Practical Breakup of Marks			
Protocol - 15 Result & viva - 15		30	35
Record Note book		5	
TOTAL			100

* Objective Capacity Testing:

For the first assessment, questions shall be set from 2 ½ units (25 questions) and evaluation for 5 marks. The assessment shall be conducted through any authentic online platform, one week prior to the commencement of I CIA theory examinations.

For the second assessment, questions shall be set from 2 ½ units (25 questions) and evaluation for 5 marks. The assessment shall be conducted through any authentic online platform, one week prior to the commencement of II CIA theory examinations.

The average of the first and second assessment scores shall be considered for the final **5 marks** allocation.

BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

K1-Remembering; K2-Understanding; K3-Appling; K4-Analyzing; K5-Evaluating

1. Theory Examination:

(i) CIA I & II and ESE: 75 Marks

Knowledge Level	Section	Marks	Description	Total
K1 Q1 to 10	A (Answer all)	10 x 1 = 10	MCQ	75
K1 – K5 Q11 to 15	B (Either or pattern)	5 x 5 = 25	Short Answers	
K2 – K5 Q16 to 20	C (Either or pattern)	5 x 8 = 40	Descriptive / Detailed	

(ii) CIA I & II and ESE: 55 Marks (Allied)

Knowledge Level	Section	Marks	Description	Total
K1 Q1 to 10	A (Answer all)	10 x 1 = 10	MCQ	55
K1 – K5 Q11 to 15	B (Either or pattern)	5 x 3 = 15	Short Answers	
K2 – K5 Q16 to 20	C (Either or pattern)	5 x 6 = 30	Descriptive / Detailed	

****For ESE 50 marks converted to 25 marks.**

2. ESE Practical Examination:

Knowledge Level	Section	Marks	Total
K3	Experiments	50	60
K4	Record Work	10	
K5			

(For Allied papers)			
Knowledge Level	Section	Marks	Total
K3	Experiments Record Work	25	30
K4		05	
K5			

3. ESE Project Viva Voce:

Knowledge Level	Section	Marks	Total
K3	Project Report	60	80
K4	Viva voce	20	
K5			

4. CIA Component for One Credit Course

CIA I	50 (Converted to 10)	20	25
CIA II	50 (Converted to 10)		
Case Study		5	

QUESTION PAPER PATTERN

Duration: 2 Hours

Knowledge Level	Section	Marks	Description	Total
K1 Q1 to Q6	A (Answer all)	6 x 1 = 6	MCQ	50
K2 – K4 Q7 to Q10	B (Either or pattern)	4 x 5 = 20	Short Answers	
K2 – K5 Q11 to Q13	C (Either or pattern)	3 x 8 = 24	Descriptive / Detailed	

Scheme of Evaluation - Health and Wellness Programme (26UHW401)###

Part	Description	Mark
A	Report	40
B	Attendance	20
C	Activities (Observation during Practice)	40
Total		100

Practical Examination mark breakup:

Knowledge Level	Section	
K3 ↑ ↓ K5	Major Experiments: Protocol - 15 Perform - 5 Result - 5 Minor Experiments: Protocol - 5 Perform - 5 Result - 5 Q&A - 5 Viva - 5	
	Record work	10

**KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)
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**THE MODALITIES FOR THE CONDUCT OF 100% CIA
EXAMINATIONS**

PREAMBLE

As per the recommendations of the Curriculum Development Cell in its meeting held on 27.08.2021, and decision taken in the General Board of Studies meeting held on 16.03.2022, the courses **Cyber Security and Information Security** were introduced in the III semester for all the UG programmes and in the even semester for the PG programme respectively for the students admitted from the academic year 2022-2023 and onwards. Also, it was unanimously decided to conduct 100 % CIA examinations (No End of Semester Examinations) for these courses. The name of the Courses Cyber Security and Information Security are renamed as **Basics of Cyber Security** and **Fundamentals of Information Security** as per the decision taken in the General Board of Studies meeting held on 26.03.2026 for the students to be admitted from the academic year 2026-2027 & onwards. As per the recommendations of the Curriculum Development Cell in its meeting held on 07.03.2022, it was approved in the BOS meeting held on 19.03.2022 to conduct 100% CIA Examinations for the **Extra Departmental Courses** offered in the UG and PG Programmes for the students admitted from the academic year 2022-2023 and onwards. The cited decisions had been approved by the Academic council in its meeting held on 18.04.2022. As per the recommendations of the Curriculum Development Cell in its meeting held on 27.02.2024, and decision taken in the General Board of Studies meeting held on 02.05.2024, the course **Basics of IPR** was introduced in the VI semester for all the UG programmes for the students admitted from the academic year 2024-2025 and onwards and decided to conduct 100 % CIA examinations (NO End of Semester Examinations) for the course.

Hence, the modalities is recommended for the following:

- (i) Conduct of I & II CIA Examinations
- (ii) Question Paper Pattern
- (iii) CIA Examination Mark Breakup
- (iv) Attendance Calculation

CONDUCT OF I & II CIA EXAMINATIONS

1. The CIA Examinations I & II for the above said courses must be conducted along with the other courses under centralized system.
2. The students must appear I & II CIA Examinations compulsorily, since **End of Semester Examinations will NOT be conducted** for the above said courses.
3. If any of the student (s) could not appear for CIA Examinations for the above said courses, with reasons mentioned in the College Calendar, re-examination shall be conducted as per the existing procedures.

QUESTION PAPER PATTERN

The following question paper pattern will be followed for the above said courses:

Section A - Multiple Choice	(10 × 1 = 10 Marks)
Section B - Either or Type	(5 × 5 = 25 Marks)
Section C - Either or Type	(5 × 8 = 40 Marks)

Maximum Marks : 75

Duration : 3 Hours

CIA EXAMINATION MARK BREAKUP

The CIA Examination mark breakup for the courses **Basics of Cyber Security, Fundamentals of Information Security and Basics of IPR** is given below:

S.No.	Distribution Component	Marks
1	CIA I – 75 Marks Converted to 30	30
2	CIA II – 75 Marks Converted to 30	30
3	Seminar/Objective Capacity Testing	10
4	Seminar/Objective Capacity Testing	10
5	Attendance	05
6	Any Case Study related to Cyber Security (as a Group)	15
	Total	100

The CIA Examination mark breakup for the **Extra Departmental Courses** offered for UG/PG Programmes is given below:

S.No.	Distribution Component	Marks
1	CIA I – 75 Marks Converted to 40	40
2	CIA II – 75 Marks Converted to 40	40
3	Seminar/Objective Capacity Testing	05
4	Seminar/Objective Capacity Testing	05
5	Attendance	05
6	Others (Group Discussion, Flipped Class room, etc.,)	05
	Total	100

ATTENDANCE CALCULATION

1. Separate attendance register must be maintained for **Basics of Cyber Security, Fundamentals of Information Security and Basics of IPR** in the Department and the final consolidated Attendance must be submitted to the COE along with the assessment Marks.
2. The attendance must be calculated by using the following formula:
$$\text{Attendance percentage} = \frac{\text{Number of Classes attended}}{\text{Number of Classes conducted}} \times 100$$
3. The students should be allowed to write the CIA examinations as per the existing norms related to attendance. The staff in charge of the respective courses have the responsibility to calculate the attendance percentage and submit the same to the Coordinator of the CIA Examination Committee during the I CIA and II CIA Examinations.
4. If the staff in charge finds that students have not put up enough attendance during the I CIA Examinations, he/she shall counsel the student(s) appropriately so that at the end of the course they have sufficient Attendance.




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**THE MODALITIES FOR THE CONDUCT OF 100% CIA PRACTICAL
EXAMINATIONS (For EDC Courses)**

CONDUCT OF 100% CIA PRACTICAL EXAMINATIONS

1. The Students shall appear for **TWO** CIA practical examinations which are evaluated as 100% internal examinations.
2. The students must appear **TWO** CIA practical examinations compulsorily, since End of Semester examinations will NOT be conducted for the above said course.
3. If any of the student(s) could not appear for CIA Examinations, as per reasons mentioned in the College Calendar, re-examination shall be conducted as per the existing procedures and norms.

The CIA Practical Examination mark breakup for the Extra Departmental Courses (EDC) offered for the UG & PG Programme is given below:

S.No.	Component Distribution	Marks
1.	CIA Practical I – 60 marks converted to 30	30
2.	CIA Practical II – 60 marks converted to 30	30
3.	Continuous assessment of practical (Observation to be submitted*) (15 Experiments/Programs x 2 = 30 marks)	30
4.	Record	05
5.	Attendance	05
Total		100

* In case a student is absent for an Experiment/Program conducted on a particular day, the student will not be allowed to compensate that Experiment/Program and will be awarded zero for that particular Experiment/Program and shall be marked absent. In case any student has an attendance lack; the concerned faculty handling the course in consultation with HoD may permit the student who has an attendance lack to compensate one or two Experiment/Programs as the case may be to enable them to become eligible with mandate of 75% attendance to appear for the Continuous Internal Practical Examinations. However the compensated Experiment/Programs will not be awarded any marks whatsoever.




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**MODALITIES FOR THE AWARD OF APPROPRIATE EXTRA CREDIT
TO THE STUDENTS WHO PREFER TO OPT ANY COURSE OUT OF
THEIR PROGRAMME ON SELF LEARNING MODE**

PREAMBLE

The Curriculum Development Cell (CDC) meeting was convened on 16.10.2025 and recommended to motivate the students to opt any course(s) other than their core programme of study (theory papers only) through self-learning mode and extra credits can be awarded on their successful completion. However, such students availing this option shall not opt for any of the 100% CIA courses. This skill set will broaden intellectual horizons, foster holistic and integrative learning and equip diverse skill sets. This is applicable for the students to be admitted from the academic year 2026-2027 and onwards.

1. Semester Restriction:

Students may choose the courses offered only within their current semester. Courses beyond the semester in which they are enrolled shall not be permitted.

2. Course Type:

Only **theory courses** may be opted under this provision. Practical courses, Extra Departmental Courses (EDC), and courses assessed entirely through Continuous Internal Assessment (CIA) shall not be eligible.

3. Evaluation Method:

A **100% End of Semester Examination (ESE)** shall be conducted for the chosen course.

4. Marks & Scheme:

The ESE shall be conducted in accordance with the marks prescribed for the particular course in the approved scheme, along with its corresponding credit allocation.

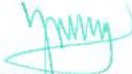
5. **Conversion of Marks:**

The marks obtained by the student in the ESE shall be converted to a scale of **100 marks** for uniformity.

6. **Award of Credits:**

The credits allotted to the course in the scheme shall be transferred to the student as **Extra Credit**, provided the student secures the prescribed pass mark in the ESE.




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**KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)
COIMBATORE – 641029**

**MODALITIES FOR THE CONDUCT OF OPEN BOOK EXAMINATION
SYSTEM FOR THE COURSES BASICS OF CYBER SECURITY AND
FUNDAMENTALS OF INFORMATION SECURITY FOR ALL UG AND
PG PROGRAMMES RESPECTIVELY**

PREAMBLE

The Curriculum Development Cell (CDC) meeting was convened on 16.10.2025 and recommended to implement an open book examination system for the courses, Basics of Cyber Security and Fundamentals Information Security for all UG and PG programmes to improvise conceptual understanding skills, promote deep learning, enhance assessment quality and strengthen comprehensive skills, for the students to be admitted from the academic year 2026-2027 and onwards.

1.Purpose

To provide guidelines for conducting open book examinations that encourage critical thinking, application of knowledge, and analytical skills.

2.Scope

Applicable to Basics of Cyber Security and Fundamentals of Information Security courses for the undergraduate and postgraduate programmes respectively.

3. Examination Guidelines

Question Paper Design

- ❖ Questions should be Focused on higher-order thinking (analysis & evaluation)
- ❖ Avoid direct recall questions

Communication to Students and Staff Members

- ❖ Inform students in advance about the format, rules, and allowed resources.

-
- ❖ Provide sample questions to familiarize them with the OBE style.
 - ❖ All the Staff members should be familiar about the prescribed Books of the Basics of Cyber Security and Fundamentals of Information Security.
 - ❖ Students are permitted to carry the prescribed Books (in original or xerox copy) duly signed by the respective staff in charge of courses to the examination Hall.
 - ❖ Invigilators of the respective examination halls should permit the students with the prescribed book (in original or xerox copy) and not to allow the students with other than the prescribed Books.




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**KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)
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**MODALITIES FOR THE CONDUCT OF 100% CIA FOR THE ONE
CREDIT SELF- STUDY COURSE AND THE MARK DISTRIBUTION
PATTERN FOR THE PART III THEORY PAPER OF APPLICABLE
COURSE**

PREAMBLE

The Curriculum Development Cell (CDC) meeting was convened on 16.10.2025 and recommended to have one credit Self Study Course for applicable programmes in both UG & PG programme in the V and II semester respectively for the students to be admitted from the academic year 2026-2027 and onwards.

In order to foster independent learning, enhance academic flexibility, and encourage students to explore knowledge, the institution introduces the One Credit Self Study Course. This initiative is designed to provide students with an opportunity to pursue structured self-learning during the regular programme of study.

The one credit Self Study Course for applicable UG & PG programme in the V and II semester respectively, for the students admitted from the academic year 2026-2027 and onwards.

1. CIA COMPONENTS FOR ONE CREDIT COURSE

CIA shall be conducted by the department concerned.

CIA I	50 (Converted to 10)	20	25
CIA II	50 (Converted to 10)		
Case Study		5	

QUESTION PAPER PATTERN

Duration : 2 Hours

Knowledge Level	Section	Marks	Description	Total
K1 Q1 to Q6	A (Answer all)	6 x 1 = 6	MCQ	50
K2 – K4 Q7 to Q 10	B (Either or pattern)	4 x 5= 20	Short Answers	
K2 – K5 Q11 to Q 13	C (Either or pattern)	3 x 8 = 24	Descriptive / Detailed	

2. PART III THEORY APPLICABLE COURSE

(CIA : 20 MARKS, ESE : 55 MARKS)

CIA: 20 Marks

CIA I	55	(55+55)	20
CIA II	55	Converted to 10	
Objective Capacity Testing /Seminar		5	
Attendance		5	

ESE : 55 Marks

QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total
K1 Q1 to 10	A (Answer all)	10 x 1 = 10	MCQ	55
K2 – K4 Q11 to 15	B (Either or pattern)	5 x 3 = 15	Short Answers	
K2 – K5 Q16 to 20	C (Either or pattern)	5 x 6 = 30	Descriptive / Detailed	




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Programme code: 08	B. Sc. Biotechnology			
Title of the Paper : Core Paper 1 – Cell Biology and Genetics				
Batch: 2026-2029	Hours / Week	Total Hours	Credits	Skill Development
	5	75	4	

Course Objectives

1. To introduce the basic concepts of cellular architecture and organelles
2. To familiarize with Cell division cycle and cancer
3. To provide an overview of the cellular environment outside the cell
4. To introduce the basic concepts of classical and population Genetics

Course Outcomes:

After Completion of the Course, the student will be able to:

K1 ↑ K5 ↓	CO1	Able to extend the learning on the cellular architecture to decipher complex cellular mechanisms
	CO2	Adaptable to a research environment to study the cell division cycles
	CO3	Able to comprehend and compare the cell signaling mechanisms and relate it to various diseases
	CO4	Able to provide a comprehensive overview of Classical genetics and its relevance in current day research
	CO5	Able to define and explain calculating genetic frequencies and allelic frequencies

Syllabus

UNIT I

(15 Hours)

Cell organization: Origin and organization of prokaryote and eukaryotic cell - Primordial Soup, internal architecture of cell, ultra structure of plant and animal Cell, Nucleus, Cell membrane systems and transport- Active and Passive Transport- Na^+ K^+ Pump, Chloride ion pump, H^+ pump, ATPase. **Cytoskeleton:** Microtubules- Structure of Cilia and flagella, microfilaments: Actin and Myosin, Structure of Sarcomere, Muscle Contraction, and Intermediate filaments.

UNIT II

(15 Hours)

Ribosomes, Chloroplast, lysosomes, peroxisomes, Golgi apparatus, mitochondria- Their structure and functions **Cell Growth and Division:** The cell Cycle (Eukaryotic) - G1, S, G2 and M phase molecular events. Mitosis and meiosis, Cell Cycle Check Points and Cancer, proto-oncogenes. Cell signaling; general principles, receptor ligand interactions- GPCR Signaling, Ras Raf pathway, Role of Calcium as Second messengers, Apoptosis- Mitochondrial pathway

UNIT III**(15 Hours)**

Cell-Cell Interaction: Glycocalyx, ECM, Collagen, fibronectin, lamin, proteoglycan, integrins, cell junctions, desmosomes, gap junctions, tight junctions, plasmodesmata, selectins, cadherins. Cellular differentiation. Plant Cell structure and Cell wall.

UNIT IV**(15 Hours)**

Classical genetics: Laws of inheritance: Mendel's Laws, concept of dominance, segregation, independent assortment- human traits; Chromosomal theory of inheritance. Allelic and non-allelic interactions: Concept of alleles, types of dominance, lethal alleles, multiple alleles, complementation; Epistasis. Sex-linked inheritance: Conceptual basis, sex influenced traits, mechanism of sex determination. penetrance and expressivity. Cytoplasmic inheritance and role of organellar genes. Linkage and linkage mapping

UNIT V**(15 Hours)**

Population genetics: Organization and measure of genetic variation: Random mating population, Hardy- Weinberg principle, non-random mating, Gene flow and genetic structure of Populations: Hierarchical populations, isolate breaking, inbreeding, assortative and non-assortative matings. Genotype Frequencies, Allele Frequencies, and Genetic Variation in Natural Populations. Genetic drift, migration, mutation and natural selection. ***Quantitative traits and heritability**

****Denotes self study***

Text book

1. Veera Bala Rastogi, (2020), A Text Book Of Cell Biology And Genetics.
2. Griffith, AF *et al.* (2015). Introduction to Genetic Analysis (11th Ed). W H Freeman and Company, USA.
3. Snustard, DP., Simmons, MJ. (2015). Principles of Genetics (7th Ed). John Wiley & Sons publisher.
4. Phillip Sheeler., Donald, E., Bianchi. (2014). Cell and Molecular Biology (3rd Ed). Wiley. UK.

Reference

1. Geoffery, M., Cooper, Hausman, RE. (2013). The Cell- A Molecular Approach (7th Ed). Oxford University Press, USA.
2. Lodhish, H. (2016). Molecular Cell Biology (8th Ed). W H Freeman and Company, USA
3. Klug, WS., Cummings, MR et.al. (2015). Concepts of Genetics (11th Ed). Pearson publisher.
4. Hartl, DL., Ruvalo, M. (2011). Genetics Analysis of Genes & Genomes (8th Ed). Jones and Bartlett publisher.

Web Sources Link

1. <https://www.ncbi.nlm.nih.gov/books/NBK9839>
2. <https://www.ncbi.nlm.nih.gov/books/NBK26818>
3. <https://openstax.org/details/books/biology-2e>
4. <https://www.khanacademy.org/science/ap-biology/cell-structure-and-function>
5. <https://openstax.org/books/biology-2e/pages/4-introduction>
6. <https://bio.libretexts.org/Bookshelves/Genetics/MAPPING>

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	S	L	L
CO2	H	S	M	M	L
CO3	S	S	S	H	M
CO4	S	M	H	S	M
CO5	M	S	S	L	M

S – Strong

H – High

M – Medium

L – Low

Content prepared by (Based on Inputs) Signature of the Course in-charge (Dr. R. Sathish Kumar)	Signature of the HOD
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Programme code: 08	B. Sc. Biotechnology			
Title of the Paper: Core Paper 2 –Bioinstrumentation				
Batch: 2026-2029	Hours / Week 4	Total Hours 60	Credits 4	Skill Development

Course Objectives

1. To understand the usage of instruments in Experimentation
2. To seed knowledge about the principles of operation of analytical instruments
3. To equip students with the working and maintenance of instruments
4. To introduce the basics of analytical interpretation

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↑ ↓ K5	CO1	Appreciate the importance and application of analytical instruments
	CO2	Examine the troubleshoot methods for maintenance of instruments
	CO3	Solve the critical steps and biological calculations
	CO4	Analyze the data obtained from instruments
	CO5	Apply the principles in research process

Syllabus

UNIT 1

(12 Hours)

Introduction to analytical Instruments: Analytical balance: operational methods and maintenance; pH meter –Principle, Buffers, factors affecting pH measurement; Equipments to maintain laboratory sterility: Autoclave and Laminar Air flow Chamber. Photometry: Colorimetry, UV-Visible spectrophotometer, fluorimetry and flame photometry, Atomic absorption spectroscopy and FTIR– working Principle and applications

UNIT 2

(12 Hours)

Centrifuge: RPM, RCF and G conversions; Principle and types: Clinical, Ultracentrifugation, Refrigerator centrifugation; Distillation units – Single and double. Filtration units – Membrane and ultrafiltration; Particle size analyser; Geiger Muller and Scintillation counters; Chemilumiscence.

UNIT 3**(12 Hours)**

Basic Microscope - Compound, Phase Contrast and Electron microscopy – TEM and SEM, Confocal and fluorescent microscopy; Electrophoresis: Agarose and Polyacrylamide gel electrophoresis; Isoelectric focusing 2 D-gel electrophoresis, Pulsed Field Gel Electrophoresis (PFGE), Gel documentation System.

UNIT 4**(12 Hours)**

Chromatography: Introduction; Types: Paper, Thin layer, Column, Ion exchange - Resins, Molecular exclusion, affinity, Gas chromatography, Liquid chromatography – working principle and applications; HPTLC and High performance Liquid chromatography – working principle and applications; Mass spectrometry - Principle and applications, Gas chromatography and Liquid chromatography coupled with Mass spectroscopy;

UNIT 5**(12 Hours)**

Lyophilizer and cryopreservation; Sonicator; ELISA reader; Thermal cycler – Principle and applications; Structural analysis by X-ray crystallography; vacuum tray dryer, Speed Vacuum and ***spray dryer**; Soxhlet apparatus and rotary vacuum evaporator. Calibration of instruments.

** denotes Self study*

Text Books

1. Veerakumari, L. (2009). Bioinstrumentation. MJP Publishers, New Delhi, India.
2. Sharma, BK. (2005). Instrumental Methods of Chemical analysis (25th Revised Ed). Goel Publishing House, Meerut.
3. Wilson, K., Walker, J. (2000). Principles and Techniques of Practical Biochemistry (5th Ed). Cambridge University Press, Cambridge.

Reference Books

1. Holme and Peck. (1998). Analytical Biochemistry (3rd Ed). Pearson Education Ltd, Essex, England.
2. Skoog and Leary. (1992). Principles of Instrumental analysis(4thEd). Saunder's College Publishing, New York.

3. Khandpur, RS. (2003). Handbook of Biomedical Instrumentation, Tata McGraw Hill Education.
4. Rickwood, D., Hames, BD. (1986). Gel Electrophoresis of Nucleic acids-A Practical approach. IRL Press, Oxford.

Web Sources Link

1. https://chem.libretexts.org/Bookshelves/Analytical_Chemistry
https://chem.libretexts.org/Courses/Providence_College/CHM_331_Advanced_Analytical_Chemistry_1
2. <https://ocw.mit.edu/courses/5-310-laboratory-chemistry-fall-2009>
3. <https://ocw.mit.edu/courses/20-109-laboratory-fundamentals-in-biological-engineering-spring-2010>
4. <https://www.agilent.com/en/products/liquid-chromatography-lc>
5. <https://www.shimadzu.com/an/products/spectroscopy>

MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	M	L	L
CO2	H	H	M	L	M
CO3	H	S	L	M	S
CO4	M	S	M	L	M
CO5	S	S	L	L	M

S – Strong

H – High

M – Medium

L – Low

Content prepared by (Based on Inputs)	
Signature of the Course in-charge (Dr. V. Elakkiya)	Signature of the HOD

Programme code: 08	B. Sc. Biotechnology			
Title of the Paper : Core Paper 3 - Microbiology				
Batch: 2026-2029	Hours / Week 4	Total Hours 60	Credits 4	Skill Development

Course Objectives

1. To understand the basic concepts of the biology of microorganisms
2. To learn the general principles of microbial classification, growth and evolution
3. To understand the role of microbes in human life
4. To study microbial pathogens, their pathogenesis and treatment.

