

**RAJAH SERFOJI GOVT. COLLEGE, (AUTONOMOUS)**  
**THANJAVUR -613 005**  
**(Reaccredited with "A" Grade by NAAC)**



**AFFILIATED TO**  
**BHARATHIDASAN UNIVERSITY**  
**TRICHIRAPPALLI -24.**



**PG & RESEARCH DEPARTMENT OF BIOCHEMISTRY**  
**SYLLABUS -M.Sc BIOCHEMISTRY**  
**(For the students admitted from 2022-2023 onwards)**

## **CHOICE BASED CREDIT SYSTEM (CBCS) UNDERGRADUATE COURSES**

Rajah serfoji govt College (Autonomous), strives to maintain and uphold the academic excellence. Students experience or enjoy their choice of courses and credits for their horizontal mobility. The existing curricular structure as specified by TANSCHE and other higher educational institutions facilitate the credit-transfer across the disciplines, a uniqueness of the choice based credit system (CBCS).

In the CBCS weightage to a course is given in relation to the hours assigned for the course. The credits and hours of each course of a programme is given in the table of Programme Pattern. However, there could be some flexibility because of practical, field visits, tutorials and nature of project work.

For UG courses, a student must earn a minimum of 140 credits as mentioned in the programme pattern table. The total number of minimum courses offered by the Department is given in the Programme Structure.

### **Outcome-Based Education (OBE)**

Outcome -Based Education is an educational theory that bases each part of an educational system around goals. By the end of the educational experience, each student should have achieved the goal. There is no single specified style of teaching or assessment in OBE; instead, classes, opportunities and assessments should all help the students achieve the specific outcomes

Outcome Based Education, depends on Outcomes and not Inputs. The outcomes in OBE are expected to be measurable. The ultimate goal is to ensure that there is a correlation between education and employability.

OBE is a student-centric teaching and learning methodology in which the course delivery, assessment are planned to achieve, stated objectives and outcomes. It focuses on measuring student performance i.e. outcomes at different levels.

### **Some important aspects of the Outcome Based Education**

1. **Course:** is defined as a theory, practical or theory cum practical subject studied in a semester.
2. **Course Outcomes (COs):** are statements that describe significant and essential learning that learners have achieved, and can reliably demonstrate at the end of a course. Generally three or more course outcomes may be specified for each course based on its weightage.
3. **Programme:** is defined as the specialization or discipline of a Degree.
4. **Programme Outcomes (POs):** Programme outcomes are narrower statements that describe what students are expected to be able to do by the time of graduation. POs are expected to be aligned closely with Graduate Attributes.
5. **Programme Specific Outcomes (PSOs):** PSOs are what the students should be able to do at the time of graduation with reference to a specific discipline.
6. **Programme Educational Objectives (PEOs):** The PEOs of a programme are the statements that describe the expected achievement of graduates in their career, and also in particular, what the graduates are expected to perform and achieve during the first few years after Graduation.
7. **Core Courses (CC) :** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course. These are the courses which provide basic understanding of their main

- discipline. In order to maintain a requisite standard certain core courses must be included in an academic program. This helps in providing a universal recognition to the concerned academic program.
8. **Discipline Specific Elective Courses (DSE)** Elective course may be offered by the main discipline of study is referred to as Discipline Specific Elective (DSE). These courses offer the flexibility of selection of options from a pool of courses. These are considered specialized or advanced to that particular programme and provide extensive exposure in the area chosen.
9. **Generic Elective Courses:** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective. Generic Elective courses are designed for the students of other disciplines. Thus, as per the CBCS policy, the students pursuing particular disciplines would have to opt GenericElective courses offered by other disciplines, as per the basket of courses offered by the college. The scope of the Generic Elective (GE) Courses is positively related to the diversity of disciplines in which programmes are being offered by the college.
10. **Skill Enhancement Elective Courses (SECs):** These courses focus on developing skills or proficiencies in the student, and aim at providing hands-on training. These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge.
11. **Self-paced Learning Courses:** It is a course for two credits. It is offered to promote the habit of independent/self- learning of Students. Since it is a two credit course, syllabus is framed to complete within 45 hours.
12. **Field Study/Industrial Visit/Case Study:** It has to be completed during the fifth semester of the degree programme.
13. **Internship:** Students must complete internship during summer holidays after the fourth semester. They have to submit a report of internship training with the necessary documents and have to appear for a viva-voce examination during fifth semester.
14. **Extra Credit Online Courses:** In order to facilitate the students, gaining knowledge/skills by attending online courses MOOC, credits are awarded as extra credits, after verifying the course completion certificates. According to the guidelinesof UGC, the students are encouraged to avail this option of enriching their knowledge by enrolling themselves in the Massive Open Online Courses (MOOC) provided by various portals such as SWAYAM, NPTEL and etc.