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↑ ↕ ↓ K5	CO1	Correlate the early development, physiology and evolution of Microorganisms
	CO2	Employ various methods of studying and identification of microorganisms
	CO3	Decipher microbial interactions in soil, food, human and animals
	CO4	Contribute in understanding the mechanism of diseases caused by various Microorganisms
	CO5	Contribute to development of novel methods of microbial applications

Syllabus

UNIT I

(12 Hours)

History of Microbiology: Discovery of Microscope, Principles, mechanisms of different types of microscopes, discovery of microorganisms. *Morphology of Prokaryotes* (Bacteria, Actinomycetes, fungi, bacteriophages and viruses); Size, shape and arrangement of bacterial cells, colony characteristics, bacterial structures and function, flagella and motility, bacterial extracellular structures, cell wall of Gram positive and negative cells, bacterial cell division, spore formation in bacteria. *Classification:* Bacteria (Bergey's and molecular taxonomy) Five kingdom and three kingdom classification of microorganisms. Baltimore Classification of virus, Classification of fungi. Four classes of Algae.

UNIT II**(12 Hours)**

Sterilization methods - Dry heat, moist heat, radiation, filtration and chemicals, asepsis; *Culture media* - Types and preparation. *Culture methods* - aerobic, anaerobic and microaerophilic cultures; Isolation and maintenance and of pure culture (spread plate, streak, and pour plate). **Type culture collections***. *Bacterial stains and staining methods* - (Simple, Grams, negative, capsular, flagellar, acid-fast stain, spore staining, fluorescent staining) and fungal staining methods (Lactophenol cotton blue (LPCB), PAS (Periodic Acid Schiff) reaction and PAS and GMS (Periodic Acid Schiff and Gomari methenamine Silver staining).

UNIT III**(12 Hours)**

Microbial growth – Growth of bacteria - Nutrient types and requirements of bacteria, Bacterial cell elements and source of elements from media for bacterial growth. Modes of cell division, growth curve. Growth Kinetics *Measurement of microbial growth* – wet and dry weight, plate count method, Membrane filter count, electronic count, packed cell volume, turbidometry. Viral replication, plaque counting and titre calculation.

UNIT IV**(12 Hours)**

Microbial interactions: Symbiosis, asymbiosis, ammensalism, synergism, mutualism, neutralism Parasitism. *Modes of transmission of Microbial Diseases* – congenital, contact, fomites, food and water, airborne; reservoirs of infection (human, animal, and non-living reservoirs), animal and insect vectors. *Microbiology of water* –water borne diseases (Cholera, Typhoid, Hepatitis A); prevention measures for water borne diseases. *Bacteriological examination of water* – Pathogens that spread through water, Faecal coliforms and Membrane filtration technique; MPN test

UNIT V**(12 Hours)**

Microbial pathogenesis and Beneficial Microbes: Toxins and virulence factors and host immunity. Fungal replication, general information on fungal pathogenesis. *Nosocomial infections*: Etiology, incidence and predisposing factors of nosocomial infections. Viral Diseases – Dengue, SARS, SARS Cov, HIV Ebola. Industrially beneficial bacteria - Overview. *** Importance of gut microbiome in human health and disease**

**denotes self study*

Text book

1. Pelczar, Jr. (2004). Microbiology (5th Ed). Tata McGraw-Hill Publishing Co. Ltd, New Delhi.
2. Stainer *et al.* (1992). General Microbiology (5th Ed). Macmillan Education Ltd, London.

References

1. Prescott's. (2016). Microbiology (Joanne M Willey, Linda Sherwood, Christopher J Woolverton Eds.) (10th Ed). McGraw-Hill Education publisher.
2. Atlas, RM., Bartha, R. (1998). Microbial Ecology – Fundamentals and Applications, Pearson Education, Asia.
3. Madigan, MT., Bender, KS., Buckley, DH., Sattley, WM., David, A. (2015). Stahl Brock - Biology of Microorganisms (15th Ed), Pearson.

Web Sources Link

1. <https://openstax.org/books/microbiology/pages/1-introduction>
2. <https://openstax.org/books/microbiology/pages/5-1-characteristics-of-prokaryotic-cells>
3. <https://asm.org/Articles/Education>
4. <https://asm.org/Guideline/Clinical-Microbiology-Procedures-Handbook>
5. <https://microbiologysociety.org/why-microbiology-matters/what-is-microbiology.html>
6. **MAPPING**

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	S	L
CO2	S	L	H	L	M
CO3	H	H	S	L	H
CO4	S	L	M	M	M
CO5	H	S	M	H	S

S – Strong

H – High

M – Medium

L – Low

Content prepared by (Based on Inputs)	
Signature of the Course in-charge (Dr. R .Selvasundaram)	Signature of the HOD

Programme code: 08	B. Sc. Biotechnology			
Title of the Paper : Core Practical 1 – Lab in Cell biology, Genetics and Microbiology				
Batch: 2026-2029	Hours / Week 5+2	Total Hours 75+30	Credits 4	Skill development /Employability

Course Objective (CO)

1. To understand basic aspects of Cell structure and Genetics
2. To provide a hands-on exposure in identification of cells and examine the stages of cell divisions.
3. To learn about the cell fractionation and basic Genetic experiments
4. To provide training on microbiological media preparation, isolation and characterization of microbes.

Course Outcomes (CO)

After completion of the course, the students will be able to:

K3 ↑ ↓ K5	CO1	Examine and appraise the cell types and different stages of cell divisions
	CO2	Examine the techniques involved in and molecular biology and genetics
	CO3	Distinguish the blood cells and obtaining the skill of blood cell counting and analyzing the amino acids pattern using chromatography techniques.
	CO4	Demonstrate the relationship between phenotype and genotype in human genetic traits.
	CO5	Apply the various microbiological techniques in an appropriate research and Industrial areas

Syllabus

CELLULAR BIOLOGY

General layout of a typical Biotechnology Laboratory

General Laboratory Instructions and Safety – Video /Power-point

1. Cell types – Microbial, Animal and Plant cells
2. Plant cell sectioning- Dicot and monocot sections of stem and root - TS and CS
3. Preparation of blood Smear- Identification of Blood cells
4. Cell Counting using Haemocytometer– RBC and WBC
5. Differential leukocyte count by Leishman's staining
6. Subcellular fractionation of Chloroplast
7. Preparations of onion peel and observations of cells

GENETICS

1. Punnet Square test in Pea plant- Mendelian Inheritance
2. Anatomy & sex-linked inheritance of *Drosophila*
3. Barr body identification in Buccal cells
4. Mitotic Preparation in Onion root tip
5. Meiosis – flower buds of *Rhoeo discolor*
6. C-Banding techniques using maize
7. Pedigree chart for ABO blood group and hereditary analysis.
8. Polytene chromosome from *Chironomus* larvae

MICROBIOLOGY**Prelab Exercises**

1. Safety guidelines
2. Types of Biosafety levels
3. Good microbiological Laboratory Practices
4. Sterilization Techniques

Experiments

1. Isolation of microbes (bacteria, fungi and actinomycetes) from soil, air and water
2. Pure culture techniques - Pour, Spread and Streak plate methods
3. Staining techniques - Simple, Negative, Gram, Spore and fungal staining
4. Growth curve and determination of generation time in *E. coli* by spectrophotometric method
5. Antibiotic sensitivity test by disc diffusion method (Kirby- Bauer method)
6. MBRT test for milk quality analysis
7. Biochemical Characteristics of Bacteria
 - (i) Starch Hydrolysis Test
 - (ii) Urease test
 - (iii) Hydrogen sulphide production test
 - (iv) Fermentation of Carbohydrates
 - (v) IMVIC test
 - (vi) Catalase Test
 - (vii) Oxidase test
8. Motility of bacteria – hanging drop, soft agar methods

Text Book

1. Majumdar, R., Sisodia, R. (2018). Laboratory Manual of Cell Biology (1st Edition). Prestige Publishers.
2. Koliantz, G., Szymanski, DB. (2009). Genetics: A Laboratory Manual (2nd Edition). American Society of Agronomy.
3. Roy, AK., Prasad, MM. (2010). Laboratory Manual of Microbiology (2nd Edition). New India Publishing Agency.

Practical Examination mark breakup:

CIA PRACTICAL			
CIA Practical	25	40	
Observation Notebook	10		
Attendance	5		

CIA Practical Breakup of Marks		30	35
Protocol - 15	Result & viva - 15		
Record Note book		5	

ESE PRACTICAL			
Knowledge Level	Section	Marks	Total
K3	Experiments	50	60
K4		10	
K5	Record Work		
Knowledge Level	Section	Marks	Total
K3	Project Report	60	80
	Viva voce		

Knowledge Level	Section	
K3 ↑ ↓ K5	Major Experiments: Protocol - 15 Perform - 5 Result - 5 Minor Experiments: Protocol - 5 Perform - 5 Result - 5 Q&A - 5 Viva - 5	
	Record work	10

MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	L	M	L	M
CO2	S	L	H	L	M
CO3	S	L	H	M	M
CO4	S	H	H	H	H
CO5	S	L	H	M	H

S – Strong H – High M – Medium L – Low

Content prepared by (Based on Inputs) Signature of the Course in-charge (Dr. V. Elakkiya)	Signature of the HOD
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Programme code: 08	B. Sc. Biotechnology			
Title of the Paper : Core Paper 4 - Enzymology and Metabolism				
Batch: 2026-2029	Hours / Week 3	Total Hours 45	Credits 3	Skill Development

Course objectives

1. To provide a basic understanding of biological catalysis, and Mechanism of action of enzymes.
2. To describe the structure and functional relationship of enzyme
3. To understand the enzyme kinetics.
4. To Study the Metabolism of Carbohydrates, Amino acids and Lipids.

Course Outcomes

After completion of the course, the students will be able to:

K1 ↑ K5 ↓	CO1	Distinguish the fundamentals of enzyme properties, nomenclatures characteristics and mechanisms.
	CO2	Describe the concepts of co-operative behavior, enzyme inhibition and allosteric regulation and the factors affecting enzymatic reactions
	CO3	Apply glucose homeostasis (pathways and hormonal regulation) and the pentose phosphate pathway
	CO4	Describe the metabolism, biosynthesis of fatty acids.
	CO5	Employ the concepts in deciphering metabolic defects and to study enzyme kinetics for novel systems

Syllabus

UNIT I

(9 Hours)

Introduction, Classification of enzymes and nomenclature, Unit of enzyme: Katal and IU, Active site- Definition, investigations of 3D structure of active site, Fischer's lock & key and Koshland's induced fit hypothesis. Enzyme specificity. Enzyme kinetics- Michaelis-Menten equation, Lineweaver-Burk plot. Determination of K_m , V_{max} , K_{cat} . Factors affecting enzyme activity. Enzyme inhibition- Reversible (competitive, uncompetitive, non-competitive) and irreversible inhibition. Cofactor and prosthetic group, apo- and holo-enzymes. Restriction enzymes. Isoenzymes.

UNIT II

(9 Hours)

General mechanisms of action. Acid-base and covalent catalysis (chymotrypsin, lysozyme). Metal activated enzymes and metallo enzymes. Allosteric regulation and feedback inhibition (ATCase). Reversible covalent modification (glycogen phosphorylase). Proteolytic cleavage- zymogen. Multi-enzyme complex. Coenzymes.

UNIT III**(9 Hours)**

Glycolysis, Citric acid cycle: establishment of the cyclic nature, individual reactions and enzymes of citric acid cycle. Amphibolic nature of the cycle. Pentose phosphate pathway of glucose oxidation. Biosynthesis: biosynthesis of glucose from non-carbohydrate precursors (gluconeogenesis). Glycogen synthesis and its regulation.

UNIT IV**(9 Hours)**

Protein digestion and absorption. Overview of amino acid degradation: Transamination and the role of pyridoxal phosphate, oxidative deamination. Pathways of degradation of different amino acids (fates of carbon atoms of degraded amino acids) via pyruvate, acetoacetyl CoA leading to acetyl CoA-Ketoglutarate pathway, succinate pathway, fumarate pathway, oxaloacetate pathway. Formation of nitrogenous excretion products. The urea cycle linking of urea cycle to citric acid cycle. Industrial enzymes- amylase, lipase and protease. ***Regulation of Urea cycle enzymes.**

UNIT V**(9 Hours)**

Digestion and absorption of triglycerides, phospholipids, glycolipids and sterols. Biosynthesis of fatty acids. Oxidation of fatty acids. Sterol biosynthesis and conversion of cholesterol to various other biologically important compounds. Formation of prostaglandins, prostacyclins and thromboxanes from unsaturated fatty acids. Nucleic Acids: Synthesis of Purines and Pyrimidines by De novo and Salvage Pathways.

****Denotes self study*****Text Books**

1. Donald Voet, Judith G. Voet. (2011). Biochemistry (4th Ed). John Wiley & Sons Publisher.
2. Jain, J.L., Sunjay Jain., Nithin Jain. (2016). Fundamentals of Biochemistry (7th Ed). S. Chand & Co Ltd). Publishers.
3. Nelson, D.L., Lehninger, A.L., Cox, M.M. (2021). Principles of Biochemistry (8th Ed). W. H. Freeman and Company, New York, pp. 677-878.

Reference

1. Robert K. Murray., Daryl K. Granner., Peter A. Mayes., Victor W. Rodwell. (2012). Harper's Biochemistry (29th Revised Ed). Appleton & Lange Publisher.
2. Jeremy M. Berg., John L. Tymoczko., Lubert Stryer. (2015). Biochemistry (8th Ed). W.H. Freeman Publisher.
3. Dixon, M., Webb E.C. (2014). Enzymes (2nd Ed). Elsevier.

Web sources Link

1. <https://www.brenda-enzymes.org/en/>
2. <https://www.brenda-enzymes.org/en/tutorials>
3. <https://www.genome.jp/kegg/pathway.html>
4. <https://www.genome.jp/kegg/kegg1.html>
5. <https://metacyc.org/MetaCycUserGuide.shtml>

MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	L	L
CO2	S	S	H	L	M
CO3	H	H	S	L	H
CO4	S	H	M	L	M

S – Strong

H – High

M – Medium

L – Low

Content prepared by
(Based on Inputs)

Signature of the Course in-charge
(Dr. R. Sathish Kumar)

Signature of the HOD

Programme code: 08	B. Sc. Biotechnology			
Title of the Paper : Core Paper 5 - Molecular Biology				
Batch: 2026-2029	Hours / Week 3	Total Hours 45	Credits 3	Skill Development

Course Objectives

1. To provide basic information about DNA, RNA and Protein biology
2. To understand the role of regulatory elements and its mechanism of operation in prokaryotes
3. To study the repair mechanism to overcome DNA damage
4. To provide an outline on transposons and molecular biology of Lambda

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↑ ↓ K5	CO1	Describe the molecular aspects of cell function
	CO2	Discuss the molecular damage and its repair systems
	CO3	Investigate the gene regulation machinery in prokaryotes
	CO4	Compare and contrast the importance of recombination and genetics of lambda phage
	CO5	Define and execute experiments using transposons and phages

Syllabus

UNIT I

(9 Hours)

Introduction to structure of nucleic acid and proteins: Physical and chemical structures and forms of DNA; Types of RNA; Replication: Mechanism in prokaryotes and eukaryotes, enzymes involved in replication.

UNIT II

(9 Hours)

DNA methylation and methyl transferases in prokaryotes; DNA repair mechanism: Types of DNA damage and repair mechanism (Photoreactivation, Excision – Base and Nucleotide, Mismatch, Recombination and SOS). Molecular basis of mutation and types of mutation.

UNIT III**(9 Hours)**

Gene, coding and non coding genes, Cistron and its types (Mono and Poly); Gene regulation in prokaryotes: Operon concept – *lac* and *trp*; Signal sequences and protein export. Recombination: Homologous recombination - Holliday model and its enzymology; Recombinase – Cre-Lox system.

UNIT IV**(9 Hours)**

Gene expression in prokaryote: Transcription – enzymology and its mechanism; post transcriptional modification; Translation - enzymology and its mechanism. Universal genetic code and wobble hypothesis. Gene regulatory elements: *cis*-regulatory elements - promoter, enhancer, silencer and response elements and *Trans*-regulatory elements – transcription factors. Reverse Transcriptase.

UNIT V**(9 Hours)**

Transposons and Insertion sequence; Prokaryotic and yeast transposons - Ty elements; Lambda phage: genome, (Theta and rolling circle model), **lytic and lysogeny cycle***; Transcriptional switch genetics in lambda phage (Cro gene, CI gene).

*** denotes Self study**

Text Books

1. Malacinski, GM. (2008). Freidfelder's Essentials of Molecular Biology (4th Ed). Narosa BookDistributors Private Ltd.
2. Weaver, RF. (2012). Molecular Biology (5th Ed). The McGraw-Hill Companies, Inc., 1221 Avenue of the Americas, New York, NY 10020.
3. Gerald karp.(2010). Cell and Molecular Biology. John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030-5774.
4. Roger, LP., Adams and Roy H. Burdon (1985). Molecular Biology of DNA Methylation. Springer-Verlag, New York, Inc.

Reference Books

1. Lodish et al. (2012). Molecular Cell Biology (7th Ed). W.H. Freeman and Co., New York.
2. Watson JD. et al. (2013). Molecular Biology of the gene (7th Ed). Person publisher.

Web Sources Link

1. https://bio.libretexts.org/Bookshelves/Biochemistry/Fundamentals_of_Biochemistry
2. <https://www.khanacademy.org/science/biology/energy-and-enzymes>
3. <https://www.khanacademy.org/science/biology/cellular-respiration-and-fermentation>
4. <https://www.nature.com/scitable/topicpage/chemical-energy-and-atp-14125597>
5. <https://www.nature.com/scitable/topicpage/enzyme-regulation-14199072>
6. <https://www.yourgenome.org/theme/metabolism-and-enzymes/>

MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	L	L
CO2	S	L	S	L	L
CO3	S	L	S	L	M
CO4	H	L	H	M	M
CO5	S	H	S	M	L

S – Strong

H – High

M – Medium

L – Low

Content prepared by (Based on Inputs)	
Signature of the Course in-charge (Dr. S. Bhargavi)	Signature of the HOD

Programme code: 08	B. Sc. Biotechnology			
Title of the Paper : Core Paper 6 – rDNA Technology				
Batch: 2026-2029	Hours / Week 4	Total Hours 60	Credits 3	Skill Development

Course Objectives:

1. To acquaint the students to versatile tools and techniques employed in Recombinant DNA technology
2. To provide theoretical base to properties and applications of DNA modifying enzymes and cloning strategies
3. To enable students to understand vector types, host genotype specificities for selection and screening of recombinants and/or recombinant transformants
4. To help students comprehend the various strategies for studying recombinant DNA molecules and its application in myriad fields
5. To sensitize on the various commercial recombinant Products

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↑ K5 ↓	CO1	Have a technical knowhow on manipulating genes and genomes
	CO2	have knowledge to construct recombinant DNA and use them for cloning
	CO3	be competent in handling PCR and related molecular methods
	CO4	be proficient in conducting and interpreting genetic engineering experiments using various types of vectors and hosts
	CO5	be competent enough to handle recombinant strains at an industrial scale

Syllabus

UNIT I

(12 hours)

Tools for the rDNA technology: Restriction endonucleases; Type I, II and III; Gene isolation strategies; Generalized cloning schemes, host genotypes specificities; markers for selection of recombinants; Ligases and Ligation strategies: End modifications, Nucleases, Polynucleotide kinase, Phosphatase, homopolymeric tailing, use of adapters and linkers.

UNIT II**(12 hours)**

Properties of vectors and Hosts: Bacterial Artificial Chromosomes as vectors, Yeast vectors- YIP, YEP, YCP, YRP BAC and YAC. Shuttle vectors, Artificial plasmids- pBR322- structure, construction and biology, pUC18, Phagemids, PGEM Series, Natural plasmids- types, properties. Hosts for cloning: *E.coli*, yeast, Plant, Insects and Animal Systems and their properties.

UNIT III**(12 hours)**

Lambda vectors - Insertion and replacement vectors, *In vitro* packaging, Selection strategies for screening of lambda recombinants, Cosmid construction protocol and cosmid cloning protocol. Construction of genomic DNA library and cDNA Library, Protein Expression Vectors (expression systems for high level protein expression in *E.coli*, Transcriptional and Translational fusion with examples of protein production).

UNIT IV**(12 hours)**

Nucleic acid sequencing methodologies: Maxam Gilbert Method, Sanger's Di-deoxy Chain termination method, Next Generation Sequencing, Pyrosequencing and illumina Polymerase Chain reaction- basic chemistry, types of PCR- nested PCR, Symmetric and asymmetric PCR, Inverse PCR, Real Time PCR. DNA Hybridization Techniques, Application of rDNA in Agriculture, ***Application of PCR in forensic science**

UNIT V**(12 hours)**

Site Directed Mutagenesis: PCR based methods for site-directed mutagenesis, Oligo Nucleotide mediated mutagenesis, selection of mutant (*dut/ung E. coli* strains for SDM through uracil replacement), Application of recombinant DNA in production of pharmaceuticals- Insulin, glucagon, clotting factors, human growth hormone and interferons, mRNA vaccine production.

****Denotes self-study***

Text Books:

1. Ernst Winnacker. (2003). From Genes to Clones- An Introduction to Gene Technology (4thEd). Panima Publishing house, Bangalore.
2. Primrose, SB and Twyman R. (2016). Principles of Gene Manipulation and Genomics (8th Ed). Wiley- Blackwell, UK.

Reference Books:

1. Brown, TA. (2016). Gene Cloning and DNA Analysis: An Introduction (7th Ed). John Wiley & Sons, UK.
2. Sambrook, J., Fritsch, EF., Maniatis, T. (1987). Molecular Cloning: A Laboratory Manual (2nd Ed). CSHL Press, USA.

Web Sources Link

1. https://bio.libretexts.org/Bookshelves/Genetics/Recombinant_DNA_Technology
2. <https://www.genome.gov/about-genomics/fact-sheets/Genetic-Engineering-and-Genome-Editing>
3. <https://learn.genetics.utah.edu/content/tech/genetherapy>
4. <https://learn.genetics.utah.edu/content/tech/cloning>
5. <https://www.khanacademy.org/science/biology/biotech-dna-technology/dna-cloning-and-recombinant-dna-technology/a/overview-of-recombinant-dna-technology>

MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	H	M	L
CO2	S	H	S	H	S
CO3	S	L	S	L	M
CO4	H	L	H	M	M
CO5	S	H	S	M	S

S – Strong

H – High

M – Medium

L – Low

Content prepared by (Based on Inputs)	
Signature of the Course in-charge (Dr. V Elakkiya)	Signature of the HOD

Programme code: 08	B. Sc. Biotechnology			
Title of the Paper : Core Practical 2 - Lab in Enzymology, Molecular Biology and rDNA Technology				
Batch: 2026-2029	Hours / Week 2+4	Total Hours 30+60	Credits 3	Skill Development/ Employability

Course Objectives

1. To Provide an opportunity to experimentally verify the theoretical principles of genetic Engineering in a more explicit and concentrated manner.
2. Students will gain a sound technical knowledge and have hands on exposure in various aspects of molecular biology and Biochemistry.
3. To provide knowledge about various isolation techniques and separation of Macromolecules

Course Outcomes (CO)

After completion of the course, the students will be able to:

K3 ↑ ↑ ↓ K5	CO1	Isolate plasmid, clone genes and transformation to a suitable host
	CO2	Apply techniques like PCR for identification of genes
	CO3	Apply chromatographic techniques for several applications
	CO4	Be compatible in use of vectors and hosts
	CO5	Become competent in handling libraries and gene cassettes

Syllabus

ENZYMولوجY

Pre lab experiments

1. Preparation of Molar, Normal and percent solutions
2. Preparation of Buffers
3. Notes on Chemical safety

Experiments

1. Cell rupture using a Sonicator
2. Estimation of Non reducing sugars and reducing sugars
3. Estimation of Amino acid- Arginine and Tyrosine
4. Estimation of total proteins – Lowry Method
5. Qualitative Tests for Catalase and Oxidase
6. Estimation of Fatty Acid – Titrimetric method
7. Estimation of RNA using Orcinol method
8. Estimation of DNA using diphenylamine method.
9. Estimation of Ascorbic acid
10. Separation of Natural Pigments by Paper and Thin layer Chromatography

MOLECULAR BIOLOGY**Prelab Experiments**

1. General chemical safety procedures
2. Calculations for molecular biology

Experiments

1. Extraction of Genomic DNA (Bacteria and Phage).
2. Extraction of Plasmid DNA.
3. Agarose gel electrophoresis
4. Quality and Quantity check of DNA/ RNA/ Protein by UV spectrophotometer
5. Polyacrylamide Gel Electrophoresis (Demo)
6. Bacterial Transformation by calcium chloride method and electroporation

RECOMBINANT DNA TECHNOLOGY**Prelab Experiments**

1. Calculation for vector: Insert cloning
2. Genotypes of cloning hosts - Bacteria - *E.coli*. DH5 alpha, JM109 and CSH strains

Experiments

1. Restriction Digestion of vector DNA and lambda DNA
2. Ligation of Restricted fragments
3. Competent cell preparation and plate count method
4. Amplification of a gene by Polymerase Chain Reaction
5. Southern Blotting and Hybridization (Demo)
6. Western blotting (Demo)

Text Book

1. Wilson, K., Walker, J. (2010). Principles and techniques of biochemistry and molecular biology (7th edition). Cambridge University Press. 759 pages.
2. Ruhi Dixit, Kartikay Bisen, Ashwani Kumar, Ashim Borah, Chetan Keswani. (2016). Lab manual on molecular biology (1st Edition). Media Associates, Delhi.
3. Kurnaz, IA. (2015). Techniques in genetic engineering. CRC Press, Boca Raton.

Practical Examination mark breakup:

CIA PRACTICAL		
CIA Practical	25	40
Observation Notebook	10	
Attendance	5	

CIA Practical Breakup of Marks		
Protocol - 15 Result & viva - 15	30	35
Record Note book	5	

End semester Particle Examination

Knowledge Level	Section	Marks	Total
K3	Experiments	50	60
K4	Record Work	10	
K5			

Practical Examination mark breakup:

Knowledge Level	Section	
K3  K5	Major Experiments: Protocol- 15 Perform- 5 Result- 5 Minor Experiments: Protocol- 15 Perform- 5 Result- 5 Q &A- 5 Viva- 5	
	Record Work	10

MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	L	H	L	M
CO2	S	L	H	L	M
CO3	S	L	H	M	M
CO4	S	H	H	H	H
CO5	S	L	H	M	S

S – Strong

H – High

M – Medium

L – Low

Content prepared by (Based on Inputs)	
Signature of the Course in-charge (Dr. R. Sathish Kumar)	Signature of the HOD

Programme code: 08	B. Sc. Biotechnology			
Title of the Paper : Core Paper 7 - Immunology				
Batch: 2026-2029	Hours / Week 5	Total Hours 75	Credits 4	Skill Development

Course Objectives

1. To understand the definition and concepts of immunity
2. To familiarize about the structural features and components of the immune system as well as their functions
3. To comprehend how the immune system recognizes self from non-self
4. To provide insights into Monoclonal antibody and its applications

Course Outcomes:

After completion of the course, students should be able to:

K1 ↑ ↓ K5	CO1	Recall the innate and adaptive immune responses and to understand their role in protection against invading pathogens
	CO2	Demonstrate the strategies used to enhance immune responses
	CO3	Investigate hypersensitivity reactions, transplantations or autoimmune diseases.
	CO4	Apply key immunological concepts and methods to diagnose immune disorders
	CO5	Analyze the strategies to improve existing vaccines

Syllabus

UNIT I

(17 hours)

Organization and classification of immune system – Immunity – *Hematopoiesis*: Development, maturation, activation, regulation, differentiation and classification of T- cells and B-cells and organs (Primary lymphoid organ- Bone marrow, secondary lymphoid organ-lymph node); *Innate immunity* - Complement pathway: Definition, Nomenclature, Activation pathways (classical and alternate). *Antigens*: Essential features, classification of antigens, Epitopes, Haptens, Adjuvants, Cross reactivity, Synthetic antigens. *Antibodies*: Structure, Types, properties and their biological functions; genes and generation of diversity; antigen-antibody reactions,

UNIT II**(16 hours)**

Antigen recognition by Pattern Recognition Receptors – Toll like receptors (TLR) and responses. Primary and Secondary immune responses, Antigen presenting cells; major histocompatibility complex structure and function - antigen processing and presentation, HLA typing, theory of clonal selection, production of plasma and memory cells, production of antibodies. *Cytokines*: Interleukins and interferons, production and their biological functions. Cytokine Strom

UNIT III**(14 hours)**

Immune tolerance, Immunosuppression, Transplantation – genetics of transplantation; laws of transplantation; *Allergy and hypersensitivity* – Types of hypersensitivity. Autoimmunity, Auto immune disorders and Immunodeficiency diseases and types.

UNIT IV**(14 hours)**

Inflammation and disease: cause for inflammation. Immune responses to virus, bacteria, fungi and parasites; *Tumor Immunology*: Tumor antigens and its regulation, tumor immune response, tumor diagnosis, tumor immunotherapy *Transplantation Immunology*: Types of grafts, transplantation reactions (graft versus host)

UNIT V**(14 hours)**

Monoclonal antibodies - antibodies production and applications, Engineering of antibodies; *Classification of Vaccines* - (Attenuated, sub-unit vaccine, DNA and RNA vaccines and anti- idiotypic vaccines) methods of vaccine development, * **Immuno- modulatory drugs**

**Denotes self study*

Text Books

1. Owen, J., Punt, J., Stranford, S. (2013). Kuby's Immunology (7th Ed). W. H. Freeman and company, New York.
2. Peter J. Delves., Seamus J. Martin., Dennis R. Burton., Ivan M. Roitt. (2016). Roitt's Essential Immunology (13th Ed). Wiley-Blackwell.

References

1. Ashim, K. Chakravarthy. (2006). Immunology and Immunotechnology. Oxford University Press, India.
2. Tizard, IR. (1995). Immunology: An Introduction (4th Ed). Prentice Hall, International.
3. Abbas, A K., Lichtman, AH., Pillai S. (2016). Basic Immunology –Functions and Disorders of the Immune System (5th Ed). Elsevier.
4. Khan, Fahim Halim. (2009). The elements of Immunology, Pearson Education Pvt. Ltd. India.
5. Ballarin, L., Cammarata, M. (2016). Lessons in Immunity (1st Ed). Academic Press, Elsevier.

Web Sources Link

1. <https://www.ncbi.nlm.nih.gov/books/NBK10757>
2. <https://www.ncbi.nlm.nih.gov/books/NBK27144>
3. <https://www.immunology.org/public-information/bitesized-immunology>
4. <https://www.niaid.nih.gov/research/immune-system-overview>
5. <https://www.khanacademy.org/science/health-and-medicine/immunology>
6. <https://www.frontiersin.org/journals/immunology>

MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	L	H	L	M
CO2	H	L	H	H	L
CO3	H	M	H	L	M
CO4	H	S	S	H	L
CO5	H	L	L	L	H

S – Strong

H – High

M – Medium

L – Low

Content prepared by (Based on Inputs)	
Signature of the Course in-charge (Dr. R. Selvasundaram)	Signature of the HOD

Programme code: 08	B. Sc. Biotechnology			
Title of the Paper : Core Paper 8 – Plant and Animal Biotechnology				
Batch: 2026-2029	Hours / Week 4	Total Hours 60	Credits 4	Skill Development

Course Objectives

1. To equip students with plant tissue culture techniques
2. To provide knowledge on genetic engineering in the improvement of plants for human welfare
3. To educate about basic embryogenesis techniques in mammalian cells
4. To gain an insight on transgenic animal production and its applications in human welfare

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↑ ↓	CO1	List the <i>in vitro</i> techniques for propagating plant and its applications
	CO2	Creating the scope of biotechnology tools in plant science
	CO3	Evaluate and discuss public and ethical concerns over the use of Animal Biotechnology
	CO4	Understand the mechanism and Principles of Embryogenesis
	CO5	Relate the importance of CRISPR technology in the relevant fields.
K5		

Syllabus

UNIT I

(10 Hours)

Nucleus, Chloroplast and Mitochondria; Plant breeding: Heterosis and Male sterility. Tissue culture: Laboratory organization; Media components; Types of media; Growth regulators: Biosynthesis, physiological effects and mechanism of action of Auxin, Cytokinin and Gibberellic acid.

UNIT II

(14 Hours)

Propagation techniques: Micropropagation; Callus culture; Cell culture: Single cell culture and Suspension culture; Protoplast - Isolation, Culture and fusion; Somatic embryogenesis and Synthetic seed preparation; Anther/pollen and embryo culture; Somaclonal variation. Production of secondary metabolites through plant cell/tissue culture, *Invitro* Germ plasm Conservation

UNIT III**(10 Hours)**

Introduction - Scope of Animal Biotechnology, Cell culture media-physical and chemical constituents and reagents, culture of mammalian cells- tissues and organs, primary culture, secondary culture, continuous cell lines, suspension cultures. Various bio-reactors used for animal cell culture-Roller bottle culture, stirred animal cell culture; Contamination- Sources, types, monitoring and eradication.

UNIT IV**(10 Hours)**

Embryogenesis–Basis principles of Human Embryogenesis, Embryo culture and transfer technology, somatic cell nuclear transfer, embryonic stem cells, Artificial insemination, IVF and embryo transfer, cryopreservation. Cloning – Therapeutic and Reproductive cloning its applications, Gene silencing and antisense therapy in the treatment of disease. Ethical Issues

Case Study: Increasing trend of IVF: Deliberate or Disease Centric?

UNIT V**(16 Hours)**

Gene Transformation: Plant viral vector: CaMV; *Agrobacterium* mediated transformation; Model plant for transformation: Tobacco. Applications of plant transformation: Nutraceuticals - Golden rice Edible vaccines: Interleukins and interferons; GM foods and ***Biosafety issues**. Gene targeting - knockout Mouse model for human genetic disorder, CRISPR - transgenic animals Production.

*** denotes Self study**

Text books

1. Chawla, H. S. (2002). Introduction to Plant Biotechnology. 2nd Edition, Science Publishers, Inc., Enfield, NH, USA.
2. Kalyan Kumar De. 2004. An Introduction to Plant Tissue Culture.2008. New Central Book Agency, Kolkata.
3. Singh B (2005). Textbook of Animal Biotechnology. The Energy and Resources Institute.
4. Brown T. A. (2002). Gene Cloning

Reference Books

1. Slater, Scott and Fowler, 2008. Plant Biotechnology, 2nd Edition, Oxford University Press.
2. Buchanan, Gruissem and Jones.2000. Biochemistry and Molecular Biology of Plants. John Wiley & Sons, UK.
3. Ralf Poetner, 2018. Animal Cell Biotechnology, Springer, Human Press, 4th Edition.

Web Sources Link

1. <https://www.fao.org/biotechnology/en>
2. <https://www.isaaa.org/resources/publications/pocketk>
3. <https://www.ibiology.org/plant-biology>
4. <https://www.nature.com/subjects/plant-biotechnology>
5. <https://www.yourgenome.org/theme/genetic-engineering>
6. <https://www.ncbi.nlm.nih.gov/books/NBK10052>

MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	H	L	M
CO2	H	L	H	L	M
CO3	S	H	H	L	L
CO4	H	L	H	H	L
CO5	H	L	L	H	L

S – Strong

H – High

M – Medium

L – Low

Content prepared by (Based on Inputs)	
Signature of the Course in-charge (Dr. S. Bhargavi)	Signature of the HOD

Programme code: 08	B. Sc. Biotechnology			
Title of the Paper : Core Paper 9 – Genomics and Proteomics				
Batch: 2026-2029	Hours / Week 4	Total Hours 60	Credits 4	Skill Development

Course Objectives

1. To acquaint the genome organization, gene identification, expression and applications of genomics analysis
2. To disseminate the fundamentals of proteomics, analysis and its applications
3. To interpret the data obtained from high through-put technologies
4. To classify the complexity of genome/ proteome structural and functional organization

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↑ K5 ↓	CO1	Discern the crucial concepts and techniques applied in genomics and Proteomics
	CO2	Communicate on the recent developments in the genomics and proteomics, and its application in human disease biology
	CO3	Apply the tools available in the open source to specific research problems and Projects
	CO4	Apply functional genomics techniques to analyze data for biological system
	CO5	Apply proteomic tools in structure - function predictions

Syllabus

UNIT I

(12 Hours)

Introduction – Organization and structure of genomes, Genome size, Sequence complexity, Introns and Exons, Genome structure in viruses and prokaryotes, Eukaryotic Genome. Molecular markers for genome analysis – RAPD, RFLP and SNP

UNIT II

(12 Hours)

Mapping and Sequencing: Restriction mapping, Genome mapping, Chromosome landmarks, Genetic variations, Physical maps. Genetic and physical mapping- Pedigree analysis, STS mapping with radiation hybrid panels; DNA and Whole Genome Sequencing; Contig assembly.

UNIT III**(12 Hours)**

Human Genome project, Ethical, legal, social implications of HGP, Hap Map Project, The 1000 genome project, and The ENCODE Project, Genome annotation, traditional routes of gene identification, detecting open-reading Frames, software programs for finding genes, Identifying the function of a new gene.

UNIT IV**(12 Hours)**

Proteomics: Structural proteomics- X-ray crystallography and Mass spectroscopy-MALDI-TOF, ESI, SELDI-TOF. Functional Proteomics - 2D analysis of cellular proteins, Yeast two hybrid system for protein-protein interaction, Protein micro arrays.

UNIT V**(12Hours)**

Protein secondary structure prediction - for globular proteins and for transmembrane proteins. Coiled coil prediction. Protein tertiary structure prediction – methods – homology modeling, threading and fold recognition; ab initio protein structural prediction. ***CASP**. Applications of Proteomics.

****Denotes self study***

Text Books:

1. Arthur M. Lesk. (2007). Introduction to Genomics (2nd Ed). Oxford University Press.
2. Primrose, SB., Twyman, R.M (2013). Principles of Genome analysis and Genomics (7th Ed).Blackwell publishing.
3. Tymann, R (2013). Principles of Proteomics (2nd Ed). Garland Science Publisher.

Reference Books:

1. Brown, TA. (2007). Genomes 3. Garland Science Publishing, New York.
2. Dunham, I. (2003). Genome Mapping and sequencing. Horizon Scientific.
3. Andrezej, K., Konopka and James C. Crabbe. (2004). Compact Hand Book – Computational Biology. Marcel Dekker, USA.
4. Pennington, Dunn (1996). Proteomics from Protein Sequence to Function (1st Ed). AcademicPress, San Diego.

Web Sources Link

1. <https://www.genome.gov/human-genome-project/about-genomics>
2. <https://www.genome.gov/genetics-glossary/Genome>
3. <https://www.ensembl.org/info/genome/genebuild/index.html>
4. <https://www.ensembl.org/info/docs/tools/index.html>
5. <https://www.ncbi.nlm.nih.gov/genome/browse>

MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	H	M	L
CO2	M	S	H	L	H
CO3	M	S	H	L	M
CO4	H	H	M	M	M
CO5	M	S	H	L	M

S – Strong

H – High

M – Medium

L – Low

Content prepared by (Based on Inputs)	
Signature of the Course in-charge (Dr.V.Elakkiya)	Signature of the HOD

Programme code: 08	B. Sc. Biotechnology			
Title of the Paper : Core Practical 3 – Lab in Immunology, Plant and Animal Biotechnology				
Batch: 2026-2029	Hours / Week 6	Total Hours 90	Credits 3	Skill Development/ Employability

Course Objectives

1. To provide hands on experience and to learn the principles behind immunological techniques
2. To make the students skilled in plant tissue culture techniques
3. To teach students the latest techniques and principles in animal biotechnology
4. To provide hands on training on animal cell culture techniques

Course Outcomes

After completion of the course, the students will be able to:

K3 ↑ ↓ K5	CO	Apply basic techniques for identifying antigen and antibody molecules
	CO	Devise conservation methods important plant species through <i>in vitro</i> Tissue culture
	CO	Analyze the bioactive natural compounds from plants
	CO	Conduct experimental studies relating to animal biotechnology
	CO	Devise and execute experiments using cell lines

IMMUNOLOGY

Prelab Exercises

1. Safety and precautionary measures in handling as and also samples
2. Introduction to automate detection systems

Experiments

1. ELISA
2. Immunoelectrophoresis
3. ABO blood grouping.
4. Radial immunodiffusion.

5. Ouchterlony Double immunodiffusion.
6. Preparation of serum and plasma from blood.
7. Immunoassay of particulate antigen.
8. WIDAL test

PLANT BIOTECHNOLOGY

Prelab Exercise

1. Laboratory organization for a typical plant tissue culture lab
2. Stocks of media components and their role

Experiments

1. Media preparation and sterilization
2. *In vitro* seed germination
3. Embryo Culture
4. Callus Induction and Cell Culture
5. Micropropagation – Nodal
6. Artificial seed preparation and culture
7. Isolation of protoplast and viability check
8. Phytochemical screening and estimation of plant secondary metabolites –
Alkaloids, flavonoids and phenols

ANIMAL BIOTECHNOLOGY

Pre lab Exercises

1. Safety guidelines and laboratory design of a typical animal cell culture lab
2. Good Laboratory Practices in handling cell lines
3. Sterilization Technique
4. Media types and components

Experiments

1. Different types of Media preparation
2. Study of Zebra fish cell structure
3. Primary cell culture preparation from embryonated egg
4. Preparation of Established Cell Lines from primary culture
5. Cell counting and viability by Trypan blue dye exclusion test
6. Trypsinization method and Preservation of cells and thawing

Text Book

1. Hay, CF., Westwood, OMR. (2008). Practical Immunology (4th Ed.). Wiley Blackwell
2. Giri, CC., Giri, A. (2013). Plant Biotechnology: Practical Manual (1st Ed). LK International
3. Portner. (2020). Animal Cell Biotechnology –Methods and Protocols Ralf (Ed), (1st Ed). Humana Press.

Practical Examination mark breakup:

CIA PRACTICAL		
CIA Practical	25	40
Observation Notebook	10	
Attendance	5	

CIA Practical Breakup of Marks		
Protocol - 15 Result & viva - 15	30	35
Record Note book	5	

ESE PRACTICAL			
Knowledge Level	Section	Marks	Total
	Experiments	50	60
		Record Work	

Knowledge Level	Section	Marks	Total
K3 K4 K5	Project Report	60 \	80
	Viva voce	20	

Knowledge Level	Section
K3  K5	Major Experiments: Protocol - 15 Perform - 5 Result - 5 Minor Experiments: Protocol - 5 Perform - 5 Result - 5 Q&A - 5 Viva - 5
	Record work 10

MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	L	H	L	M
CO2	S	L	H	L	M
CO3	S	L	H	M	M
CO4	S	H	H	H	H
CO5	M	L	H	M	S

S – Strong

H – High

M – Medium

L – Low

Content prepared by (Based on Inputs)	
Signature of the Course in-charge (Dr. S. Bhargavi)	Signature of the HOD

Programme Code: 08	B.Sc. Biotechnology			
Title of the paper : Applications of Modern Biotechnology				
Batch 2026 – 2029	Hours/Week 1	Total Hours 15	Credits 1	Employability

Course Objectives

- **To understand the applications of biotechnology** in food, environmental, pharmaceutical, animal, and plant sectors, with emphasis on emerging technologies and industry practices.
- **To explore career opportunities and entrepreneurship avenues** in biotechnology-based industries, diagnostics, healthcare, agriculture, environmental management, and bioproduct development.
- **To develop problem-solving and analytical skills** through industry-oriented case studies involving real-world biotechnology challenges and their practical solutions.

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 to K5	CO1	Understand the applications of biotechnology in food, environmental, pharmaceutical, animal, and plant sectors.
	CO2	Apply diagnostic and analytical tools used in biotechnology industries for quality assessment, monitoring, and disease detection.
	CO3	Analyze the role of biotechnology in addressing challenges related to food safety, environmental sustainability, healthcare, agriculture, and animal health.
	CO4	Evaluate career opportunities and industrial practices in biotechnology-based organizations and enterprises.
	CO5	Develop problem-solving and entrepreneurial skills through analysis of industry-based case studies and biotechnology innovations.

Syllabus

Unit I

(3 Hours)

Applications of food safety and smart food processing in food industries; food quality monitoring, adulteration detection and food safety management in food manufacturing, NABL accredited food testing laboratories and regulatory sectors; career opportunities and entrepreneurship in food industries.

Case Study: Analysis of food contamination outbreaks, food adulteration incidents, allergen detection, product recalls, and quality assurance practices in dairy, beverage, nutraceutical, and processed food industries.

Unit II

(3 Hours)

Applications of CRISPR-based diagnostics, high-throughput screening, genomic analysis, and point-of-care testing (POCT) in healthcare; molecular diagnostic technologies for infectious disease detection, biomarker-based cancer diagnostics, non-invasive diagnostic methods and diagnostic kit development. Methods to mitigate AMR

Case Study: Investigation of infectious disease diagnosis, diagnostic assay validation, vaccine quality control, and cancer diagnostic applications in healthcare sectors.

Unit III**(3Hours)**

Careers in developing disease-resistant livestock and biomedical models. Animals for pharmaceutical production. Stem Cell Research in regenerative medicine. Fertility services: IVF, IUI, ICSI. Surrogacy in India (Act, 2021).

Unit IV**(3 Hours)**

Climate-resilient farming, organic farming, terrace farming, aquaculture and soilless farming. career opportunities and entrepreneurship in seed industries, agri-biotechnology companies, biofertilizer production units, plant-based product industries, and precision farming services.

Unit V**(3 Hours)**

Water quality analysis, biodiversity conservation, and sustainable environmental management in environmental and industrial sectors; application of environmental biotechnology tools for resource conservation, pollution control, and sustainability initiatives. Career opportunities in environmental industries, water treatment sectors, and sustainability solution enterprises.

Text Books

1. B. D. Singh. Biotechnology: Expanding Horizons, 5th Edition, Kalyani Publishers, New Delhi, 2022.
2. S. B. Primrose and R. M. Twyman. Principles of Gene Manipulation and Genomics, 9th Edition, Wiley-Blackwell, 2020.
3. Glick, B. R., Pasternak, J. J., and Patten, C. L. Molecular Biotechnology: Principles and Applications of Recombinant DNA, 6th Edition, ASM Press, 2021.
4. David Gardner and Carlos Simón. Handbook of In Vitro Fertilization, 5th Edition, CRC Press, 2023.