#### **Programme Pattern:**

- The Under Graduate degree programme consists of **FIVE** vital components. They are as follows:
- Part -I : Tamil
  - Part-II : English
  - Part-III : Core Course (Theory, Practical, Discipline Specific Electives, Allied courses, Project, Internship, and field visit /industrial visit/Case Study)
  - Part-IV: Value Education, Ability Enhancement Courses, Skill Enhancement Courses/Soft Skills, Generic Electives, Self paced courses, etc.
  - Part-V: Outreach Programme NCC, NSS, YRC, RRC, BDC, CCC.

The Post Graduate degree programme consists of Part-III : Core Course only (Theory, Practicals, Discipline Specific Electives, Allied courses, Project Work, Self-paced courses, Internship, and field visit /industrial visit/Case Study)

#### **Course Coding:**

The following system is adopted for coding the various courses in the different Programmes. The Course Code for UG Course is set as follows:

**A (SEMESTER NUMBER) (PRG/COURSE IDENTIFIER) (NUMBER OF THE COURSE).**

The Code for PG Course is set as follows:

**A (SEMESTER NUMBER) P (PRG/COURSE IDENTIFIER) (NUMBER OF THE COURSE).**

Semester number ranges from 1 to 6 for UG and 1 to 4 for PG, programme identifier and course identifier are followed as found below:

<b>PROGRAMME IDENTIFIER</b>	
TL	B.Lit. Tamil Literature
EL	B.A. English
BC	B.Sc. Bio-Chemistry
BT	B.Sc. Bio-Technology
CH	B.Sc. Chemistry
CS	B.Sc. Computer Science
M	B.Sc. Mathematics
PH	B.Sc. Physics
ST	B.Sc. Statistics
Z	B.Sc. Zoology
BA	BBA Business Administration
CO	B.Com. Commerce
EC	B.A. Economics
PTL	M.A. Tamil Literature
PEL	M.A. English
PBC	M.Sc. Bio-Chemistry
PCH	M.Sc. Chemistry
PCS	M.Sc. Computer Science
PM	M.Sc. Mathematics
PH	M.Sc. Physics
PST	M.Sc. Statistics
PZ	M.Sc. Zoology
PEC	M.Sc. Economics
PCO	M.Com. Commerce
<b>COURSE IDENTIFIER</b>	
T	Tamil
E	English
CC	Core Course
SB	Skill Enhancement Elective Course
VE	Value Education

GS	Gender Studies
ES	Environmental Studies
SSD	Skill Enhancement Compulsory Course
PW	Project Work
EL	Discipline Specific Elective Course
ELO	Generic Elective
A	Allied Course

### Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

The Programme Outcomes (POs)/Programme Specific Outcomes (PSOs) are the qualities that must be imbibed in the graduates by the time of completion of their programme. At the end of each programme the PO/PSO assessment is done from the CO attainment of all curriculum components. The POs/PSOs are framed based on the guidelines of LOCF. There are five POs for UG programme and five POs for PG programs framed by the Heads of the concerned Programme collectively. PSOs are framed by the departments and they are five in number. For each Course, there are five Course Outcomes to be achieved at the end of the course. These Course outcomes are framed to achieve the POs/PSOs. All course outcomes shall have linkage to POs/PSOs in such a way that the strongest relation has the weight 3 and the weakest is 1. This relation is defined by using the following table.

Mapping	<40%	$\geq 40\%$ and < 70%	$\geq 70\%$
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

Mean Scores of COs = Sum of values / Total No. of POs& PSOs

Mean Overall Score = Sum of Mean Scores / Total No. of COs

Result for Mean Overall Score: If  $< 1.2$ , it is of low relationship

If  $\geq 1.2$  and  $< 2.2$ , it is of medium relationship

If  $\geq 2.2$ , it is of high relationship

If the relationship is found low, the course-in-charge has to redesign the Particular course content so as to achieve high level.