Reference Books

1. 1. Wilson, K. and Walker, J. (Eds.). Principles and Techniques of Biochemistry and Molecular Biology, 9th Edition, Cambridge University Press, 2023.
2. 2. Atul Bhargava and Shilpi Srivastava (Eds.). Integrative Approaches to Biotechnology, CRC Press, 2024.
3. 3. Vibha Rani, Bhawna Saxena, and Neha Atale (Eds.). Advancing Biotechnology: From Science to Therapeutics and Informatics, Springer, 2025.
4. 4. Dinesh Kumar Srivastava, Ajay Kumar Thakur, and Pankaj Kumar (Eds.). Agricultural Biotechnology: Latest Research and Trends, Springer, 2023.
5. 5. Pradeep Verma (Ed.). Industrial Microbiology and Biotechnology: Emerging Concepts in Microbial Technology, Springer, 2023.

Web Sources Link

1. <https://www.bio.org/healthcare-biotechnology>
2. <https://www.biotechnologyinnovation.org/biotech-basics>
3. <https://www.who.int/health-topics/biotechnology>
4. <https://www.who.int/teams/health-product-and-policy-standards/biologicals>
5. <https://www.nabl-india.org/accreditation/laboratories>
6. <https://www.nabl-india.org/testing-laboratories>

MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	H	H
CO2	M	H	S	S	H
CO3	H	M	S	S	S
CO4	M	M	S	S	S
CO5	H	H	M	M	S

S – Strong**H** – High**M** – Medium**L** – Low

Content prepared by (Based on Inputs) Signature of the Course in-charge (Dr. V. Elakkiya)	Signature of the HOD
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Programme code: 08	B. Sc. Biotechnology			
Title of the Paper : Core Paper 10 – Bioprocess Technology				
Batch: 2026-2029	Hours / Week	Total Hours	Credits	Skill Development
	5	75	4	

Course Objectives

1. To introduce the principles and techniques of bioprocess engineering and downstream processing.
2. To understand the basics of fermentation techniques
3. To enable the students to learn about the design of fermentors.
4. To decipher techniques for genetic improvements of micro-organisms to improve yield of bioproducts.

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↑ K5 ↓	CO1	Recognize and apply the basic principles of bioprocess technology and different types of bioreactors.
	CO2	Design and use selectable and optimized media for maximum production of microbial metabolites
	CO3	Explain designing of protocols for strain improvement and separation of molecules after fermentation process.
	CO4	Apply the process for commercial production of metabolites
	CO5	Apply the principles of bioprocessing in product development and products

Syllabus

UNIT I

(15 Hours)

Introduction: Basic principles of fermentation, scope and application of bioprocess technology, Commercial significance of enzymes, metabolites and recombinant products. *Selection of Industrially important microorganism:* Isolation, screening- primary and secondary screening methods; Strain improvement- Selection of natural variants; Selection of induced mutants - Auxotroph mutant; Use of recombination system; Pure culture maintenance.

UNIT II**(15 Hours)**

Bioreactor configuration: Body construction; Construction material; Aeration and agitation system, Stirrer glands and bearings, Baffles, Valves and stream traps, Pressure-control valves.

Bioreactors Types: Trickling bed, CSTR, Bubble column, Air lift bioreactor, Packed bed, Tower bioreactor, Fluidized bed and Photobioreactor and Hollow fiber Bioreactor and Upflow Aerobic Sludge Bioreactor (UASBR); Solid substrate operation of bioreactor,

UNIT III**(15 Hours)**

Upstream processing: Introduction, Raw material and media formulation for fermentation process: Fermentation media - Natural media, Synthetic media; Sources of carbon; Nitrogen and vitamins; antifoams; *Media designing* - Submerged and solid-state processes; Media optimization. AI driven approach.

Sterilization: Methods of sterilization- Batch and continuous sterilization; Air sterilization-air filters design and mechanism of air sterilization; Inoculum source – Seed culture; Inocula Development; Scale up and scale down.

UNIT IV**(15 Hours)**

Culture System: Batch, Fed batch, Continuous culture. Phases of cell growth, Factors affecting cell growth. Microbial Growth kinetics: Specific growth rate, substrate utilization and product development, Monod's model and yield coefficients.

Transport phenomena: Mass and heat transfer mechanism. *Bioprocess monitoring and control:* Monitoring variables: pH, temperature, pressure, agitation, Computer aided control.

UNIT V**(15 Hours)**

Downstream processing: Introduction, Solid-liquid separation - Flootation, Flocculation and Filtration (Rotary Drum Vacuum filter); Centrifugation- Tubular Bowl, Disc Dowl, Multichamber, Decanter Centrifuge; Cell disruptions (Mechanical, enzymatic and chemical). Concentration – Methods of protein precipitations. Membrane filtration - Ultrafiltration, Nanofiltration, Reverse Osmosis. Chromatography – Gel permeation Chromatography; Product polishing: drying - spray driers, drum driers and freeze driers and crystallization.

Industrial Biotechnology: Alcoholic beverages (***beer and wine**), organic acids (Lactic acid), enzymes (Protease), 4th generation antibiotics (Cephalosporin) and amino acids (glutamic acid).

*** denotes Self study**

Text books

1. Pauline and Doran M., 2003. A Textbook of Industrial Microbiology, Panima Publishing corporation. New Delhi.
2. Sathyanarayana U., *et al.*, 2005. Biotechnology, Books and Allied (P) Ltd. India
3. Bernard R, Glick and Jack J, Pasternak, Molecular Biotechnology- Principles & application of Recombinant DNA, 4th edition, ASM press, Washington, DC.

References

1. Stanbury, PF., Whitaker, A., Hall, SJ (2016). Principles of Fermentation Technology (3rdEd). Butterworth-Heinemann Elsevier Ltd, Oxford, United Kingdom.
2. Shuler, ML., Kargi, F (2017). Bioprocess engineering, Basic Concepts (3rd Ed) Prentice Hall, Englewood Cliffs.
3. Casida, LE. (2002). Industrial Microbiology. John Wiley & Sons Inc., United States.
4. Lancini, G., Lorenzetti, R (2014). Biotechnology of Antibiotics and other Bioactive Microbial Metabolites, Springer publications, Germany.

Web Sources Link

1. <https://www.ncbi.nlm.nih.gov/books/NBK559098>
2. <https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/bioprocess>
3. <https://www.thermofisher.com/in/en/home/industrial/bioprocessing.html>
4. <https://www.bio-rad.com/en-in/applications-technologies/bioprocessing>
5. <https://www.fao.org/biotechnology>
6. <https://www.biopharminternational.com>

MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	L	S	L	H
CO2	L	L	H	L	H
CO3	S	H	S	M	M
CO4	H	L	S	H	S
CO5	M	L	M	L	M

S – Strong

H – High

M – Medium

L – Low

Content prepared by (Based on Inputs) Signature of the Course in-charge (Dr. R. Sathish Kumar)	Signature of the HOD
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Programme code: 08	B. Sc. Biotechnology			
Title of the Paper : Core Paper 11 – Biopharmaceuticals				
Batch: 2026-2029	Hours / Week 5	Total Hours 75	Credits 5	Skill Development

Course Objectives:

1. To enable the students to learn Indian system of medicine.
2. To understand the basic facts in pharmaceutical technology
3. To give them the knowledge on drug development process
4. To teach them to evaluate on the biological-efficacy of drugs.
5. To provide students a foundation on clinical research.

Course Outcomes:

After completion of the course, students should be able to:

K1 ↑ K5	CO1	Apply the knowledge on drug use, dose and dosage
	CO2	Prepare the drug and test the same
	CO3	Use classical treatment processes and relate it to the novel methods of drug Development
	CO4	Integrate the use of past and present drug treatment regimes for health benefits
	CO5	Distinguish conventional lab and proficient lab with good GLP

Syllabus**UNIT I****(16 hours)**

Introduction Biopharmaceuticals: current status and future prospects, generic and branded biopharmaceuticals, overview of life history for development of biopharmaceuticals. Introduction to Indian system of medicine- Ayurvedic, siddha, Unani and Allopathy. Sources of drug and preparation. Need for pharmaco economics. Classification of drugs based on ATC system and pharmacotherapy. NSAID drug and mode of action of NSAID drug. Basic principle in drug formulation and drug dosage forms.

1. Case study on some drugs ayurveda and allopathy for dose and dosage.

Routes of drug administration and adverse drug effects in collaboration with Arya Vaidya Pharmacy, Coimbatore

2. Observational study for symptoms of adverse drug effects with known allopathic drugs

UNIT II**(15 hours)**

Pharmacokinetics and Pharmacodynamics of Biopharmaceuticals: Definition, rationales, absorption, distribution and metabolism pathway. Factors governing absorption of drug. Pharmacokinetics and Pharmacodynamics of therapeutic peptides. Dose response relationship, interspecies scaling, heterogeneity of therapeutic proteins. Chemical modification of therapeutic protein, ADMET-biotransformation of drugs

UNIT III**(15 hours)**

Drug discovery and development : Drug development cycle-Source identification , separation - extraction (Solvent extraction , Steam distillation) identification of bioactive constituents, quality management and its clinical chemistry, formulation **(study one formulation for each student-capsule, tablet cream etc. of any chemical entity)**** (Demo on GCMS /HPTLC/FTIR) Clinical research : preclinical study for toxicity testing, clinical trial , FDA review , ANDA (Abbreviated New Drug Application Review) and **pharmacovigilance***

UNIT IV**(14 hours)**

Drug Manufacturing Processes: Good Manufacturing practice: Industrial plant design, quality control, maintenance of manufacturing standards, validation. rDNA technology in manufacturing processes. Production of biopharmaceutical ingredients like curcumin, vincristine, omega -3- Fatty acid.

(A Case study on drug manufacturing process/ visit to a factory)

UNIT V**(15 hours)**

Formulation of Biopharmaceuticals: Rational for formulation of biotherapeutics, formulation recipients: solubility enhancers, anti-aggregating agents, buffers, cryoprotectants, antioxidants and preservatives etc significance with relevant examples. Methods to enhance shelf-life protein-based therapeutics. Packaging techniques and quality analysis of product. Oils used in aroma therapy Compliance/Adherence and acceptability of Product. ***Genesis of Biopharmaceuticals from traditional medicine as per AYUSH.**

**denotes self study **case study*

Text Books:

1. Guyton, C., John E. Hall. (2000). Hall Textbook of Medical Physiology (13th Ed).Oxford University Press.
2. Gary Walsh. (2004). Biopharmaceuticals: Biochemistry and Biotechnology, John Wiley & Sons.

Reference Books:

1. Mahato, RI. (2012). Pharmaceutical Dosage Forms and Drug Delivery (10th Ed).<https://doi.org/10.1201/9781315156941>.
2. Tripathy KD. (2017). Essentials of Pharmacology for medicine, (3rd Ed) Jaypee brothers medical Publishers.
3. Brahmanekar, BM., Sunil B jaiswal. (2015). Concepts in Biopharmaceutics and Pharmacokinetics A treatise (3rd Ed). Vallabh Prakashan Publishers, Delhi.

Web Sources Link

1. <https://www.fda.gov/drugs/development-approval-process-drugs>
2. <https://www.fda.gov/drugs/pharmaceutical-quality-resources>
3. <https://www.who.int/health-topics/medicines>
4. <https://www.ayush.gov.in>
5. <https://www.ncbi.nlm.nih.gov/books/NBK547852>

MAPPING

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	L	L	M	L
CO2	H	S	M	M	M
CO3	M	S	H	S	M
CO4	H	L	M	H	M
CO5	M	L	M	S	H

S – Strong

H – High

M – Medium

L – Low

Content prepared by (Based on Inputs)	
Signature of the Course in-charge (Dr. R. Selvasundaram)	Signature of the HOD

Programme code: 08	B. Sc. Biotechnology			
Title of the Paper : Core Paper 12 - Bioinformatics				
Batch: 2026-2029	Hours / Week	Total Hours	Credits	Skill Development
	5	75	4	

Course Objectives

1. To impart the challenges and importance of bioinformatics in the biological research field
2. To describe the different sequence types and the specific databases available for biological data.
3. To outline the usage of specialized database and their significance
4. To explain the various applications of bioinformatics in the field of biological sciences

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↑ ↓	CO1	Outline the importance and basics of bioinformatics as a tool in biological sciences
	CO2	Use knowledge on different types of biological databases for solving real time Problems
	CO3	Employ the nucleotide and protein sequences using specialized databases
	CO4	Analyze the different applications of bioinformatics in biological research field
	CO5	Apply computational tools in myriad areas of research

Syllabus

UNIT I:

(15 Hours)

Bioinformatics- Definition, Background, Aim, Scope, Challenges and Applications- Sequence analysis, Protein structure prediction, Genome annotation, Health and Drug discovery; Opportunities in Bioinformatics. *Introduction to Python* - Installing and Working with Python. Python MYSQL – Create Database, Create Table, Insert, Select, Where, Order By, Delete, Drop Table, Update, and Join. Emerging areas of Bioinformatics

Exercise: 1.Retrieve information from NCBI, PubMed databases

2.Retrieve information from primary nucleotide sequence databases: EMBL, DDBJ,

UNIT II: (15 Hours)

Genome, Gene, Nucleotides, DNA sequence, Nucleotide Database- National Center for Biotechnology Information (NCBI), GenBank, European Molecular Biology Laboratory (EMBL), DNA Databank of Japan (DDBJ), The Human Genome Project- Sangers and shot gun method of genome sequencing; Prokaryotic and Eukaryotic gene structure, gene prediction rules and software. **Exercise:** 1. Perform similarity search for protein sequence using (BLAST)

2. Perform Multiple Sequence Alignment SA using ClustalW

UNIT III: (15 Hours)

Protein structure- importance, Primary structure of proteins- amino acid sequence, Peptide bond; Protein sequence databases: Uniprot-KB: SWISS-PROT, TrEMBL; Secondary structure of proteins- α - helix, β -sheets; Domains and Motifs, Secondary Structure database-PROSITE, Tertiary structures- Side chains and protein folding, PFam database, Quaternary structure, Protein Data Bank (PDB).

Exercise: 1. Retrieve 3D structure information from PDB

2. Perform protein structure visualization using Pymol, SPDBViewer, Rasmol

UNIT IV: (15 Hours)

Sequence retrieval system - Entrez, SRS; Sequence submission system- BankIt, Sequin; Metabolic pathway database- KEGG (Kyoto Encyclopedia of Genes and Genomes), Meta Cyc (Metabolic Pathway Database), Eco Cyc (*Escherichia coli* genes and metabolism); OMIM (Online Mendelian Inheritance in Man); Species specific database- ACeDB (*A Caenorhabditis elegans* database), SGD (*Saccharomyces* Genome Database)

Exercise: 1. Design primer from sequence information

2. Retrieve structure information of small molecules from PubChem

UNIT V: (15 Hours)

Genomics- Comparative genomics and Structural genomics; Proteomics- Structural and functional proteomics; Transcriptomics, Metabolomics, Metagenomics, Pharmacogenomics, Pharmacogenetics, Rational Drug Designing, ***CADD**.

Exercise: 1. Perform Structure drawing of small molecules using Chem sketch

2. Predict the biological activity for small molecules using Pass prediction

3. Perform Docking analysis using Argus Lab

****denotes self study***

Text books

1. Teresa K. Attwood and David J. Parry Smith. (1999). Introduction to Bioinformatics (1999) Addison Wesley Longman Limited.
2. Rastogi S. C. Namita Mendiratta; Parag Rastogi (2008) Bioinformatics Concepts Skills and Application (3rd Ed). New Delhi : PHI Learning Publishers
3. Jenny Gu, Philip E. Bourne (2011). Structural Bioinformatics. (2nd Ed). Wiley-Blackwell
4. Jin Xiong (2012). Essentials of Bioinformatics. Cambridge University Press
5. Richard Twyman (2013). Principles of Proteomics, (2nd Ed). Garland Science Publishers.
6. Curran BG and Walker RJ, (2017) Bioinformatics, CBS Publishers & Distributors Pvt Ltd, India

Reference book

1. Bryan Bergeron (2002). Bioinformatics Computing- Bergeron- Prentice Hall India Learning Private Limited
2. Murthy, CSV (2016). Bioinformatics, Himalaya Publishing House publishers.
3. Arthur M. Lesk (2019). Introduction to Bioinformatics, Oxford University Press.
4. Malcolm Campbell A. and Laurie J. Heyer (2003), Discovering Genomics Proteomics and Bioinformatics- Campbell, Heyer, Cold Spring Harbor Laboratory Press.

Web Sources Link

1. <https://www.ebi.ac.uk/training/online>
2. <https://blast.ncbi.nlm.nih.gov/Blast.cgi>
3. <https://www.uniprot.org/help/uniprotkb>
4. <https://www.rcsb.org/education>
5. <https://www.genome.jp/kegg/docs>

MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	M	L	L
CO2	H	S	H	L	L
CO3	H	S	M	M	L
CO4	H	S	H	M	M
CO5	H	S	M	M	H

S – Strong

H – High

M – Medium

L – Low

Content prepared by (Based on Inputs)	
Signature of the Course in-charge (Dr. R.Sathish Kumar)	Signature of the HOD

Programme code: 08	B. Sc. Biotechnology			
Title of the Paper : Core Practical 4 - Lab in Bioprocess Technology & Biopharmaceuticals				
Batch: 2026-2029	Hours / Week 6	Total Hours 90	Credits 3	Skill Development/ Employability

Course Objectives

1. To provide an opportunity to experimentally verify the theoretical concepts already studied.
2. To provide an exposure to design and run batch fermentation experiments for production of microbial enzymes
3. To introduce basics of herbal drug preparation and testing.

Course Outcomes (CO)

After completion of the course, the students will be able to:

K3 ↑	CO1	Apply the principles of industrially important microorganisms for large yield of Products
	CO2	Explain the basic design and types of bioreactors and its working principles
	CO3	Demonstrate various techniques like media formulation, strain improvement and inocula development and product recovery to improve processing
	CO4	Use various bioseparation processes such as cell disruption techniques, product enrichment techniques and product purification methods
K5 ↓	CO5	Able to design and execute modules for drug preparation and testing

Syllabus

BIOPROCESS TECHNOLOGY

Prelab Exercise

1. Bioprocess engineering lab
2. Working model of Bioreactor
3. Design of a bioreactor

Experiments

1. Isolation of alpha amylase producing bacteria
2. Optimization of medium conditions for bacterial growth and amylase production (Substrates, pH & temperature)
3. Concentration of bacterial amylase - Ammonium sulfate precipitation
4. Dialysis
5. Purification - size-exclusion chromatography

6. Wine production and analysis
7. Sauerkraut preparation for lactic acid fermentation and analysis.
8. Immobilization of Enzyme – Gel entrapment

BIOPHARMACEUTICALS

1. Determination of antibacterial spectrum of Drugs/antagonist
2. Preparation of a Herbal Hydrogel
3. Conversion of Herbal oil to Gel
4. Testing Hemagglutination and Hemolytic activity of a drug formulations

Text book:

1. Kulandaivel, S., Janarthanan, S. (2012). Practical Manual on Fermentation Technology Paperback edition. I K International Publishing House Pvt. Ltd.
2. Baltz, RH., Davies, JE., Demain, AL. Manual of industrial Microbiology and Biotechnology (3rd Edition). ASM publications. ASM press, Washington, DC.
3. ReshmaFathima, K. Biopharmaceutics and Pharmacokinetics Practical Manual. Trinity Publishing House.

Practical Examination mark breakup:

CIA PRACTICAL		
CIA Practical	25	40
Observation Notebook	10	
Attendance	5	
CIA Practical Breakup of Marks		
Protocol - 15 Result & viva - 15	30	35
Record Note book	5	

ESE PRACTICAL					
Knowledge Level K3 K4 K5	Section	Marks	Total		
	Experiments	50	60		
		Record Work		10	

Knowledge Level	Section	Marks	Total
K3	Project Report	60	80
K4			
K5	Viva voce	20	

Knowledge Level	Section	
K3 ↑ ↓ K5	Major Experiments: Protocol - 15 Perform - 5 Result - 5 Minor Experiments: Protocol - 5 Perform - 5 Result - 5 Q&A - 5 Viva - 5	
	Record work	10

MAPPING

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	S	S	S
CO2	H	H	H	H	S
CO3	H	L	H	S	H
CO4	H	L	M	H	M
CO5	M	L	H	H	H

S – Strong

H – High

M – Medium

L – Low

Content prepared by (Based on Inputs)	
Signature of the Course in-charge (Dr. V. Elakkiya)	Signature of the HOD

Programme code: 08	B. Sc. Biotechnology		
Title of the Paper : Internship Training			
Batch: 2026-2029	Hours / Week -	Total Hours -	Grade

Course objective

- To provide an opportunity to work in industry/institute under the mentorship of an industrial personnel
- To develop key skill sets that are industry relevant for future placements
- To have a flavor of corporate life in an industry sector
- To built strength, sprit of team work and self confidence
- To prepare the students to comprehend industrial problem

Working Instructions

- The tutor of the respective class shall identify a list of industries/institutes at the beginning of the fourth semester and the same shall be approved by the HoD
- The tutor shall prepare a letter of request with the name of the student who will be placed in a particular industry and send the same or concurrence from the industry
- The class tutor shall ensure not more than four students allotted to a particular industry or institute
- The class tutor shall ensure that a daily log book provided to all the students while they leave for the internship during the summer vacation (The format of the log book will be available with the HoD)
- The tutor shall also ensure that the following documents are received from the students before they leave for the internship
 - i. The letter of undertaking from the concerned student
 - ii. A letter of undertaking from a parent/guardian indicating the willingness for permitting for his/her ward to the internship either in Coimbatore or other places
 - iii. During the internship the student must be in contact with the tutor and shall send weekly report

- iv. After the internship is completed the log books have to be submitted to the tutor
which has to be verified

The tutor shall arrange for an evaluation in consultation with the HoD and grades be allotted

Mark breakup for Evaluation

Component	Marks
Log book submission	15
Report	50
Attendance	15
Review & Evaluation	20
Total	100

Content prepared by (Based on Inputs)	
Signature of the Course in-charge	Signature of the HOD

Programme code: 08	B. Sc. Biotechnology			
Title of the Paper : Case Study analysis, Report and Viva Voce				
Batch: 2026-2029	Hours / Week 3+2	Total Hours 45+30	Credits 5	Skill Development

Course objectives

- To comprehend the problem that needs a viable solution
- To describe an individual/collective situation in industry/society
- To identify the key issues/factors that govern the problem
- Analyze the problem using extensive review and theory
- Recommend an action plan to alleviate the problem

Work Instructions

- Each student will be allotted to the teaching faculty in a department based on random lot
- The topic of the case study work will be finalized by the respective guide either solely or in consultation with industrial personnel provided a memorandum of understanding exist
- Monitoring of the progression of the case study will be done by the respective guides on a continuous basis
- Every student will subject himself or herself to a mid-review on case study progression on a date fixed by the Department
- The student shall submit the consolidated case study report in the format prescribed by the Department by the end of the sixth semester or a date intimated by the authorities
- The guide and the student shall ensure maximum integrity and shall not go astray in any form
- The case study report will be subjected to the end semester examination and will be jointly evaluated by internal examiner and industrial personnel
- Plagiarism in any form shall not be entertained in the dissertation and if found shall invite necessary disciplinary action on grounds of mal practice

Evaluation scheme for case study analysis

Knowledge Level	Section	Marks	Total
K3	Case study Viva voce	35	50
K4		15	
K5			

Case study mark breakup

Knowledge Level	Section
K3 ↑ ↓ K5	Case study Report: Issue identification - 10 Review - 10 Analysis - 5 Recommendation - 5 Report - 5
	Viva Voce: Layout of presentation - 5 Clarity - 5 Defense - 5

Content prepared by (Based on Inputs)	
Signature of the Course in-charge	Signature of the HOD

Programme code: 08	B. Sc. Biotechnology			
Title of the Paper : Major Elective -Stem cell and Neuroscience				
Batch: 2026-2029	Hours / Week 5	Total Hours 75	Credits 5	Employability/ Entrepreneurship

Course Objectives

1. To familiarize the students with stem cell technology and basics of neuroscience
2. To discuss various chemical and biological neural signals and its types.
3. To explain the importance of artificial intelligence in neural network
4. To familiarize the use of stem cells in the treatment of genetic and human diseases

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↑ ↓ K5	CO1	Relate various stem cells and their characteristic features.
	CO2	Explain neuronal signaling pathways and neurotransmitters in action potential
	CO3	Investigate the role of Artificial intelligence in neural network.
	CO4	Investigate the applications of stem cell and neuroscience in the treatment of various diseases.
	CO5	Use stem cells in design of therapeutic regimes

Syllabus

UNIT I

(15 Hours)

Introduction to stem cell Biology: Properties, proliferation, Identification, characterization and differentiation; overview of different stem cell types (embryonic, adult, and induced pluripotent stem cell), adult stem cell from amniotic fluid and cord blood; Ethical and legal issues of stem cell.