### Knowledge levels for assessment of Outcomes based on Blooms Taxonomy

S. No.	Level	Parameter	Description
1	K1	Knowledge/Remembering	It is the ability to remember the previously learned
2	K2	Comprehension/ Understanding	The learner explains ideas or concepts
3	K3	Application/Applying	The learner uses information in a new way
4	K4	Analysis/Analysing	The learner distinguishes among different parts
5	K5	Evaluation/Evaluating	The learner justifies a stand or decision
6	K6	Synthesis /Creating	The learner creates a new product or point of view

### Continuous Internal Assessment:

The performance of a student in each course is evaluated in terms of percentage of marks with a provision for conversion to grade points. Evaluation for each course shall be done by a continuous internal assessment by the course teacher concerned as well as by an end semester examination and will be consolidated at the end of the course.

### The Components for Continuous Internal Assessment for UG /PG Programme:

Internal Tests (Minimum Two Tests, first one for Two units (2 hours-to be converted to 4 marks) and the second for all the five units (3 hours-to be converted to 6 marks)	10 Marks
Assignment Activity* (Minimum Two Assignment Components, as appropriate to the Course Objective)	5 Marks
Seminar/ other Activity * (Minimum Two Seminar/other Components, as appropriate to the Course Objective)	5 Marks
Attendance	5 Marks

\*Assignment Activity includes

1. Problem-solving assignments;
2. Practical assignment
3. Laboratory reports;
4. Observation of practical skills;
5. Individual project reports
6. Team project reports;
7. Paragraph/essay writing,
8. Writing composition,
9. Field visit Report,
10. Publication in peer-reviewed journals

\*\*Seminar/ other Activity includes

1. Oral seminar presentations,
2. Viva-voce interviews;
3. Listening comprehension,
4. Reading comprehension,
5. Open-book tests;
6. Group discussion,
7. Library referencing,
8. Paper Presentations
9. Computerized online test;
10. Quiz (descriptive / objective),

**Question paper pattern and Distribution of marks for Mid the Semester Test:**

From academic year 2022-23 onwards, unless otherwise specifically mentioned by the Board of studies differently, Mid-Semester Tests for Part-I, Part-II, and Part-III Courses of UG, PG, and M.Phil. Programs is followed under:

Part-A	$5 \times 2$	= 10 Marks
Part-B	$4 \times 5$ (Open choice- 3 out of 5 Questions)	= 20 Marks
Part-C	$2 \times 10$ (Open choice- 3 out of 5 Questions)	= 20 Marks
TOTAL		

For Part-IV Courses, (Except self-study Extra Credit Course), from 2022-23 onwards, the Question paper pattern followed as under:

Part-A	$4 \times 5$	= 20 Marks
Part-B	$3 \times 10$ (Open choice- 3 out of 5 Questions)	= 30 Marks
TOTAL		

**Question paper pattern and Distribution of marks for Model Test and Semester:**

From academic year 2022-23 onwards, unless otherwise specifically mentioned by the Board of studies differently, Model Tests and Semester Examinations for Part-I, Part-II, and Part-III Courses of UG, PG, and M.Phil. Programs.

Part-A	$10 \times 2$ (Two questions from each unit)	= 20 Marks
Part-B	$5 \times 5$ (Internal Choice- Either or Type Questions)	= 25 Marks
Part-C	$3 \times 10$ (Open choice- 3 out of 5 Questions)	= 30 Marks
TOTAL		

For Lab Experiment papers - 100 Marks (CIA-40 Marks Evaluation -60 Marks)

For Part-IV Courses, (Except self-study Extra Credit Course), from 2022-23 onwards, the Question paper pattern followed as under:

Part-A	$5 \times 6$ (Two questions from each unit, Internal Choice- Either or Type Questions) = 30 Marks	
Part-B	$3 \times 15$ (Open choice- 3 out of 5 Questions)	= 45 Marks
TOTAL		

For Part-IV Extra Credit self-study Courses, there are no CIA Components, and the semester examination paper will be for 100 Marks. Depending on the nature of the Course it may have any of the following question paper patterns:

1. Pattern-1: Essay Type alone with 5 Questions one from each unit with internal choice ( $5 \times 20 = 100$  marks)
2. Pattern-2: Descriptive pattern

Part-A	(5 Questions out of 8)	$5 \times 8 = 40$ Marks
Part-B	(5 Questions out of 8)	$5 \times 12 = 60$ Marks
Total		=100 Marks (or)

3. Pattern-3: Multiple Choice with objective type  $100 \times 1 = 100$  Marks (or)

4. Pattern-4: Lab Oriented Courses Lab Experiment -100 Marks (Record-20 Marks + Evaluation -80 Marks).

### Passing Minimum

- In UG courses, the passing minimum for CIA & Semester Examination shall be 40%. For all theory courses all the programs ratio between CIA and End Semester Examination will be 25:75 and 40:60 for all Practical Courses.
- In PG and M.Phil Programmes also, the passing minimum for CIA & Semester Examination shall be 50%. Passing minimum for PG / M.Phil. Project work also will be 50% -each for evaluation and Viva-Voce.

### Passing Minimum for the UG/PG/M.Phil. Programmes

Nature of the Course	CIA	ESE	Aggregate
<b>FOR UG PROGRAMMES</b>			
Theory	40% of 25 Marks (i.e., 10 Marks)	40% of 75 Marks (i.e., 30 Marks)	40% of 100 Marks (i.e., 40 Marks)
Practical	40% of 40 Marks (i.e., 16 Marks)	40% of 60 Marks (i.e., 24 Marks)	40% of 100 Marks (i.e., 40 Marks)
<b>FOR PG/ M.PHIL. PROGRAMMES</b>			
Theory	50% of 25 Marks (i.e., 12 Marks)	50% of 75 Marks (i.e., 38 Marks)	50% of 100 Marks (i.e., 50 Marks)
Practical	50% of 40 Marks (i.e., 20 Marks)	50% of 60 Marks (i.e., 30 Marks)	50% of 100 Marks (i.e., 50 Marks)

### WEIGHTAGE of K \*- LEVELS IN QUESTION PAPER

(Cognitive Level) K- LEVELS →	Lower Order Thinking			Higher Order Thinking			Total %
	K1	K2	K3	K4	K5	K6	
Proportion of Marks in %	27	33		40			100

### BLUE PRINT OF QUESTION PAPER FOR SEMESTER EXAMINATION

DURATION: 3.00 Hours.

Max Mark : 75

- LEVELS SECTIONS	K1	K2	K3	K4	K5	K6	Total Mark
SECTION-A (One Mark, No choice)( $10 \times 2 = 20$ )	10Q						20

<b>SECTION- B (5- Marks) (Either/or type) (5x5=25)</b>		5Q	5Q				<b>25</b>
<b>SECTION-D (10 Marks) (3 out of 5)(3x10=30)</b>				10Q			
Courses having only K4 levels							
Courses having K4 and K5 levels				6Q	4Q		<b>30</b>
<b>One K5 level question is compulsory</b>							
Courses having all the 6 cognitive levels							
<b>The K5 and K6 level questions can be compulsory</b>				5Q	3Q	2Q	
	<b>Total</b>						<b>75</b>

**Grading System:** The total marks will be calculated by adding both CIA and end-semester examinations for each courses. The total marks thus obtained will then be graded. From the second semester onwards the performance within a semester and the continuous performance starting from the first semester are indicated Semester Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA), respectively. These two are calculated by the following formulae:

$$\text{Grade Point Average (GPA)} = \frac{\sum_{i=1}^n C_i G_i}{\sum_{i=1}^n C_i}$$

$$\text{WAM (Weighted) Average Marks} = \frac{\sum_{i=1}^n C_i M_i}{\sum_{i=1}^n C_i}$$

where

$C_i$  is the Credit earned for the Course i;

$G_i$  is the Grade Point obtained by the student for the Course i.

$M$  is the Marks obtained for the course i and

n is the number of Courses passed in that semester.

CGPA is Average GPA of all the Courses starting from the first semester to the current semester.

The GPA and the CGPA shall be calculated separately for the following three parts : Part I : LCs ; Part II : ELCs ; and Part III : CCs, DSECs, and Allied.