UNIT II

(15 Hours)

Stem cell culture and Aging: Growth factor and serum free culture of stem cells, Feeder free culture, Trophoblast stem cells – Identification and lineage specificity, Role of Yamanaka factor in iPSC; aging theory; cell cycle; senescence of stem cell; Role of stem cell in aging; regeneration of adult stem cell.

Case Study I: Potential impact of CRISPR and iPS cells over the coming decades

UNIT III

(15 Hours)

Neuron: Neural membrane, classification, nerve fibre, neural growth, nervous system, Blood Brain Barrier, Cerebrospinal fluid, Neuronal signaling- ion channel, recording neural signal, propagation of action potential, Role of Artificial intelligence in neural network.

UNIT IV

(15 Hours)

Synapse and Neurotransmitters: Synapse, Electrical synapse transmission, Synaptic transmitter release, Myoneural junction, neurotransmitters – synthesis, storage, release and functions – acetyl choline, catecholamine, histamine, serotonin, nitric oxide.

Case Study II: The Amalgamation of Human Brain and Artificial Intelligence

UNIT V

(15 Hours)

Applications: Current stem cell therapy for type 1 diabetes, cancer. Clinical outcomes of stem cell therapy, pluripotent stem cell in cell replacement therapy. Neurodegenerative disorders – Hearing and Memory, Parkinson's disorder, ***Alzheimer's disorder.**

Group discussion on Neuropsychology and well being

** denotes Self study*

Textbooks

1. Deb, KD., and Totey, SM. (2017). Stem cell basics and Applications. Tata McGraw Hill Pvt .Ltd.
2. Kiessling, AA. (2006). Human Embryonic stem cells. Jones and Barlett Publications.
3. Kandel, E., Schwartz, J., Jessell, T., Siegelbaum, S. (2013). Principles of Neurosciences (5th Ed). McGraw hill Medicals.
4. Kuldhip S Sindhu. (2018). Frontiers in Pluripotent stem cells research and therapeutic potentials. Bench to Bedside.

References

1. Quesenberry, PJ., Stein, GS, Wiley, ED. (2001). Stem Cell Biology and Gene therapy. Springer.
2. Bear, M., Connors, BW., Paradiso, MA. (2015). Neuroscience: Exploring the Brain (4th Edition). Wolters Kluwer.

Web Sources Link

1. <https://stemcells.nih.gov/info/basics/stc-basics>
2. <https://www.isscr.org/education-learning/educational-resources/stem-cell-facts>
3. <https://www.ncbi.nlm.nih.gov/books/NBK27048>
4. <https://www.brainfacts.org/thinking-sensing-and-behaving/brain-development>
5. <https://www.ninds.nih.gov/health-information/disorders/parkinsons-disease>

MAPPING

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	L	L	H
CO2	S	H	L	L	H
CO3	M	L	M	M	H
CO4	M	M	L	H	M
CO5	H	H	L	H	H

S – Strong

H – High

M – Medium L – Low

Content prepared by (Based on Inputs)	
Signature of the Course in-charge (Dr. S. Bhargavi)	Signature of the HOD

UBT 62

Programme code: 08	B. Sc., Biotechnology			
Title of the Paper : Major Elective -Nanotechnology				
Batch: 2026-2029	Hours / Week 5	Total Hours 75	Credits 5	Employability/ Entrepreneurship

Course objective

1. To familiarize the influence of dimensionality of the object at Nanotechnology on their properties.
2. To discuss various classification of Nano materials and its different approaches
3. To comprehend the principle behind nanoparticle synthesized methods
4. To understand the concepts of nanomaterials in different characterization techniques
5. To acquaint with Nanotechnology and its medical applications

Course outcomes:

After completion of the course, the students will be able to:

K1 ↑ ↓ K5	CO1	Distinguish between the functional aspects of various Nanomaterials
	CO2	Explain different classification methods and approaches
	CO3	Utilization of significant role of synthesis
	CO4	Use the appropriate method of characterization
	CO5	Employ nanoparticles in diagnosis and therapy

Syllabus

UNIT I

(15 Hours)

Concepts of Nanomaterials – Definition of nanoscale, surfaces and particle size, surface energy and surface tension and relation to size, phase transformation in nanomaterials, specific heat and heat capacity of nanomaterials, mechanical properties of nanomaterials, optical properties of nanomaterials, electrical and magnetic properties of nanomaterials.

UNIT II

(15 Hours)

Classifications of Nanomaterials: Fullerenes and carbon nanotubes (CNTs) classes of carbon-based Nanoparticles, Metal based nanoparticles – Ag Au Cu Pt Zn Fe Ni, Metal sulfide, Metal Oxide and Metal organic Nanoparticles, Semi-conductor Nanoparticles, Polymorphic Nanoparticles, Lipid based Nanoparticles.

UNIT III

(15 Hours)

Synthesis Methods of Nanomaterials: Top down: Milling; Bottom-up approaches – Synthesis of zero-dimensional metal, metal oxides, Physical and chemical methods; Superlattices; Self Assembly; Langmuir-Blodgett Films; Electrochemical Deposition; Special Nanomaterials – Core/shell structures, Carbon-based Nanomaterials, Micro and Mesoporous Materials, Organic-Inorganic Hybrids, Green synthesis method –Plants, Biosynthesis method – Fungi, Bacteria, Viruses and algae.

UNIT IV

(15 Hours)

Characterization: X-ray diffraction - nanolayers effects of nanosize and shape of nanostructures, SEM, SEM/EDX - scattering of electrons, secondary and backscattered electrons, electron sources, imaging for nanomaterials size and shape analysis, TEM - imaging and diffraction modes of operation HRTEM - Energy dispersive analysis of x-rays, Nanomaterials size and shape structural analysis, AFM - dynamic force microscopy, and various other modes, FTIR - single and group frequencies, advantages of surface enhanced.

UNIT V

(15 Hours)

Nanomedicine and Drug Delivery: Basic concepts in the design of nanomedicine, Nanomedicines for various disease conditions: infectious diseases, neurological diseases: (***challenges of blood brain barrier**), pulmonary disorders, cardiovascular diseases, cancer: nano-chemotherapy, -radiation therapy, immunotherapy, -nuclear medicine therapy, -photodynamic therapy, -photothermal and RF hyperthermia therapy, -scintillation therapy, gene-therapy: DNA, RNA delivery.

**denotes Selfstudy*

Text Books

1. Materials Science and Engineering – An Introduction, William D Callister, 12th Edition, John Wiley (Available in Amazon India, Rs. 287)
2. G. Cao, Nanostructures and Nanomaterials – Synthesis, Properties and Applications, Imperial College Press 2006.
3. Understanding Nanomedicine: An Introductory Textbook Rob Burgess, CRC Press, 2012.

Reference Books

1. Nanostructured materials: Processing, Properties and Potential Applications, Edited by Carl. C. Koch, Noyes Publications, 2002.
2. N. Yao and Z. L. Wang, Handbook of Microscopy for Nanotechnology, Springer Science and Business Medi (2005).
3. Nanomedicine for Cancer Therapy: From Chemotherapeutic to Hyperthermia-Based Therapy, Springer, Piyush Kumar, Rohit Srivastava, 2017

Web Sources Link

1. <https://www.nano.gov/nanotech-101/what/definition>
2. <https://www.nano.gov/you/nanotechnology-benefits>
3. <https://www.nature.com/subjects/nanotechnology>
4. <https://www.sciencedirect.com/topics/materials-science/nanoparticles>
5. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5516856>

MAPPING

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	M	H
CO2	M	M	M	M	H
CO3	M	M	H	H	H
CO4	H	L	H	H	M

S–Strong

H–High

M–Medium

L–Low

Content prepared by (Based on Inputs)	
Signature of the Course in-charge (Dr. .R. Selvasundaram)	Signature of the HOD

Programme code: 08	B. Sc. Biotechnology			
Title of the Paper : Major Elective - Biosafety, Bioethics and Industrial process ethics				
Batch: 2026-2029	Hours / Week 5	Total Hours 75	Credits 5	Employability/ Entrepreneurship

Course Objectives

1. To disseminate fundamentals of Intellectual Property Rights to students
2. To impart the importance of IPR laws and to encourage students in the novel creation to meet the biotechnological demands.
3. To educate students about the principles and conflicts in bioethics
4. To understand the basics of bioethics in biotechnology research and biosafety measures to protect the ecology and human health

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↑ K5 ↓	CO1	Apply intellectual property law principles (including copyright, patents, designs and trademarks) to real problems and analyze the social impact of intellectual
	CO2	Identify and analyze Patent law, the legislative provisions regulating patents, principles and procedure for obtaining patent
	CO3	Demonstrate and develop awareness of relevance and impact of intellectual property law on academic and professional live
	CO4	Demonstrate knowledge and understanding of the specific aspect(s) of intellectual property law that is/are relevant to their legal careers
	CO5	Draft and apply Design/Process/Product patent

Syllabus

UNIT I

(15 Hours)

Intellectual property rights: Types of IP: Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications: Traditional knowledge- indigenous, medicinal, bioprospecting knowledge, need for protection, positive protection, defensive and legal protection, Protection of GMOs IP as a factor in R&D; IPs of relevance to Biotechnology. Biodiversity Act: Introduction to Biodiversity -Biodiversity- components of biodiversity (Genetic, Species and Ecosystem diversity). Case Studies- Neem, Turmeric, Basmati, *Bt* Brinjal, *Bt* Cotton*

Activity: List and identify the various products in India which has got G.I tags

UNIT II**(15 Hours)**

Patents; Types of patent applications: Ordinary, PCT, Conventional, Divisional and Patent of Addition; Specifications: Provisional and complete; Forms and fees Invention in context of “prior art”; Patent databases; legal requirements for patents- Granting of patent- Rights of a patent, exclusive right. Searching International Databases; Country-wise patent searches (USPTO, esp@cenet(EPO), PATENT Scope (WIPO), IPO, etc.)

UNIT III**(15 Hours)**

Patents and patent processing: International scenario of patents, patenting of biological materials, significance of patents in India, Patent application types- Patent document, Specification and claims, protection of biotechnological inventions, Patent Act (1970), Patent (Amendments) Act (2002), Infringement, The different layers of the international patent system: National, Regional and International options.

Activity: Drafting for an application for Design patent

UNIT IV**(15Hours)**

Bioethics: Introduction, Ethical issues related to biotechnology, legal and socioeconomic impacts of biotechnology, health and safety issues, possible benefits of successful cloning, Ethical concerns of gene cloning, hazards of environmental engineering, Ethical issues in Human Cloning and stem cell research, Ethical implications of biotechnological products and techniques. Social and ethical implications of biological weapons.

UNIT V**(15 Hours)**

Biological Safety Cabinets; Primary Containment for Biohazards; Biosafety Levels; Biosafety Levels of Specific Microorganisms; Recommended Biosafety Levels for Infectious Agents and Infected Animals, Government of India; Definition of GMOs & LMOs; Roles of Institutional Biosafety Committee, RCGM, GEAC etc. for GMO applications in food and agriculture; Environmental release of GMOs; Risk Analysis; Risk Assessment; Risk management and communication; Overview of National Regulations and relevant International Agreements including; **Cartegana Protocol***.

Case study: Regulation in India with reference to use of GM foods/crops

**denotes self study*

Text Books:

1. Deepa Goel and Shomini Parasha. (2013). IPR, Bio safety and Bioethics. (1st Edition). Pearson.
2. Reddy, SVD. (2019). Intellectual property rights. (1st Edition). Asia Law House.
3. Prabodh K. Maiti and Mait, P., 2011. Biodiversity: Perception, peril and preservation. Learning Private Limited, New Delhi.

Reference Books:

1. Vaughn, L. (2016). Bioethics: Principles, Issues and Cases. (3rd Edition). Oxford University Press.
2. Sree Krishna, V. (2007). Bioethics and Biosafety in Biotechnology. (1st Edition). New Age International Publishers.
3. Sibley, D. (2007). The Law and Strategy of biotechnological patents. (1st Edition). Butter worth publication.
4. Ganguli, P. (2001). Intellectual property rights. (1st Edition). Mc Graw hill.
5. Wattal, V. (1997). Intellectual Property Right. (1st Edition). Oxford Publication House.

Web Sources Link

1. <https://dbtindia.gov.in/regulations-guidelines/recombinant-dna-research-and-biocontainment>
2. <https://bch.cbd.int/protocol/text>
3. <https://www.wipo.int/patents/en/topics/biotechnology.html>
4. <https://www.who.int/health-topics/ethics-and-health>
5. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7923912>

MAPPING

PSO \ CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	H	S	S
CO2	M	L	M	S	S
CO3	M	M	H	H	S
CO4	M	L	H	H	H
CO5	M	L	M	S	H

S – Strong

H – High

M – Medium

L – Low

Content prepared by (Based on Inputs)	
Signature of the Course in-charge (Dr. V. Elakkiya)	Signature of the HOD

Programme code: 08	B. Sc. Biotechnology			
Title of the Paper : Major Elective - Research Methodology				
Batch: 2026-2029	Hours / Week 5	Total Hours 75	Credits 5	Skill development/ Employability

Course Objectives

- 1) To inculcate the basic framework of a typical research process
- 2) To understand a general definition of research design and experimentation
- 3) To disseminate the various information for literature review and data collection
- 4) To identify the primary characteristics of quantitative research and qualitative research.

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↑ K5 ↓	CO	Design a good quantitative purpose statement and good quantitative research questions and hypotheses
	CO	Identify various types of quantitative sampling and which presents the most rigorous approach to use.
	CO	Distinguish and apply methods for a population and a sample, design
	CO	Analyze the link between quantitative research questions and data collection and how research questions are operation
	CO	Present the findings of research in an organised and non-plagiarized form

Syllabus

UNIT I:

(15 Hours)

Research Methodology –Characteristics and Criteria of Good research, Types of research, Research Problem- Scientific thinking, Selection and evaluation of research problem, Review of Literature-Need of review of literature, Sources, functions and hints for the review of literature. Research Approach- Qualitative, quantitative, mixed-methods approach, Criteria for selecting a research approach, Research Strategies- Case studies, Experiments, Action research

Activity: Collect at least 10 literatures on the given topic and make a concept note.

UNIT II:

(15 Hours)

Writing a Article; Essay, Research Paper, Research Project, Legislation Drafting, Judgment Writing, Thesis, Dissertation, Book, Reviews - Book Review; Case Review- Criteria of Good Research, Research Ethics; Citation Methods- Foot Note, Text Note, End Note, Bibliography; Citation Rules- Blue Book, OSCOLA, MLA, APA, Chicago, Oral Presentations using usual aids such as handouts, overhead transparencies and presentation software such as PowerPoint.

Activity: Calculate citation index, h-index and impact factor

UNIT III:

(15 Hours)

Sampling techniques- Concepts of statistical population, sampling error, sample size, methods of sampling, characteristics of good sample, Data collection- Questionnaires, Interviews, Focus Groups, Observation, Research Hypotheses- nature, importance and kinds of hypothesis, Variables, formulating, hypothesis testing, data processing and analysis strategies and tools, data analysis with statically package (Sigma STAT, SPSS for student t-test, ANOVA, etc.)

Activity: Frame and validate a survey questionnaire for health data

UNIT IV:

(15 Hours)

Organizing and writing a rough draft – searching and reviewing scientific literature – publishing in scientific journals – ethical and legal issues – scientific presentations – oral presentation – poster presentation. Preparation of research report - steps involved in writing a good report - concepts of bibliography and references. Developing a Research Proposal: Format of research proposal - Individual research proposal - Institutional proposal.

Activity: Develop a research proposal concept note in given area

UNIT V:

(15 Hours)

Application of Computer for Research Work: Application of Computer packages - Educational and Research resources on the Internet - Data Analysis and Display using software. Use of encyclopedias, Research guides, Handbook, Internet, Academic databases. Use of tools- Reference management, Zotero/Mendeley, ***Paper formatting MS Office**, Plagiarism- Types, penalty, software and tools for the detection of plagiarism.

Case study: Compare and report the features of Academic Database

****denotes self study***

Text Books

- 1) Kothari, CR. (1990). Research Methodology. (1st Edition).
- 2) Kerlinger, FN. (2017). Foundation of Research. (1st Edition). Surjeet Publications

Reference books

1. Cohen, L., Lawrence, M., and Morrison, K. (2005). Research Methods in Education (5th edition). Oxford: Oxford University Press.
2. Denscombes, M. (2010). The Good Research Guide: For small-scale social research projects. Maiden-Read: Open University Press
3. Singh, YK. (2006). Fundamental of Research Methodology and Statistics. New International (P) Limited, Publishers

Web Sources Link

1. <https://research-methodology.net/research-methodology/research-design>
2. <https://research-methodology.net/sampling-in-primary-data-collection>
3. <https://www.scribbr.com/research-process/research-problem>
4. <https://apastyle.apa.org/style-grammar-guidelines/references>
5. https://www.zotero.org/support/creating_bibliographies

MAPPING

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	M	H	M
CO2	H	L	M	S	S
CO3	M	M	H	M	S
CO4	L	L	M	H	H
CO5	M	M	M	S	H

S – Strong

H – High

M – Medium

L – Low

Content prepared by (Based on Inputs)	
Signature of the Course in-charge (Dr. R. Sathish Kumar)	Signature of the HOD

UBT 71

Programme code: 08	B. Sc. Biotechnology			
Title of the Paper : Major Elective -Molecular Diagnostics				
Batch: 2026-2029	Hours / Week 5	Total Hours 75	Credits 5	Skill development/ Employability

Course Objectives

1. To State the fundamental principles of clinical molecular diagnostics and explores the use of molecular techniques in the diagnosis of disease
2. To explain the required quality assurance and quality control measures required in a molecular laboratory.
3. To sensitize on the application of monoclonal antibodies
4. To introduce basic of Neonatal and Prenatal diagnostics

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↑ ↓ K5	CO1	Clarity about the molecular diagnostic aspects, its significance and goal
	CO2	Categorize various techniques used in the clinical diagnostic laboratory for the diagnosis of various pathogenic situations
	CO3	Explain how these methods are applied in current research and diagnostics
	CO4	Asses the need of quality assurance that needs to be followed in the molecular diagnostic lab.
	CO5	Apply basic diagnostic principles for design of novel tools for diagnosis

Syllabus

UNIT I

(15 Hours)

Traditional disease diagnosis methods and tools: Diagnosis of infection caused by Coliforms, Vibrio and Mycobacterium, Candidiosis and Aspergillosis. Diagnosis of DNA and RNA viruses- Pox virus, Adenovirus, Hepatitis Virus and · Retrovirus. Protozoan diseases: Amoebiosis, Malaria - Study of helminthic diseases- *Fasciola hepatica* and *Ascaris lumbricoides*

UNIT II

(15 Hours)

DNA sequencing methods in molecular diagnosis: Automated DNA sequencing- Principles, Methods and Instrumentation- Advances in DNA sequencing- New Generation sequencing Methods, Pyrosequencing, Microarrays- Personalized Medicine- Pharmacogenomics (ADMET), RT-PCR - Diagnosis of Sars-CoV-2

UNIT III

(15 Hours)

Neonatal and Prenatal disease diagnostics: Gender identification using amelogenin gene locus. Amplification of Y chromosome specific Short Tandem Repeats (Y-STR). Analysis of mitochondrial DNA for maternal inheritance. Molecular diagnosis for early detection of cerebral palsy and cancer. Edible vaccine.

UNIT IV

(15 Hours)

Therapeutic monoclonal antibodies: Human monoclonal and Humanized monoclonal. Uses – unconjugated antibodies for treatment of kidney rejection, HIV treatment, treatment of multidrug resistant cancer cells, Herceptin in breast cancer therapy, toxin delivery, Sars-CoV-2.

UNIT V

(15 Hours)

Recombinant Vaccine therapy: Protein based vaccine for Sars-CoV-2, DNA vaccine for Ebola virus, Gene vaccine-the vaccinia virus approach, Edible vaccine from transgenic plants, Role and properties of adjuvants, reverse vaccinology, ***Vaccine safety and quality assurance**

** denotes Self study*

Text books

1. Pamela Greenwell and McCulley, M. (2008). Molecular Therapeutics: 21st century medicine. (1st Ed). Springer.
2. Coleman, WB. (2006). Molecular Diagnostics for the Clinical Laboratorian. (2nd Edition). Humana Press.

References

1. Buckingham, M and Flaw, S. (2019). Molecular Diagnostics: Fundamentals, Methods and Clinical Applications. (3rd Ed). FA Davis Company Publication.
2. Burtis, C., Bruns, D. (2014). Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics. (7th Ed). Elsevier- Saunders.

Web Sources Link

1. <https://www.ncbi.nlm.nih.gov/books/NBK559312>
2. <https://www.cdc.gov/lab-quality/php/molecular-diagnostics/index.html>
3. <https://www.genome.gov/about-genomics/fact-sheets/genetic-testing>
4. <https://www.fda.gov/medical-devices/in-vitro-diagnostics>
5. <https://www.who.int/health-topics/in-vitro-diagnostics>

MAPPING

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	H	S
CO2	H	M	M	S	S
CO3	H	M	H	S	M
CO4	H	L	M	H	H
CO5	M	M	M	S	S

S – Strong

H – High

M – Medium

L – Low

Content prepared by (Based on Inputs)	
Signature of the Course in-charge (Dr. S. Bhargavi)	Signature of the HOD

UBT 74

Programme code: 08	B. Sc. Biotechnology			
Title of the Paper : Major Elective - Food and Dairy Technology				
Batch: 2026-2029	Hours / Week 5	Total Hours 75	Credits 5	Skill development/ Employability/ entrepreneurship

Course Objectives

1. To familiarize students with advances in food processing techniques
2. To acquaint students with the industrial techniques
3. To introduce the various methods to preserve and process foods and extend their shelf-life
4. To sensitize the methods to improve their palatability characteristics.

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↑ ↓ K5	CO1	To provide an overview of basic principles and methods of food processing, preservation and quality.
	CO2	To predict processing and to standardize methods of preservation in relation to food composition.
	CO3	To review quality standards and ethics in processed foods.
	CO4	To invent and develop novel food processing and preservation technologies to manufacture and preserve food in an effective manner
	CO5	To design smart packaging systems from local resources

Syllabus

UNIT I

(15 Hours)

Introduction to food processing, preservation and quality, Basic principles and methods. Emerging Technologies in food processing. Food additives and preservatives. Food laws and standards. Effect of processing on acceptability and nutritive value of food, Conventional foods and indigenous food.

Activity: Prepare a nutritive chart on Indian conventional snacks

UBT 75

UNIT II

(16 Hours)

Milk Products: Physico-chemical properties and structure of milk and milk constituents. Chemical and microbial spoilage of milk and milk products; Fluid milk processing, packaging and distribution.

Dairy products- cream, Butter, Ghee, Evaporated milk, Condensed milk, Whole and skim milk powder, Butter oil, Ice cream. Fermented milk-Yoghurt, Acidophilus milk, butter milk, Paneer and similar products. *Cheese-* Classification, Cottage cheese, Cheddar cheese, processed cheese-manufacturing methods.

UNIT III

(14 Hours)

Dairy plant sanitation- Selection and use of dairy cleaner and sanitizer in plant cleaning system, Waste disposal methods. Common dairy processes – cream separation (standardization), pasteurization, sterilization and Homogenization. Grading and Quality- Specifications and standards in milk processing industry Judging and grading of milk

Activity: Visit to a local dairy unit

UNIT IV

(15 Hours)

Food products: Technological processes for industrially manufactured foods of commercial importance, from plant and animal origin. Functional foods and Nutraceuticals. Ready to eat therapeutic food, micronutrient fortified high energy bar, gluten free bread, lactose free milk, carbonated cereal beverage. Cereals, vegetables, fruits, meats, poultry and egg products; Bakery, pasta and confectionary products, ready to eat foods, fermented foods, alcoholic and non- alcoholic Beverages, tea, coffee and cocoa, fabricated foods.

Activity: Reading and comprehending food labels

UNIT V

(15 Hours)

Packaging materials: Characteristics, properties and their design. Packaging requirement for different processed and unprocessed foods. Working Principles of various types of fillers: form-fill- seal machine. Gas packaging and modified atmosphere Package design. Shelf life prediction of foods in packages. Quality control in Food packaging. ***Product safety and packaging regulations.**

Case study: Compare the conventional methods of food package with the latest ones

**** denotes Self study***

UBT 76

Text books

1. Shakuntalamany, V and Shadakshara Swamy, M. (1987). Foods: Facts and Principles. NewAge International Pub. (P) Limited.
2. Srilakshmi B, (2007). Food Science. New Age International Pub. (P) Limited.
3. Eckles, E., Comb, B and Macy, S. (1972). Technology of Indian Milk products. TataMcGraw Hill.
4. Vijaya Khade. (1999). Text Book on Foods Storage and Preservation. (1st Ed). Kalyani Publ.

References

1. Goldberg I. (1994). Functional foods. Chapman & Hall.
2. Gutierrez-Lopez, GF. and Barbosa-Conovas, GV. (2003). Food Science and Food Biotechnology. CRC Press.
3. Lee Byong H. (1996). Fundamentals of food Biotechnology. VCH Publ.
4. Sukumar, D. (2001). Outline of Dairy technology. (1st Edition). Oxford University Press

Web Sources Link

1. <https://www.fao.org/food-safety/background/en>
2. <https://www.fssai.gov.in/cms/food-safety-and-standards.php>
3. <https://www.dairyknowledge.in/content/milk-processing-and-packaging>
4. <https://www.idfa.org/food-safety>
5. <https://www.ncbi.nlm.nih.gov/books/NBK236241>

MAPPING

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	H	S
CO2	H	M	H	S	H
CO3	H	M	H	S	M
CO4	M	L	M	H	H
CO5	M	M	H	S	H

S – Strong H – High M – Medium L – Low

Content prepared by (Based on Inputs)	
Signature of the Course in-charge (Dr. .R. Selvasundaram)	Signature of the HOD

Programme code:	For B.A., BBA, B.Com, BCA and B.Sc., Degree Students				
Title of the Paper : Skill Based Subject 1 – Basics of Cyber Security					
Batch: 2026-2029	Semester III	Hours / Week 2	Total Hours 30	Credits 3	Skill development

COURSE OBJECTIVES

- To provide fundamental knowledge of cyber security concepts and the digital environment.
- To create awareness about cyber threats, cybercrimes, and common online frauds.
- To develop the ability to identify risks associated with internet, mobile, and online transactions.
- To familiarize students with safe practices in email, social media, and digital communication.
- To introduce basic cyber laws, ethics, and responsible digital behavior.

COURSE OUTCOMES

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

K Level	CO Code	Course Outcome
K1 ↑ ↓ K5	CO1	Apply the fundamental concepts of cyber security and digital safety at appropriate place
	CO2	Identify various cyber threats, cybercrimes, and online frauds
	CO3	Enable safe practices while using internet, mobile, and e-commerce platforms
	CO4	Interpret security issues related to email and social media usage
	CO5	Comprehend cyber laws, ethics, and legal responses to cybercrime

SYLLABUS

UNIT I

6 Hours

Foundations of Cyber Security: Cyberspace and Digital Environment -Evolution of Cyber Security- Basic Concepts and terminology in Cybersecurity –Cybersecurity Threat – Defense in Depth concept in Cyber Security- Information Literacy – Types of False Information — Digital footprint — Cyber Frauds- Basic Safety Practices and Password Awareness - Multi-Factor Authentication (MFA)- Zero Trust Security Model

UNIT II

6 Hours

Cyber Crimes & Threat Landscape: Introduction to AI in Cyber Security- Cyber Crimes- Important of Cybercrime- Types of Cyber Crime - CIA Triad – Tools for Confidentiality, Integrity, Availability - Cyber Crime & Digital Evidence Indian Perspective- Recent Cyber Crime Incidents-Social Engineering Frauds- Financial Frauds using Social Media Platforms- Ransomware Attacks -Deep fake based frauds -Cryptocurrency scams -Dark Web basics - Preventive Measures for individuals and Organizations – Awareness and Safe Online Behavior- Incident Response Process.

UNIT III**6 Hours**

Internet, Mobile & Digital Transaction Security: Browser Security Tools – Mobile phone security and privacy settings – E-commerce concepts and risks – UPI Fraud Awareness -QR Code Scams - App permissions & Data Tracking – Malware Types and Cyber Attacks- Secure browsing and Data Theft & Public Wi-Fi Precautions – Symmetric vs Asymmetric Encryption.

UNIT IV**6 Hours**

Communication & Social Media Security: Basics of email usage and Communication – Email threats: Spam, Phishing, Malicious links- Fake News – Fake profiles, Cyber Bullying and Data Misuse – Computer Viruses – Antivirus and Firewall concepts – Safe sharing practices and Digital responsibility. Ethical Hacking.

UNIT V**6 Hours**

Cyber Laws, Ethics & Digital Responsibility: Introduction to Cyber Law – IT Act 2000 and Amendments– Data Protection Laws (India DPDP Act 2023). Intellectual Property in Digital Space- Cybercrime and legal provisions – User rights and responsibilities in cyberspace – Digital footprint and online identity – Personal data protection and privacy – Cyber ethics and responsible usage – Cyber safety awareness programs and best practices.

Case Study: Case studies of cyber law enforcement in India

Work Book

1. *Basics of Cyber Security*, prepared by Kongunadu Arts and Science College, Coimbatore

Reference Books

1. Data Security Council of India (DSCI), in collaboration with Seqrite, presents the second edition of the India Cyber, Threat Report 2025.
2. Green, J., Smith, A., & Brown, T. (2024). Information security management principles. Routledge.
3. Armstrong-Smith, S. (2024). Understand the cyber attacker mindset: Build a strategic security program. Kogan Page.
4. Ismail, Y., Lacy, F., & Belu, R. (Eds.). (2024). Cybersecurity: Threats, technologies, and emerging solutions. IntechOpen.
5. Rais, R., Morillo, C., Gilman, E., & Barth, D. (2023). Zero trust networks: Building secure systems in untrusted networks (2nd ed.). O'Reilly Media.
6. Shapiro, S. J. (2023). Fancy bear goes phishing: The dark history of the information age. Farrar, Straus and Giroux.
7. Tamil Nadu Fact Check Unit, Training Handbook
8. James Graham (2011), Cyber Security Essentials, CRC Press, Auerbach Publications, Taylor & Francis Group.
9. Kathryn Knerler (2022), 11 Strategies of a World-Class Cybersecurity Operations Center, MITRE Corporation.
10. Dr. Jeetendra Pande (2017), Introduction to Cyber Security, Uttarakhand Open University.
11. Rohas Nagpal (2008), Real world cyber crime cases, Cyber Crime & Digital Evidence – Indian Perspective, Asian School of Cyber Laws

12. Prof. (Dr.) Nilesh K. Modi (2021), Cyber Security Techniques, Dr. Babasaheb Ambedkar Open University.
13. Cyber Security Awareness Handbook (2020), Ciso Jil information Technology Limited.
14. Jeff Kosseff (2020), Cybersecurity Law, John Wiley & Sons, Inc.
15. Cyber Crime Law and Practice, The Institute of Company Secretaries of India, 2016
16. Yuri Diogenes (2018), Cybersecurity Attack and Defense Strategies, Packt Publishing.
17. Cybersecurity Handbook, Ministry of Digital Governance, National Cybersecurity Authority, June 2021.
18. Justin Hutchens (2024), The Language of Deception: Weaponizing Next Generation AI– Explores AI in social manipulation, deep fakes, and malware.
19. D.R. Halston (2025), Cyber Security Mastery Covers AI-driven attacks, cloud security, and career preparation.

Web References

- <https://safety.google/>
- <https://safety.google/security/security-tips/>
- <https://www.simplilearn.com/tutorials/cyber-security-tutorial>
- <https://www.getcybersmart.org/for-students>
- <https://www.techbuddies.io/cyber-security-basics>
- <https://www.geeksforgeeks.org/ethical-hacking/what-is-cyber-security/>
- <https://www.drishtias.com/daily-updates/daily-news-editorials/india-s-cybersecurity-challenge-threats-and-strategies>
- <https://www.dsci.in/resource/content/india-cyber-threat-report-2025>
- <https://www.eimt.edu.eu/25-major-cyber-attacks-in-india-threats-and-strategies>
- <https://www.coursera.org/in/articles/types-of-cyber-attacks>
- <https://eventussecurity.com/cybersecurity/india/cyber-attacks/>
- www.heimdalsecurity.com

Question Paper Pattern**Duration: 3 hrs****Max: 75 marks****Section - A (10x1=10)****Choose the correct answer****Section - B (5x5=25)****Short answer questions, either or type, one question from each unit.****Section - C (5x8=40)****Essay answer questions, either or type, one question from each unit.****CIA EXAMINATION MARK BREAKUP**

S. NO	DISTRIBUTION COMPONENT	MARKS
1.	CIA I – 75 Marks Converted to 30	30
2.	CIA II – 75 Marks Converted to 30	30
3.	Seminar/Objective Capacity Testing	10
4.	Seminar/Objective Capacity Testing	10
5.	Attendance	05
6.	Any Case Study related to Cyber Security (as a Group)	15
Total		100

Programme code: 08	B. Sc. Biotechnology			
Title of the Paper : Skill based Subject 2 - Traditional Indian Technology and Bio Business				
Batch: 2026-2029	Hours / Week 2	Total Hours 30	Credits 3	Skill development/ Employability/ Entrepreneurship

Course Objectives

1. To educate students about our Indian systems of medicine and explain methods for identification and authentication of herbal drugs.
2. To make the students to be skilled in hydroponics and to use the technology in developing commercial ornamental species.
3. To impart the knowledge of various aspects of Creativity, Innovation and New Product Development
4. To develop knowledge and skills to master the future challenges of the biotechnology industries
5. To educate students about concepts of traditional knowledge and trade system

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↑ ↓	CO1	Recognize the basic principles of Identification, authentication and Validation of herbs.
	CO2	Explore and offer services with regard to hydroponics
	CO3	Be a responsible biotechnologist who can work in an interdisciplinary framework of related fields
	CO4	Imbibe self-management, interpersonal and team work skills and set up a rewarding business venture
	CO5	Understand the concepts of traditional knowledge in different sectors.

Syllabus

UNIT I:

(6 Hours)

Indian System of Medicine: Ayurveda, Yoga, Unani, Siddha, Homeopathy, Naturopathy, “Sowa-Rig- Pa” (Amchi Medicine), Prospects for the twenty first century in herbal medicine. Phytopharmaceuticals: Selection of suitable extraction processes – Infusion, Decoction, Digestion, Maceration, Percolation, Solvent extraction, steam distillation, Sepbox, Headspace techniques, WHO and ICH Standardization of single and compound formulations, Shelf-life determination and stability testing of herbal formulation.

UNIT II**(6 Hours)**

Principles of Hydroponics: Substrates; Hydroponic systems. Plant anatomy, physiology and growth requirements. Plant varieties: Crop selection, Crop selection for different systems, Crop scheduling; Monitoring plants. Nutrient Supply: Plant requirements, Monitoring of the nutrient solution, Advantages and Disadvantages.

UNIT III**(6 Hours)**

Introduction to bio-business from the Indian context, SWOT analysis of bio-business. Development of Entrepreneurship; Stages in entrepreneurial process; Project Planning– Business opportunity, Essential requirement for Commercial biotech / bioproducts. Entrepreneurial ventures in biotechnology – scope, sectors and avenues. Quality control and strategies for future development of products, IT for business administration, use of IT in business performance, e- business setup

UNIT IV:**(6 Hours)**

Value addition to Biotechnology products, Marine biotechnology products–biomedical applications, Functional nutraceuticals. Microbial consortia in Environmental Biotechnology industry. Design of proto type - testing - quality standards - marketing research –introducing new products.

UNIT V:**(6 Hours)**

Indigenous Traditional Knowledge (ITK): Production of Bijamrut, Sanjivak, Jivamrut, Amritpani, Panchagavya enriched, Anda-Ark, Fish –Ark, Brahmastra (broad spectrum botanical pesticides), Kunapajala, Panchagavya, Cow horn manure production, compost tea production using suitable Agricultural resources and ***Indian Trade System**.

** denotes Self study*

Textbooks

1. Peter Kolchensky.(2011).The Entrepreneurship Guide to a Biotech startup. Evelexa.
2. Tripathi,PC. and Reddy,PN. (2012). Principles of Management. (6thEdition).TataMcGraw Hill.
3. Khanka,S S.(2006).Entrepreneurship Development. S.Chand & Co.
4. Agarwal, SS., Paridhavi M. (2012). Herbal Drug Technology (2nd Ed). Orient Blackswan.
5. Afsar. Z. (2019). Essentials of Herbal Drug technology. (1st Ed). S Vikas and Company.

Reference Books:

1. Damian Hine and John Kapeleris. (2008). Innovation and Entrepreneurship in Biotechnology, Concepts, Theories and Case. Edward Elgar Publishing.
2. Yali Friedman. (2008). Best practices in biotechnology business Development. Logos Press.
3. Neelesh Malviya, SapnaMalvia. (2019). Herbal Drug Technology. CBS Publishers

Web Sources Link

1. <https://www.ayush.gov.in/about-the-systems/ayurveda/introduction-to-ayurveda>
2. <https://www.who.int/teams/health-product-and-policy-standards/standards-and-specifications-for-herbal-medicines>
3. <https://www.fao.org/family-farming/detail/en/c/1632027>
4. <https://www.nhb.gov.in/default.aspx?enc=3ZOO8K5CzcdC/Yq6HcdIxJjM1RmjJX5+Yz5m4M6JmWQ=>
5. https://www.birac.nic.in/webcontent/1595689665_Biotechnology_Entrepreneurship_Development_Guidelines.pdf
6. <https://www.startupindia.gov.in/content/sih/en/government-schemes/biotechnology-ignition-grant.html>

MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	L	L	S	L
CO2	L	M	H	L	L
CO3	S	M	M	H	M
CO4	M	L	L	M	M
CO5	M	L	M	S	L

S – Strong

H – High

M – Medium

L – Low

Content prepared by (Based on Inputs)	
Signature of the Course in-charge (Dr.V.Elakkiya)	Signature of the HOD

Programme code: 08	For B.A., BBA, B.Com, BCA and B.Sc., Degree Students				
Skill Based Subject III: BASICS OF INTELLECTUAL PROPERTY RIGHTS					
Batch: 2026-2027	Semester VI	Hours / Week 2	Total Hours 30	Credits 3	Skill development

COURSE OBJECTIVES

- To create awareness about recent trends in IPR and Innovation
- To explore the basic concepts IPR
- To focus upon trademarks, copyrights, patents, industrial designs and traditional knowledge.
- To learn more about managing IP rights and legal aspects.

COURSE OUTCOMES

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

K1  K5	CO1	Know about basic concepts of IPR and patent
	CO2	Understand copyrights, industrial designs and geographical indication of goods.
	CO3	Differentiate between trademarks and trade secrets
	CO4	Acquire knowledge on protection of traditional knowledge and plant varieties.
	CO5	Manage and protect IP Rights

UNIT – I (6 hours)

Introduction -origin and development of Intellectual Property Rights (IPR), need for protecting IP, **Patents:** Foundation of patent law, patent searching process, basic criteria of patentability. Patentable and non - patentable subject matters in India. Patent prior art search, drafting the patent specification and filing procedure

UNIT – II (6 hours)

Copyrights: Fundamentals of copyright law, originality of material, right of reproduction, right to perform the work publicly, copyright ownership issues, notice of copyright. **Industrial Designs:** Kind of protection provided in Industrial design. **Geographical Indication of Goods:** Basic aspects and need for the registration.

UNIT – III (6 hours)

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, transfer of rights, selecting and evaluating trademark, registration of trademarks, claims. **Trade Secrets:** Trade secret law, determination of trade secret status, liability form is appropriation of trade secrets, trade secret litigation

UNIT – IV**(6 hours)**

Protection of traditional knowledge - Objectives, concept of traditional knowledge, issues concerning, bioprospecting and biopiracy. **Protection of Plant Varieties** - Objectives, international position, plant varieties protection in India. Rights of farmers, breeders and researchers.

UNIT- V**(6 hours)**

Managing IP Rights: Acquiring IP Rights: letters of instruction, joint collaboration agreement, protecting IP Rights: non-disclosure agreement, cease and desist letter, settlement memorandum. **Transferring IP Rights:** Assignment contract, license agreement, deed of assignment. Infringement and enforcement.

TEXT BOOKS

1. Ramakrishna Chintakunta and M. Geethavani (2022). A Textbook of Intellectual Property Rights. Blue Hills publications.
2. N.K Acharya (2021). Intellectual property rights(8thEdn). Asia Law House.
3. Craig Allen Nard, Michael J. Madison, and Mark P. McKenna. (2017). Law of Intellectual Property (5thEdn). New York Aspen publishers.
4. Barrett and Margreth (2009). Intellectual Property. New York Aspen publishers.
5. Deborah E.Bouchoux(2013). Intellectual property:The Law of Trademarks, Copyrights, Patents, and Trade Secrets. Publisher: Cengage India

REFERENCES

1. B.Ramakrishna and H.S.Anil Kumar (2017). Fundamentals of Intellectual Property Rights: For Students, Industrialist and Patent Lawyers.Notion Press.
2. V. K. Ahuja(2013). Law relating to Intellectual Property rights (2nd Edn). LexisNexis.
2. R. Radhakrishnan and S. Balasubramanian (2008).Intellectual property rights: Text and Cases. Excel Books India.
4. D. Goeland S. Parashar (2013). IPR Biosafety and Bioethics. Pearson Education India.

MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	M	S
CO2	H	S	H	M	S
CO3	H	H	M	S	H
CO4	S	M	S	M	H
CO5	S	M	S	S	H

S-Strong

H -High

M-Medium

L – Low

CIA EXAMINATION MARK BREAKUP

The CIA Examination mark breakup for the course **Basics of IPR** is given below:

S.No.	Distribution Component	Marks
1	CIA I – 75 Marks Converted to 30	30
2	CIA II – 75 Marks Converted to 30	30
3	Assignment I	10
4	Assignment II	10
5	Attendance	05
6	Any Case Study related to IPR (as a Group)	15
	Total	100

QUESTION PAPER PATTERN

The following question paper pattern will be followed for the above said courses:

Section A - Multiple Choice (10 × 1 = 10 Marks)

Section B - Either or Type (5 × 5 = 25 Marks)

Section C - Either or Type (5 × 8 = 40 Marks)

Maximum Marks : 75

Duration : 3 Hours

Programme code: 08	For All UG Degree Students			
Title of the Paper: EDC -Bio-Entrepreneurship				
Batch: 2026-2027	Hours / Week 2	Total Hours 30	Credits 3	Skill Development/ Employability/ Entrepreneurship

Course Objectives:

1. To provide an insight into the field of Bioentrepreneurship, i.e. innovation and entrepreneurship in the life sciences
2. To motivate students for entrepreneurship and the need for technological innovation
3. To familiarize students with the scope of issues and decisions that managers in biotechnology face as their company progresses from its earliest stages to self-sustainability
4. To give students the vocabulary to participate and contribute to the business side of scientific enterprises

Course Outcomes:

After completion of the course, the students will be able to:

K1 ↑ ↓ K5	CO1	Develop an understanding of Bio entrepreneurship
	CO2	Apply basic Business tools
	CO3	Compose and write a business plan offering a convincing presentation of a biotech venture
	CO4	Setup enterprise for new biotechnology product
	CO4	Assess the national and international market for product launch
	CO5	Apply for funding from Government/non-Government agencies

Syllabus**UNIT I****(6 Hours)**

Introduction to Bioentrepreneurship: translational biotechnology industry overview (include the commercialization pathways for drug, medical device, diagnostic companies), Skills needed for a bioentrepreneur, identify and market need, Biotechnology startups in India,

Case Study: Prepare a list of Biotechnology start ups and their contribution to the National GDP

UNIT II**(6 Hours)**

New product development, IP/Licensing strategy, Value innovation and market creation Market scanning, data collection, and market selection, the strategic triangle: segmentation, targeting and positioning, The business plan and financial projections,

Case Study: Identify local resources from Coimbatore District which can fit in to a new product development.

UNIT III**(6 Hours)**

Starting a Company: Issues and methods of starting a monopoly biotech company/start up, Business Model Canvas, Biotechnology Business Models, Role of Venture capitalist, Angel Investors, Government Funding agencies like NSTEDB, MSME, TBI etc. Problems of entrepreneurship, The Art of Negotiation, Workable marketing and the strength of distribution. Opportunities and lessons in international marketing.

Case Study: Prepare a 5-minute presentation based on Business Model Canvas to be presented to a Venture Capitalist

UNIT IV**(6 Hours)**

How to Start a Startup: corporate structure (LLC, LLP, C-Corp, S-Corp, etc.), ownership/vesting, LLP check in (customer development), Test Marketing Strategies, choosing a business location, Hiring and managing staff

Case Study: Prepare a present a customer interview and a test marketing survey for a product that will be launched

UNIT V:**(6 Hours)**

Problem and Solution of Entrepreneurship: Risk and benefit, Steps involved in commercialization of a biotechnological product, Introduction to IPR and Patenting of a Biological product

Case Study: Real time experiences from Start up CEO/CTO's on establishment of a Start up.

**denotes self study*

Text books:

1. Vasant Desai. (2011). Dynamics of Entrepreneurial development & management. (6th Edition) Himalaya Publications.
2. Bisht, MS. and Mishra, RC. (2000). Entrepreneurship reflection and investigation. Chugh Publication.
3. Samiuddin, M. (1992). Entrepreneurship development in India. Mittal Publication.
4. Roth, CR. (2001). From Alchemy to IPO: The Business of Biotechnology. (1st Edition). BasicBook Publisher.

References:

2. Dorf, RC. and Byers, TH. (2007). Technology Ventures: From Idea to Enterpris. (2nd Edition). Mc Graw-Hill.
3. Hisrich, RD., Peters, MP and Shepherd, DA. (2007). Entrepreneurship. (7th Edition). McGraw-Hill.
4. Shimasaki, C. (2014). Biotechnology Entrepreneurship: Starting, Managing, and Leading Biotech Companies. (2nd Edition). Elsevier.