When a student completes his / her UG/ PG programmes after the fixed duration of the course, the maximum will be only First Class with the respective grade. They cannot be considered for award of Distinction or standing categories. Once the marks of the CIA and semester examinations for each course are available, they will be added. The marks thus obtained will then be graded. From the second semester onwards the total performance within a semester and continuous performance starting from the first semester are indicated Semester Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA).

### Classification of Final Results

For each of the three parts, there shall be separate classification on the basis of the CGPA. For the purpose of awarding a candidate to have qualified for the Degree of Bachelor Arts/Science/Commerce/Management/Literature as Outstanding/ Excellent/ Very Good/ Good/ Above Average, the marks and the corresponding CGPA earned by the candidate in Part III alone will be the criterion provided he / she has secured the prescribed passing minimum in the LCs and the ELCs.

Grade in Part IV and Part V shall be shown separately and it shall not be taken into account for classification.

#### Grading of the Courses (UG)

Marks Range	Grade Point	Corresponding Grade
90 and above	10	O
80 and above but below 90	9	A+
70 and above but below 80	8	A
60 and above but below	7	B+
50 and above but below	6	B
40 and above but below	5	C
Below 40	N.A.	R.A.

#### Final Result (UG)

CGPA	Corresponding Grade	Classification of Final Results
9.00 and above	O	Outstanding
8.00 to 8.99	A+	Excellent
7.00 to 7.99	A	Very Good
6.00 to 6.99	B+	Good
5.00 to 5.99	B	Above Average
4.00 to 4.99	C	Average
Below 4.00	R.A.	Re-Appearance

#### Grading of the Courses (PG)

Marks Range	Grade Point	Corresponding Grade
90 and above	10	O
80 and above but below 90	9	A+
70 and above but below 80	8	A
60 and above but below	7	B+
50 and above but below	6	B
Below 50	N.A.	R.A.

#### Final Result (PG)

CGPA	Corresponding Grade	Classification of Final Results
9.00 and above	O	Outstanding
8.00 to 8.99	A+	Excellent
7.00 to 7.99	A	Very Good
6.00 to 6.99	B+	Good
5.00 to 5.99	B	Above Average
Below 5.00	R.A.	Re- Appearance

### Credit structure for Under Graduate Programmes

The following is the credit structure for B.Sc. ( Except Mathematics w.e.f. 2022-23

Part	Course	No.of Papers	Credit	Total Credit
Part I	TAMIL	4	3	12
Part II	ENGLISH	4	3	12
Part III	CORE	8	4	32
		4	5	20
		2	6	12
	ELECTIVE	2	4	8
	ALLIED	6	4	24
Part IV	NON-MAJOR ELECTIVE	2	2	4
	EXTRA CREDIT COURSE	2	4	(8)
	ES,VE	2	2	4
	SKILL BASED	3	2	6
	SSD	1	2	2
	GS	1	2	2
	EXTRA ACTIVITIES	1	2	2
<b>TOTAL</b>		<b>39</b>		<b>140</b>

\* Not Considered for CGPA

### Credit structure Post Graduate Programmes:

The following is the credit structure for M.A, M.Sc, and M.Com programmes with effect from 2022-23

Nature of Courses	No of papers	Credit
Core courses	14	56
Elective courses	5	20
NME/Supportive/Generic Elective/Open Elective/EDEC	2	4
Soft Skills	2	4
Project	1	4
Internship	-	2
*Extra Credit Course	2*	4*
<b>Total</b>	<b>24</b>	<b>90</b>

## **DEPARTMENT OF BIOCHEMISTRY**

### **VISION**

Forming globally competent, committed, compassionate and holistic persons promoting a just society.

### **MISSION**

1. Fostering learning environment to students of diverse background, developing their inherent skills and competencies through reflection, creation of knowledge and service.
2. Cultivating comprehensive learning and best practices through innovative and value driven pedagogy.
3. Contributing significantly to Higher Education through Teaching, Learning, and Research and Extension activities.

### **PROGRAMME EDUCATIONAL OBJECTIVES (PEO)**

1. Graduates will be able to accomplish professional standards in the global environment.
2. Graduates will be able to uphold integrity and human values.
3. Graduates will be able to appreciate and promote pluralism and multiculturalism in working environment.