Web Sources Link

1. https://www.birac.nic.in/webcontent/1595689665_Biotechnology_Entrepreneurship_Development_Guidelines.pdf
2. https://www.startupindia.gov.in/content/sih/en/reources/startup_india_learning_program.html
3. <https://www.investindia.gov.in/team-india-blogs/biotechnology-sector-india-opportunities-growth-and-investment-potential>
4. <https://www.msme.gov.in/1-prime-ministers-employment-generation-programme-pmegp>
5. https://www.wipo.int/sme/en/ip_business/biotechnology.htm

MAPPING

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	S	S	S	S
CO2	S	S	M	S	H
CO3	L	L	L	S	S
CO4	M	L	L	H	S
CO5	H	H	L	H	H

S – Strong

H – High

M – Medium

L – Low

Content prepared by (Based on Inputs)	
Signature of the Course in-charge (Dr. S. Bhargavi)	Signature of the HOD

Question Paper Pattern

Duration: 3 hrs

Max: 75 marks

Section - A (10x1=10)
Choose the correct answer

Section - B (5x5=25)
Short answer questions, either or type, one question from each unit.

Section - C (5x8=40)
Essay answer questions, either or type, one question from each unit.

CIA EXAMINATION MARK BREAKUP

(For Theory Only)

S. NO	DISTRIBUTION COMPONENT	MARKS
1.	CIA I – 75 Marks Converted to 40	40
2.	CIA II – 75 Marks Converted to 40	40
3.	Seminar/Objective Capacity Testing	05
4.	Seminar/Objective Capacity Testing	05
5.	Attendance	05
6.	Others (Group Discussion, flipped Class room, etc.,)	05
Total		100

CIA EXAMINATION MARK BREAKUP**(For Practical Only)**

	DISTRIBUTION COMPONENT	MARKS
1.	CIA Practical I – 60 Marks Converted to 30	30
2.	CIA Practical I – 60 Marks Converted to 30	30
3.	Continuous Assessment of Practical (Observation to be Submitted*) (15 Experiments/Programs $\times$ 2 = 30Marks)	30
4.	Record	05
5.	Attendance	05
	Total	100

* In case a student is absent for an Experiment/Program conducted on a particular day, the Student will not be allowed to compensate that Experiment/Program and will be awarded zero for that particular Experiment/Program and shall be marked absent. In case any students has an attendance lack; the concerned faculty handling the course in consultation with HoD may permit the student who has an attendance lack to compensate one or two Experiments/Programs as the case may be to enable them to become eligible with mandate of 75% attendance to appear for the Continuous Internal Practical Examinations. However the compensated Experiments/Programs will not be awarded any marks whatsoever.

For B.A., BBA, B.Com, BCA and B.Sc., Degree Students				
Title of the Paper: PART IV – ENVIRONMENTAL STUDIES				
Batch: 2026-2027	Semester I	Hours / Week 2	Total Hours 30	Credits 2

COURSE OBJECTIVES

- To provide a fundamental understanding of natural resources, environmental ethics, and the impact of modern practical conservation and sustainability.
- To inculcate knowledge and create awareness about concepts, components and function of ecosystems
- To appraise on the importance of biodiversity, its values, threats, indigenous and Traditional knowledge systems, conservation strategies, and modern identification tools, and cultivate conscious responsibility and awareness for biodiversity conservation and sustainability.
- To understand the environment threats and pollution, its impacts and mitigation strategies
- To develop an understanding of disasters (natural and man-made) and its preparedness

COURSE OUTCOMES

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

K1 ↑ ↓ K5	CO1	Formulate genetic resource conservation strategies and assess India's SDG performance through AI/ML tools.
	CO2	Evaluate and predict the impact of humans on web of life, global economy and quality
	CO3	Think critically and develop strategies for biodiversity conservation, sustenance and environmental equity through eco conscious approach
	CO4	Demonstrate values and have compassion towards complex environmental issues and take part in mitigating current environment challenges through sustainable solutions
	CO5	Apply basic safety and preparedness measures in disaster situations in society, household and workplace

UNIT I MULTIDISCIPLINARY NATURE OF ENVIRONMENT AND ITS SOCIAL ETHICS AND VALUE (6 HOURS)

Introduction to environment; Historical Development of Human – environment interaction; Industrial revolution, Economic development and its impact on the environment; **Overview of resources:** Definition, Classification of natural resources – biotic and abiotic, renewable and non-renewable. **Renewable Resources:** Water Resources- Rainwater Harvesting, Reservoirs managements, AI & ML tools for water resource management. Sustainable Development goals - Agriculture and Environment. Revisiting traditional agricultural practices- Biodynamic Farming, Physical and Biological soil factors. **Non-renewable Resources-** fossil fuel, nuclear fuel, Energy Resources: Conventional and non-conventional Resources- solar, wind, clean energy- hydrogen, Biomass energy-coir pith, charcoal; Use of exotic/invasive weed biomass for alternative energy/economy. Eg: *Lantana camara*, *Eichhornia Sp*, Genetic Resources and conservation, strategies.

- *Activity:** (i) Analyze your department and its practices towards compliance to SDG's. List out the compliances towards SDG's with justification.
- (ii) Examine your campus' current resource conservation strategies and provide recommendations to improve its sustainability and resource efficiency.

* Students can take up any one of the above.

UNIT II ECOSYSTEMS (6 HOURS)

Ecosystem- Definition, Components (producers, consumers and decomposers) and functions- Energy flow, Food chains and its types, food web, Disturbances to food chain and food web due to anthropogenic intrusions Eg: Diclofenac Case, Ecological pyramids: types and importance of ecological pyramids, **Types of Ecosystems:** Natural ecosystem- Aquatic Ecosystem (Pond, River, Marine and Estuarine), Terrestrial Ecosystem (Forest, Grassland and Desert). Artificial Ecosystem (Crop land).

Activity: Develop a working model for an ecosystem through building a Terrarium or Suseum.

UNIT III BIODIVERSITY (6 HOURS)

Concept of Biodiversity: Definition, Types-Genetic, Species and Ecosystem diversity. Indigenous Knowledge Systems on Biodiversity – Traditional knowledge and legal framework for bioprospecting and Biomimicry. Biodiversity- Values, uses and threats, sustainable use of bioresources for value additions, Conservation strategies of Biodiversity- *In-situ* - National Parks, Wildlife Sanctuaries, Community Reserve and Conservation Reserves, *Ex-situ* – Zoological Park, Aquarium, Botanical garden. ***Case Study-** Nilgiri Tahr Conservation Project.

Activity: (i) Applications for plant and animal identification by software -*iNaturalist* and

Merlin Bird ID

(ii) Field observation and documentation of the campus biodiversity.

UNIT IV ENVIRONMENTAL THREATS AND POLLUTION

(6 HOURS)

Introduction and Classification of Pollution- physical, chemical and biological; major types of pollution- air, water, soil/land, noise, thermal, radioactive, solid waste, electronic waste (e-waste), plastic, biomedical waste. **Assessment and Monitoring:** Pollution impact assessment/health risk assessment & monitoring techniques, Biological indicators of pollution – Dissolved Oxygen (DO), Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD). Impact of pollution and incidence of Life style disorders like Diabetes, Cardio Vascular Disease, Cancer, PCOS etc. **Waste Management** – concept of 3R (Reduce, Recycle and Reuse) and sustainability. ***Case studies:** Dye Industrial pollution from tanneries, paper and pulp industrial effluents in Noyyal and Cauvery rivers.

Activity: Prepare an Audit report for:

(i) Water usage in your department/house

(ii) Magnitude of solid waste generation and its management at your department/house.

UNIT V: DISASTER MANAGEMENT AND PREPAREDNESS

(6 HOURS)

Definition and Classification of Disaster (Natural and Man-made disasters). **Natural Disaster:** Earthquakes, Landslides, Tsunami, Floods, Volcanic eruptions, Cyclones. Wayand- landslides, Joshimath- The sinking Village, Forest fires: causes, spread, control measures. **Man-made Disasters:** Industrial and chemical accidents (Bhopal disaster, oil spills), Nuclear hazards (Chernobyl and Fukushima). Kasargod- Impact of Endosulfan spraying on cashew farms. **Preparedness and safety measures:** Early warning system, response, recovery, mitigation, vulnerability, risk, resilience and capacity building. **Forecasting methods:** Conventional – cloud formation & wind, wave patterns, behaviours of animals & plants, Modern methods – remote sensing, drone and AI tools for impact assessment. ***Case studies:** Chennai flood 2015, causes and control measures.

Activity: Prepare (i) Personal/Class emergency plan

(ii) Risk identification checklist like loose heavy furniture, poor wiring,
blocked exits

(iii) A document using Mobile technology to map local resources or identify
safer locations.

Field Study: Visit to eco parks'/conservation sites and report.

* Case studies are not for examination purposes.

Text book

1. Workbook on Environmental Science (2026), published by Kongunadu Arts and Science College, Coimbatore-641029.

Reference Books:

1. Fundamentals of Ecology, Odum E.P, Odum H.T & Andrews- Saunders publications
2. Ecology, Environmental science and Conservation. Singh J.S & Gupta SR, S Chand Publishing (2017).
3. This Fissured Land: An Ecological History of India; Gadgil M & Guha R (1993), University of California Press, 1st Edition.
4. Environment (8th Ed.) by Raven PH, Gift, Bary LR, Hassenzahl DM, 2015, Wiley publishing house.
5. R. S. Ambasht, A Text Book of Plant Ecology, Students Friends & Company, 1990 - Plant ecology - 373 pages
6. A. Ravikrishnan (2019), Environmental Science and Engineering (Forth Edition) by Sri Krishna Hitech Publishing Company Pvt.Ltd, Velappanchavadi, Chennai.
7. Yadav, P. (2021). Applied and Economic Zoology. Kedar Nath Ram Nath
8. Krishnamurthy, K. V. (2023). An advanced textbook on biodiversity: Principles and practice. Oxford and IBH Publishing.
9. Anonymous (2003) Professional's The Wildlife (Protection) Act, 1972. Professional Book Publications.
10. National Disaster Management Guidelines - National Disaster Management Information and Communication System (NDMICS) (2011). A publication of the National Disaster Management Authority, Government of India. ISBN: 978-93-80440-12-5, February 2012, New Delhi.
11. Disaster Risk Management Systems Analysis: A Guide Book, Food and Agriculture Organization of the United Nations, Rome (2008). ISBN 978-92-5106056-8.

Web Reference Sources

1. <https://egyankosh.ac.in/bitstream/123456789/77368/1/Unit-4.pdf>
2. <https://agritech.tnau.ac.in/pdf/sustainableagriculture.pdf>
3. https://www.dev-practitioners.eu/media/key_documents/SDGs_Booklet_Web_En.pdf
4. <https://www.pmfias.com/environment-ecosystem-components-ecosystem/>
5. <https://www.ugc.gov.in/oldpdf/modelcurriculum/Chapter3.pdf>
6. https://mjcollege.kces.in/pdf/download_documents/study_material_env_studies/ch3.pdf
7. [https://www.deshbandhucollege.ac.in/pdf/resources/1587401626_BA\(H\)-Psc-Eco-Eng-BA\(P\)-II-Ecosystem.pdf](https://www.deshbandhucollege.ac.in/pdf/resources/1587401626_BA(H)-Psc-Eco-Eng-BA(P)-II-Ecosystem.pdf)
8. <http://www.tezu.ernet.in/denvsc/IDC/biodiversity.pdf>
9. <https://egyankosh.ac.in/bitstream/123456789/86424/1/Unit-11.pdf>
10. <https://utkaluniversity.ac.in/wp-content/uploads/2022/05/Environmental-Pollution.pdf>
11. https://cdn.visionias.in/value_added_material/d6c24-disaster_management.pdf
12. https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SCIA4001.pdf
13. [https://mrcet.com/downloads/MBA/Disaster%20and%20Crisis%20Management_Digital%20Notes.p
df](https://mrcet.com/downloads/MBA/Disaster%20and%20Crisis%20Management_Digital%20Notes.pdf)

QUESTION PAPER PATTERN

Maximum Marks: 50

Duration: 3 Hours

Answer all Questions (5×10=50 Marks)

Essay type, Either or type questions from each unit

Course Objectives

Programme Code :	For B.A., BBA, B.Com, BCA and B.Sc., Degree Students		
Title of the Paper: VALUE EDUCATION - MORAL AND ETHICS			
Batch: 2026-2027	Hours / Week	Total Hours	Credits
	2	30	2

COURSE OBJECTIVES

- To impart Value Education in every walk of life
- To help the students to reach excellence and reap success
- To impart the right attitude by practicing self-introspection
- To portray the life and messages of Great Leaders
- To insist the need for universal brotherhood, patience and tolerance
- To help the students to keep them fit
- To educate the importance of Yoga and Meditation

Course Outcomes (CO)

After completing the course the students:

K1 to K5	CO1	will be able to recognize Moral values, Ethics, contribution of leaders, Yoga and its practice
	CO2	will be able to differentiate and relate the day to day applications of Yoga and Ethics in real life situations
	CO3	can emulate the principled life of great warriors and take it forward as a message to self and the society
	CO4	will be able to Analyse the Practical outcome of practicing Moral values in real life situation
	CO5	could Evaluate and Rank the outcome of the pragmatic approach to further develop the skills

Syllabus

UNIT I:

4 Hours

Moral and Ethics: Introduction – Meaning of Moral and Ethics – Social Ethics – Ethics and Culture – Aim of Education.

UNIT II:

6 Hours

Life and Teachings of Swami Vivekananda: Birth and Childhood days of Swami Vivekananda – At the Parliament of Religions – Teachings of Swami Vivekananda

UNIT III:

4 Hours

Warriors of our Nation: Subhas Chandra Bose – Sardhar Vallabhbhai Patel – Uddham Singh – V. O. Chidambaram Pillai – Bhagat Singh – Tiruppur Kumaran – Dheeran Chinnamalai – Thillaiyadi Valliammai – Velu Nachiyar – Vanchinathan

UNIT IV:

8 Hours

Fundamentals of Yoga : Introduction to Yoga – Benefits of Yoga - Principles of Yoga Practice– Yoga for Health and Well Being – Yoga for Peace – Yoga for Success – Brain Yoga Benefits – The Science of Yoga - Importance of Yoga in Modern Life

UNIT V:

8 Hours

Yoga Practices : Warm-Up Exercises in Yoga : Neck, Shoulder, Wrist, Hip, Knee and Ankle Rotations - Basic Yoga Asanas: Tadasana, Vrikshasana, Bhujangasana, Vajrasana , Shavasana and Ardhasiddhasana – Surya Namaskar - Pranayama - Meditation and Relaxation

Text Books:

Value Based Education – Moral and Ethics – compiled by Kongunadu Arts and Science College (Autonomous), 3rd Edition (2024).

Reference Books:

1. Swami Vivekananda - A Biography, Swami Nikhilananda, Advaita Ashrama, India, 24th Reprint Edition (2010).
2. Gandhi, Nehru, Tagore and other eminent personalities of Modern India, Kalpana Rajaram, Spectrum Books Pvt. Ltd., revised and enlarged edition(2004).
3. Freedom Fighters of India, Lion M.G. Agrawal, Isha Books Publisher, First Edition (2008).

4. Easy steps to Yoga by Swami Vivekananda, A Divine Life Society Publication(2000).

Web References:

1. <https://youtu.be/4UXFb7Cs3PU?si=6c50D1IfFvxTXdX>
2. <https://youtu.be/zCag6hbDlQw?si=kNWsrIxQXvOKfacp>
3. https://youtu.be/_2GgRQJ9IbU?si=Xp_YEcCSR8mvMEG-
4. <https://youtu.be/ZkyN4Dy4kO0?si=BkctTS1W3jDS886v>
5. https://youtu.be/TWbiDzi-rQc?si=92crHrzoNq_0jrU-

MAPPING

PSO CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	S	S
CO2	S	S	S	H	H
CO3	S	H	S	H	H
CO4	S	H	S	H	H
CO5	S	H	H	S	S

S – Strong

H – High

M – Medium

L – Low

Value Education – Moral & Ethics**Question Paper Pattern****(External only)**

Duration: 3 hours

Total Marks: 50

Answer all Questions (5 x 10 = 50 Marks)

Essay type, either or type questions from each unit.

Programme code:	B. Sc. Biotechnology		
Title of the Paper:	PART IV -Non-Major Elective – Human Rights		
Batch: 2026-2027	Hours / Week 2	Total Hours 30	Credits 2

COURSE OBJECTIVES

To prepare for responsible citizenship with awareness of the relationship between Human Rights, democracy and development.

- To impart education on national and international regime on Human Rights.
- To sensitive students to human suffering and promotion of human life with dignity.
- To develop skills on human rights advocacy
- To appreciate the relationship between rights and duties
- To foster respect for tolerance and compassion for all living creature.

COURSE OUTCOMES

After Completion of the Course the student will be able to

K1 ↑ ↓ K5	CO1	To understand the hidden truth of Human Rights by studying various provisions in the Constitution of India.
	CO2	To acquire overall knowledge regarding the Feminist perspectives in the Liberative Empowerment of Women.
	CO3	To gain knowledge about various gender roles and stereotypes involved in the comprehension of gender equality and women's rights.
	CO4	To comprehend the legal provisions and policies that foreground the safety of children in the society and to promote awareness.
	CO5	To gain enhanced knowledge about sexual and gender minorities to recognize, celebrate and acknowledge the diversified forms of gender expressions and rights.

SYLLABUS

UNIT I

(6 Hours)

HUMAN RIGHTS HUMANS RIGHTS CONSTITUTION OF INDIA: Humans Rights - Constitution Of India

UNIT II

(6 Hours)

WOMEN EMPOWERMENT IN INDIA: Feminism And Sexual Violence - Women And Liberation

UNIT III

(6 Hours)

GENDER EQUALITY AND WOMEN'S RIGHTS: Stereotype Gender Roles - Women's Education, Power And Scienc

UNIT IV

(6 Hours)

RIGHTS OF THE CHILD IN INDIA: Status of child in contemporary Indian society - Special Laws and Policies for protection of children

UNIT V**(6 Hours)**

SOGIESC RIGHTS: Understanding SOGIESC- basic Definitions- inclusivity of SOGIESC-importance of studying SOGIESC- presence of SOGIESC in Indian Traditions- temples and cultural practices that exemplify SOGIESC in India- Genetics of Sex determination- Genetics of Intersex community- Successful SOGIESC Personalities and achievers – Alan Turing- Sally Ride- Leonardo da vinci- Alan Hart- Virginia -Woolf- Bayard Rustin- Padmini Prakash- Akkai Padmashali- K Prithika Yashini- Laxmi Narayan Tripathi- Madhu Bai Kinnar-Manabi Bandhopadhyay- SOGIESC Rights and laws

Books for Study:

1. Human Rights (2024) Compiled by Kongunadu Arts and Science College, Coimbatore –29.

REFERENCES:

1. Human Rights, (2018) by Jaganathan, MA.,MBA.,MMM.,ML.,ML., (Humanitarian Law) and J.P. Arjun
Proprietor: Usha Jaganathan, Refugee Law
Law series, 1st floor, Narmatha Nanthi Street, Magathma Gandhi Nagar, Madurai – 625014.
2. Country Report on SOGIESC Rights In India: An Unfinished Agenda.
Weblink: <https://www.ilgaasia.org/publications/india-country-report-an-unfinished-agenda>
3. Intersex.
Weblink: <https://my.clevelandclinic.org/health/articles/16324-intersex>
4. SOGIESC Personalities:
<https://www.bbc.com/news/world-asia-india-29357630>
https://en.wikipedia.org/wiki/Laxmi_Narayan_Tripathi
https://en.wikipedia.org/wiki/Akkai_Padmashali
<https://www.indiatoday.in/india/story/prithika-yashini-india-first-transgender-police-officer-tamil-nadu-969389-2017-04-04>
<https://yourstory.com/2018/03/first-transgendre-college-principal-west-bengal>
5. SOGIESC Rights and laws
<https://www.openglobalrights.org/lgbtqia-to-sogiesc-reframing-sexuality-gender-human-rights/>
<https://static1.squarespace.com/static/5a84777f64b05fa9644483fe/t/625ead0484f9005d75b92dd0/1650371887436/ILGA+Asia+India+Report+2021.pdf>

Duration: 3 hrs

Question Paper Pattern

Max: 75 marks

Section - A (10x1=10)

Choose the correct answer

Section - B (5x5=25)

Section - C (5x8=40)

Essay answer questions, either or type, one question from each unit.

Programme code:	For B.A., BBA, B.Com, BCA and B.Sc., Degree Students		
Title of the Paper: Part IV -Non- Major Elective – Women’s Rights			
Batch: 2026-2027	Hours / Week	Total Hours	Credits
	2	30	2

COURSE OBJECTIVES

- To know about the laws enacted to protect Women against violence.
- To impart awareness about the hurdles faced by Women.
- To develop a knowledge about the status of all forms of Women to access to justice.
- To create awareness about Women's rights.
- To know about laws and norms pertaining to protection of Women.
- To understand the articles which enables the Women's rights.
- To understand the Special Women Welfare laws.
- To realize how the violence against Women puts an undue burden on healthcare services.

COURSE OUTCOMES

After Completion of the Course the student will be able to

K1 ↑ ↓ K5	CO1	Appraise the importance of Women's Studies and incorporate Women's Studies with other fields
	CO2	Analyze the realities of Women Empowerment, Portrayal of Women in Media, Development and Communication
	CO3	Interpret the laws pertaining to violence against Women and legal consequences
	CO4	Contribute to the study of the important elements in the Indian Constitution, Indian Laws for Protection of Women
	CO5	Spell out and implement Government Developmental schemes for women and create awareness on modernization and impact of technology on Women

Syllabus

Unit I

(6 Hours)

Women's Studies: Basic concepts of Women's studies in Higher education, Women's studies perspectives- Socialization- Patriarchy- Women's studies as an academic discipline- Growth and development of Women's studies as a discipline internationally and in India.

Unit II

(6 Hours)

Socio-Economic Development of Women: Family welfare measures, role of Women in economic development, representation of Women in media, status of Women land rights, Women Entrepreneurs, National policy for the empowerment of women.

Unit III**(6 Hours)**

Women's Rights – Access to Justice: Crime against Women, domestic violence – physical abuse- verbal abuse – emotional abuse - economic abuse – minorities, dowry- harassment and death, code of conduct for work place, abetment of suicide.

Unit IV**(6 Hours)**

Women Protective acts: Protective legislation for Women in the Indian constitution- Anti dowry, SITA, PNDT, and Prevention Sexual Harassment at Workplace (Visaka case), Domestic violence (Prevention) Act.

Unit V**(6 Hours)**

Women and Child welfare: Safety provisions - various forms of mass media, radio, visual, internet, cyber space, texting, SMS and smart phone usage. Healing measures for the affected Women and child society by private and public sector, NGO and society.

Text Book:

1. **Women's Rights** (2021), compiled by Kongunadu Arts & Science College, Coimbatore – 641 029.

Reference Books:

1. **"Rights of Indian Women"** by Vipul Srivatsava. Publisher: Corporate Law Advisor, 2014.
2. **"Women's security and Indian law"** by Harsharam Singh. Publisher: Aabha Publishers and Distributors, 2015.
3. **"Women's Property Rights in India"** by Kalpaz publications, 2016.

QUESTION PAPER PATTERN

Duration: 3 Hours

Max. Marks: 75

SECTION A

(5 x 5 = 25 marks)

Short answers, either or type, one question from each unit.

SECTION B

(5 x 10 = 50 marks)

Essay type questions, either or type, one question from each unit.

UBT 108

Programme Code :		For B.A., B.Sc., and BCA Degree Students	
PART IV - NON- MAJOR ELECTIVE III - CONSUMER AFFAIRS			
Batch	Hours/Week	Total Hours	Credits
2026-2027	2	30	2

COURSE OBJECTIVES

- To familiarize the students with their rights and responsibilities as a consumer.
- To understand the procedure of redress of consumer complaints.
- To know more about decisions on Leading Cases by Consumer Protection Act.
- To get more knowledge about Organizational set-up under the Consumer Protection Act
- To impart awareness about the Role of Industry Regulators in Consumer Protection
- To understand Contemporary Issues in Consumer Affairs

COURSE OUTCOMES

K1 ↑ K5 ↓	CO1	Able to know the rights and responsibility of consumers.
	CO2	Understand the importance and benefits of Consumer Protection Act.
	CO3	Applying the role of different agencies in establishing product and service standards.
	CO4	Analyse to handle the business firms' interface with consumers.
	CO5	Assess Quality and Standardization of consumer affairs

SYLLABUS**UNIT I****(6 Hours)**

Conceptual Framework - Consumer and Markets: Concept of Consumer, Nature of markets: Liberalization and Globalization of markets with special reference to Indian Consumer Markets, E-Commerce with reference to Indian Market, Concept of Price in Retail and Wholesale, Maximum Retail Price (MRP), Fair Price, GST, labeling and packaging along with relevant laws, Legal Metrology. Experiencing and Voicing Dissatisfaction: Consumer buying process, Consumer Satisfaction/dissatisfaction-Grievances-complaint, Consumer Complaining Behaviour: Alternatives available to Dissatisfied Consumers; Complaint Handling Process: ISO 10000suite

UNIT II**(6 Hours)**

The Consumer Protection Law in India - Objectives and Basic Concepts: Consumer rights and UN Guidelines on consumer protection, Consumer goods, defect in goods, spurious goods and services, service, deficiency in service, unfair trade practice, restrictive trade practice.

UBT 109

Organizational set-up under the Consumer Protection Act: Advisory Bodies: Consumer Protection Councils at the Central, State and District Levels; Adjudicatory Bodies: District Forums, State Commissions, National Commission: Their Composition, Powers, and Jurisdiction (Pecuniary and Territorial), Role of Supreme Court under the CPA with important case law.

UNIT III

(6 Hours)

Grievance Redressal Mechanism under the Indian Consumer Protection Law - Who can file a complaint? Grounds of filing a complaint; Limitation period; Procedure for filing and hearing of a complaint; Disposal of cases, Relief/Remedy available; Temporary Injunction, Enforcement of order, Appeal, frivolous and vexatious complaints; Offences and penalties.

Leading Cases decided under Consumer Protection law by Supreme Court/National Commission: Medical Negligence; Banking; Insurance; Housing & Real Estate; Electricity and Telecom Services; Education; Defective Products; Unfair Trade Practices.

UNIT IV

(6 Hours)

Role of Industry Regulators in Consumer Protection

- i. Banking: RBI and Banking Ombudsman
- ii. Insurance: IRDA and Insurance Ombudsman
- iii. Telecommunication: TRAI
- iv. Food Products: FSSAI
- v. Electricity Supply: Electricity Regulatory Commission
- vi. Real Estate Regulatory Authority

UNIT V

(6 Hours)

Contemporary Issues in Consumer Affairs - Consumer Movement in India: Evolution of Consumer Movement in India, Formation of consumer organizations and their role in consumer protection, Misleading Advertisements and sustainable consumption, National Consumer Helpline, Comparative Product testing, Sustainable consumption and energy ratings.

Quality and Standardization: Voluntary and Mandatory standards; Role of BIS, Indian Standards Mark (ISI), Ag-mark, Hallmarking, Licensing and Surveillance; Role of International Standards: ISO an Overvie

UBT 110

Note: Unit 2 and 3 refers to the Consumer Protection Act, 2086. Any change in law would be added appropriately after the new law is notified.

Teaching Methods:

- Smart Class rooms /Power Point Presentations / Seminars/Quiz /Discussion /Flipped Classrooms

SUGGESTED READINGS:

1. Khanna, Sri Ram, Savita Hanspal, Sheetal Kapoor, and H.K. Awasthi. (2007) Consumer Affairs, UniversitiesPress.
2. Choudhary, Ram Naresh Prasad (2005). Consumer Protection Law Provisions and Procedure, Deep and Deep Publications PvtLtd.
3. G. Ganesan and M. Sumathy. (2012). Globalisation and Consumerism: Issues and Challenges, RegalPublications
4. Suresh Misra and Sapna Chadah (2012). Consumer Protection in India: Issues and Concerns, IIPA, NewDelhi
5. Rajyalaxmi Rao (2012), Consumer is King, Universal Law Publishing Company
6. Girimaji, Pushpa (2002). Consumer Right for Everyone Penguin Books.
7. E-books :-www.consumereducation.in
8. Empowering Consumers e-book, www.consumeraffairs.nic.in
9. ebook,www.bis.org
10. The Consumer Protection Act, 1986 and its later versions.

UBT 111

Question paper pattern

Duration: 3 hrs

Max: 75 Marks

Section A (5 x 5=25)

Short notes

Either – or / type – question from each unit.

Section B (5 x 10=50)

Essay type

Either – or / type – question from each unit.

Programme code: 08	B. Sc. Biotechnology			
Title of the Paper: JOC1 – Clinical Research & Medical Coding				
Batch : 2026-2027	Hours / Week 2	Total Hours 30	Credits 2	Employability / Entrepreneurship

Course Objectives

1. To understand the concepts of human anatomy and physiology
2. To learn the various medical terminology of organs and treatment strategies for medical coding
3. To Interpret and understand healthcare documentation and billing
4. To understand diagnostic procedure codes using ICD coding systems

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↑ ↓ K4	CO1	Explaining anatomy and physiology concepts of organs with medical terminology.
	CO2	Understanding the different procedures involved in medical documentation
	CO3	Applying the standard coding resources for medical billing
	CO4	Understanding the pharmaceutical codes for identifying medications

Syllabus

UNIT I

(6 Hours)

Anatomy and Physiology I: Introduction to Integumentary System – thermoregulation, types, functions. Musculoskeletal System - Concepts, types, Structural and functional features. Cardiovascular System – Systemic circulation, Function and diseases.

UNIT II

(6 Hours)

Anatomy and Physiology II: Respiratory System – Physiology of respiration, Parts and functions. Gastrointestinal system- Basic Medical Science, Clinical assessment and investigation. Genitourinary System – Urinary tract structure and infection, Regulation of osmolality and infection

UNIT III (6 Hours)

Anatomy and Physiology III: Eye, Ear, Nose and throat - Anatomy and clinical correlates. Nervous System – Neurophysiology and function

UNIT IV (6 Hours)

Endocrine System – Introduction and hormonal functions. Exocrine system – Physiology and Biological importance. Lymphatic system – Anatomy, functions and disorders

UNIT V (6 Hours)

ICD: ICD 10 CM Overview, CPT Overview, HCPCS and Modifiers, Pharmaceutical codes for identifying medications, ***The Systematized Nomenclature of Medicine (SNOMED)**

**Denotes self-study*

Text Books

1. Zahoor ul Haq Bhat, 2018. Khel Sahithya Kendra Publisher, First Edition, Pages 137.
2. Medical Coding Training: Practical Application ICD 10CM CPC®- AAPC; AAPC publisher; 2022; ISBN-13:978-1-626880-925

References

1. Ross and Wilson, 2018. Anatomy and Physiology in Health and Illness, 13th Edition, Elsevier Health Science.
2. <http://www.icd10data.com/>

Web Sources Link

1. <https://www.ncbi.nlm.nih.gov/books/NBK553187>
2. <https://training.seer.cancer.gov/anatomy>
3. <https://www.cdc.gov/nchs/icd/icd-10-cm.htm>
4. <https://www.cms.gov/medicare/coding-billing/healthcare-common-procedure-system>
5. <https://www.aapc.com/resources/medical-coding-training>

MAPPING

CO \ PSO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	H	S	M
CO2	M	M	S	M	H
CO3	H	H	M	S	H
CO4	H	S	M	H	S

S – Strong

H – High

M – Medium

L – Low

Content prepared by (Based on Inputs)	
Signature of the Course in-charge (Dr. S. Bhargavi)	Signature of the HOD

Programme code: 08	B. Sc. Biotechnology			
Title of the Paper : JOC 2 – Agro industrial biotechnology				
Batch 2026-2029	Hours / Week 2	Total Hours 30	Credits 2	Employability / Entrepreneurship

Course Objectives

1. To provide knowledge on Indian agriculture, biomass, biofertilizer and biocontrol agents
2. To develop students technical skills on bio fertilizer and Biocontrol agents production
3. To encourage natural ways of crop disease management

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↑ K4 ↓	CO1	Defining and to impart training of ecofriendly agricultural inputs so as to nullify the ill effects of chemical fertilizers.
	CO2	Illustrating the production and use of biopesticides, bio-control agents etc as alternative inputs in organic farming
	CO3	Demonstrating the effectiveness of biofertilizer cultural practices in the farmers fields for enhanced crop productivity through bioreclamation of waste land
	CO4	Analyzing and promoting disease management in the country

Syllabus

UNIT I

(6 Hours)

History of Indian Agriculture, Green Revolution in India, Cropping patterns in India, Soil, Rainfall Patterns in India. Agroindustries.

UNIT II

(6 Hours)

Biofertilizers: Isolation, purification and characterization of *Rhizobium*, *Azospirillum*, *Blue green algae*, *Azolla* and *Frankia*. Screening for their activity and strain improvement, *Spirulina*, biogas, biodiesel, SCP, mushroom.

UNIT III

(6 Hours)

Biocontrol agents: Types: parasites, parasitoids, predators and entomopathogenic nematodes. and mass production strategies of Biocontrol agents, Field application methods.

UNIT IV

(6 Hours)

Biopesticides: Definition and significance, mass production and formulation of microbial control agents: Bt and NPV. Economics of production of biocontrol agents and biopesticides: cost of production, capital cost and pr

UNIT V**(6 Hours)**

Disease Management: Major crops and major diseases in India. Emerging diseases, Alternate approaches of disease management. Drought, Salinity, Cold tolerant crops in India and its economic importance. Post harvest and storage of grains. Economic importance. Post harvest and storage of grains.

Text book

1. Ahindra Nag, (2009). Textbook of Agricultural Biotechnology, PHI Learning Private Ltd., New Delhi,
2. Dubey, R.C., (1996). A Textbook of Biotechnology, S. Chand and Co. Ltd., New Delhi.

References

1. Subba Rao. N.S., (1982). Biofertilizers, In: Advances in Agricultural Science. Oxford and IBHPub. Co., New Delhi.
2. Tanuja S. (2008). Biofertilizer Technology. Agrobios (India).
3. Mahendra Rai. (2006). Handbook of Microbial Biofertilizers, CRC Press.

Web Sources Link

1. <https://agricoop.nic.in/en/divisiontype/natural-resource-management>
2. <https://www.icar.org.in/content/biofertilizers-and-organic-farming>
3. <https://www.fao.org/soil-partnership/resources/highlights/detail/en/c/1141130>
4. <https://www.cabi.org/cpc>
5. <https://www.fao.org/agriculture/crops/thematic-sitemap/theme/pests/en>

MAPPING

PS O CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	S	M	M
CO2	H	S	M	H	S
CO3	M	H	S	S	S
CO4	S	H	H	H	H

S – Strong

H – High

M – Medium

L – Low

Content prepared by (Based on Inputs)	
Signature of the Course in-charge (Dr. R. Sathish Kumar)	Signature of the HOD

ALL UG COURSES		
Title of the paper : HEALTH AND WELLNESS		
Batch 2026 – 2027	Semester IV	Credits 2

Skill Areas:

Physical Fitness, Nutrition, Mental Health, Awareness on Drug addiction and its effects

Purpose:

The Health & Wellness course focuses on teaching the elements of physical, mental, emotional, social, intellectual, environmental well-being which are essential for overall development of an individual. The course also addresses the dangers of substance abuse and online risks to promote emotional and mental health.

Learning Outcomes:

Upon completion of the Health & Wellness course, students will be able to:

1. Demonstrate proficiency in sports training and physical fitness practices.
2. Improve their mental and emotional well-being, fostering a positive outlook on health and life.
3. Develop competence and commitment as professionals in the field of health and wellness.
4. Awareness on drug addiction and its ill effects

Focus:

During the conduct of the Health & Wellness course, the students will benefit from the following focus areas:

1. Stress Management.
2. Breaking Bad Habits.
3. Improving Interpersonal Relationships.
4. Building Physical Strength & Inner Strength.

Role of the Facilitator:

The faculty plays a crucial role in effectively engaging with students and guiding them towards achieving learning outcomes. Faculty participation involves the following areas:

1. **Mentorship & Motivation:** The Facilitator mentors students in wellness and self-discipline while inspiring a positive outlook on health. Faculty teach stress management, fitness, and daily well-being.
2. **Promoting a Safe and Inclusive Environment:** The facilitator ensures a safe, inclusive, and respectful learning environment for active student participation and benefit.
3. **Individualised Support and Monitoring Progress:** The facilitator plays a crucial role in providing personalized support, monitoring and guidance to students.

Guided Activities:

In this course, several general guided activities have been suggested to facilitate the achievement of desired learning outcomes. They are as follows:

1. Introduction to Holistic Well-being.
2. Holistic Wellness Program- Nurturing Body and Mind
3. Breaking Bad Habits Workshop.
4. Improving the elements of physical, emotional, social, intellectual, environmental and mental well-being.
5. Creating situational awareness, digital awareness.
6. Understanding substance abuse, consequences and the way out.

Period Distribution

The following are the guided activities suggested for this Audit course.

The Physical Director should plan the activities by the students.

Arrange the suitable Mentor / Guide for the wellness activities.

Additional activities and programs can be planned for Health and Wellness.

S.No	Guided Activities	Period
1	Introduction to Holistic Well-being 1. Introduce the core components of Health & Well-being namely Physical, mental and emotional well-being 2. Provide worksheets on all the four components individually and explain the interconnectedness to give an overall understanding.	
2	Wellness Wheel Exercise (Overall Analysis)	

	• Guide students to assess their well-being in various life dimensions through exercises on various aspects of well – being, and explain the benefits of applying wellness wheel. • Introduce Tech Tools: • Explore the use of technology to support well-being. • Introduce students to apps for meditation, sleep tracking, or healthy recipe inspiration.	
3	Breaking Bad Habits (Overall Analysis) • Open a discussion on bad habits and their harmful effects. • Provide a worksheet to the students to identify their personal bad habits. • Discuss the trigger, cause, consequence and solution with examples. • Guide them to replace the bad habits with good ones through worksheets.	
4	Physical Well-being 1. Fitness Introduce the different types of fitness activities such as basic exercises, cardiovascular exercises, strength training exercises, flexibility exercises, so on and so forth. (Include theoretical explanations and outdoor activity). 2. Nutrition Facilitate students to reflect on their eating habits, their body type, and to test their knowledge on nutrition, its sources and the benefits. 3. Yoga & Meditation Discuss the benefits of Yoga and Meditation for one's overall health. Demonstrate different yoga postures and their benefits on the body through visuals (pictures or videos)	

	4. Brain Health Discuss the importance of brain health for daily life. Habits that affect brain health (irregular sleep, eating, screen time). Habits that help for healthy brains (reading, proper sleep, exercises). Benefits of breathing exercises and meditation for healthy lungs. 5. Healthy Lungs Discuss the importance of lung health for daily life. Habits that affect lung health (smoking, lack of exercises). Benefits of breathing exercises for healthy lungs. 6. Hygiene and Grooming Discuss the importance of hygienic habits for good oral, vision, hearing and skin health. Discuss the positive effects of grooming on one's confidence level and professional growth. <u>Suggested Activities (sample):</u> Nutrition: Invite a nutritionist to talk among the students on the importance of nutrition to the body or show similar videos shared by experts on social media. Organize a 'Stove less/fireless cooking competition' for students where they are expected to prepare a nutritious dish and explain the nutritive values in parallel.	
5	Emotional Well-being 1. Stress Management Trigger a conversation or provide self-reflective worksheets to identify the stress factors in daily life and their impact on students' performance. Introduce different relaxation techniques like deep breathing, progressive muscle relaxation, or guided imagery. (use audio recordings or visuals to guide them through these techniques). After practicing the techniques, have them reflect on how these methods can help manage stress in daily life. 2. Importance of saying 'NO'.	

	The power of small gestures. Understanding another's perspective. The fruits of compassion. 3. Practising Forgiveness Discuss the concept of forgiveness and its benefits. Forgiveness: What is it? and What it isn't? Benefits of forgiveness. Finding forgiveness practices. 4. Celebrating Differences Appreciate the value of individual differences and foster inclusivity. The World: A Tapestry of Differences (cultures, backgrounds, beliefs, abilities, and appearances). Finding strength in differences (diverse perspectives and experiences lead to better problem-solving and innovation). Celebrating differences, not ignoring them (respecting and appreciating the unique qualities). Activities for celebrating differences (share culture, learn about others, embrace new experiences). 5. Digital Detox Introduce the students to: The concept of a digital detox and its benefits for social well-being. How to disconnect from devices more often to strengthen real-world connections. <u>Suggested Activities (sample):</u> (Practicing Gratitude) Provide worksheets to choose the right ways to express gratitude. Celebrate 'gratitude day' in the college and encourage the students to honour the house keeping staff in some way to express gratitude for their service.	
7.	Intellectual Well-being 1. Being a lifelong Learner Give students an understanding on: The relevance of intellectual well-being in this 21st century to meet	

	the expectations in personal and professional well-being The Importance of enhancing problem-solving skills Cultivating habits to enhance the intellectual well-being (using the library extensively, participating in extra-curricular activities, reading newspaper etc.) 2. Digital Literacy Discuss: The key aspects of digital literacy and its importance in today's world. It is more than just liking and sharing on social media. The four major components of digital literacy (critical thinking, communication, problem-solving, digital citizenship). Why is digital literacy important? Boosting one's digital skills. 3. Transfer of Learning Connections between different subjects – How knowledge gained in one area can be applied to others. <u>Suggested Activities(sample):</u> Intellectual Well-being. Provide worksheets to students for teaching them how to boost intellectual well-being. Ask the students to identify a long-standing problem in their locality, and come up with a solution and present it in the classroom. Also organize an event like 'Idea Expo' to display the designs, ideas, and suggestions, to motivate the students to improve their intellectual well-being.	
8	Environmental Well-being 1.The Importance of initiating a change in the environment. The session could be around: Defining Environmental well-being (physical, chemical, biological, social, and psychosocial factors) – People's behaviour, crime, pollution, political activities, infra-structure, family situation etc. Suggesting different ways of initiating changes in the environment (taking responsibility, creating awareness, volunteering,	

	Indulging in writing poems, stories, music making/listening, creating visual arts to connect with inner selves. <u>Suggested Activities(Sample):</u> (Mindfulness and Meditation) – Conducting guided meditation every day for 10 minutes and directing the students to record the changes they observe.	
10	Situational Awareness (Developing Life skills) 1. Being street smart Discuss: Who are street smart? Why is it important to be street smart? Characteristics of a street smart person: Importance of acquiring life skills to become street smart – (General First-aid procedure, CPR Procedure, Handling emergency situations like fire, flood etc). 2. Digital Awareness Discuss: Cyber Security Information Literacy Digital Privacy Fraud Detection <u>Suggested Activities (sample):</u> (Street Smart) Inviting professionals to demonstrate the CPR Procedure Conducting a quiz on Emergency Numbers	
11	Understanding Addiction Plan this session around: Identifying the environmental cues, triggers that lead to picking up this habit. Knowing the impact of substance abuse – Adverse health conditions, social isolation, ruined future, hidden financial loss and damaging the family reputation. Seeking help to get out of this addiction. <u>Suggested Activities:</u>	

	Provide Worksheets to check the students' level of understanding about substance addiction and their impacts. Share case studies with students from real-life. Play/share awareness videos on addiction/de-addiction, experts talk. *Conduct awareness programmes on Drugs and its ill effects. (Arrange Experts from the concerned government departments and NGOs working in drug addiction issues) and maintain the documents of the program.	
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Closure:

Each student should submit a Handwritten Summary of their Learnings & Action Plan for the future.

Assessments:

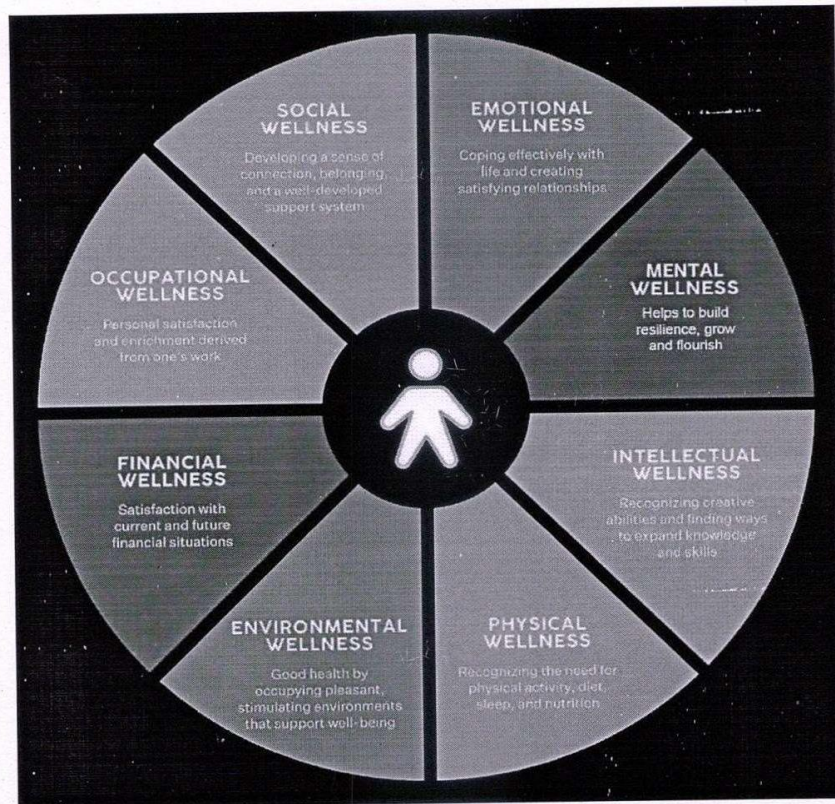
- Use Self-reflective worksheets to assess their understanding.
- Submit the worksheets to internal audit/external audit.
- Every student's activities report should be documented and the same have to be assessed by the Physical Director with the mentor. The evaluation should be for 100 marks. No examination is required.

Scheme of Evaluation

Part	Description	Marks
A	Report	40
B	Attendance	20
C	Activities (Observation During Practice)	40
Total		100

References/Resource Materials:

The course acknowledges that individual needs for references and resources may vary. However, here are some general reference materials and resources that may be helpful:

1. The Well-Being Wheel:

2. Facilities & Spaces: Some activities may require access to specific facilities, resources or spaces. Students may need to coordinate with the college administration to reserve these as required.

3. Online Resources:

1. United Nations Sustainable Development Goals - Goal 3 - Good Health & Well-Being: <https://www.un.org/sustainabledevelopment/health/>
2. Mindfulness and Meditation: Stanford Health Library offers mindfulness and meditation resources:
<https://healthlibrary.stanford.edu/books-resources/mindfulness-meditation.html>

3. Breaking Bad Habits: James Clear provides a guide on how to build good habits and break bad ones: <https://jamesclear.com/habits>
4. 6 Ways to Keep Your Brain Sharp
<https://www.lorman.com/blog/post/how-to-keep-your-brain-sharp>
5. What Is Social Wellbeing? 12+ Activities for Social Wellness
<https://positivepsychology.com/social-wellbeing/>
6. How Does Your Environment Affect Your Mental Health?
<https://www.verywellmind.com/how-your-environment-affects-your-mental-health-5093687>
7. How to say no to others (and why you shouldn't feel guilty)
<https://www.betterup.com/blog/how-to-say-no>