### **PROGRAMME OUTCOMES (POs)-PG**

Upon completion of the UG Degree Programme, students will be able to

- PO1 - Biochemistry master's students will be able to demonstrate an understanding of fundamental biochemical principles, metabolic pathways and the regulation of biochemical processes.
- PO2 - They will gain proficiency in basic laboratory techniques in biochemistry and be able to apply scientific method to processes of experimentation
- PO3 - Students will gain an ability to design and carry out experiments and to interpret experimental data.
- PO4 - Students will be able to develop in-depth understanding of the area of biochemistry to choose for the research purpose
- PO5 - They will demonstrate excellent critical thinking and problem solving abilities.
- PO6 - They will develop an ability to present their work through written, oral and visual presentations.
- PO7 - Students will learn construction of project thesis and able to defend their project result to other students and faculty.
- PO8 - They will gain the hands on knowledge of various techniques useful in biochemistry which can help them to stand with a skilful job at various industries and research labs
- PO9 - Students get ready to apply informatics and statistics to explore biological data for experimental and research purpose.
- PO10 - They acquire communication skill, team work strength and leadership qualities through

### **PROGRAMME SPECIFIC OUTCOMES (PSO)- M.Sc BIOCHEMISTRY**

On completion of the Programme, the M. Sc BIOCHEMISTRY Under Graduates will be able to;

- PSO-1 - The student will be able to understand characterisation biomolecules in research.
- PSO-2 - Students will understand the concept of spectrophotometer, relevant terms of visible spectroscopy and outline of uv spectroscopy device.
- PSO-3 - Students will learn basics of enzymology and will be familiar with important terms of enzymology.
- PSO-4 - Students will learn different types of fermentation process, strain improvement methods and isolation of industrial important microorganisms.
- PSO-5 - They will be able to describe the mechanisms of protein transport to various cellular sites and process of protein degradation.
- PSO-6 - Learn to work as a team as well as independently to retrieve information, carry out Research investigations and result interpretations.
- PSO-7 - Develop the ability to understand and practice the ethics surrounding scientific Research.
- PSO-8 - Realize the impact of science in society and plan to pursue research.



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**Thanjavur – 613 005, TAMIL NADU, INDIA.**

**BOARD OF STUDIES IN BIOCHEMISTRY**  
**MINUTES OF THE MEETING HELD ON 18<sup>th</sup> August 2022**

The meeting of the Board of Studies in Commerce, for the Academic Year 2022-23, was held on 18<sup>th</sup> August 2022 at 11.30 am at Department of Biochemistry, Rajah Serfoji Government College, Thanjavur-5.

The following members attended the meeting:

<b>1</b>	<b>Dr. A. SUBRAMANIAN</b>	Chairperson	Assistant Professor, Department of Biochemistry
<b>2</b>	<b>Dr. M. JEYARAJ</b>	Subject Expert & University Nominee	Asst Professor and Head, Govt Arts College Kumbakonam -01.
<b>3.</b>	<b>Dr. S MANOHARAN</b>	Subject Expert Academic Council Nominee	Professor, Dept of Biochemistry and Biotechnology, Annamalai University, Annamalai Nagar, Chidambaram
<b>4</b>	<b>Dr. S. VELAVAN</b>	Industrialist	Harman Research Institute, Thanjavur
<b>5</b>	<b>Dr.V. MURALI KRISHNAN</b>	Faculty Member	Assistant Professor, Dept of Biochemistry
<b>6.</b>	<b>Dr.L.MALARVANNAN</b>	Faculty Member	Assistant Professor, Dept of Biochemistry
<b>7.</b>	<b>Mrs.G.UMARANI</b>	Faculty Member	Assistant Professor, Dept of Biochemistry
<b>8.</b>	<b>Dr.S.MAHALAKSHMI</b>	Faculty Member	Assistant Professor, Dept of Biochemistry

**Dr. A. SUBRAMANIAN**, Chairperson, BoS and Assistant Professor, Department of Biochemistry, Rajah Serfoji Government College, and Board members passed the following resolutions.

- 1) Discussions for the new additions in the existing curriculum for B.Sc and M.Sc Biochemistry were made in the context of local needs and recent developments.
- 2) It is resolved to introduce Extra Departmental Elective Course for msc students from Chemistry Department on the Papers "Chemistry in "Every day life" and "Food and Adulterants" for first and second semesters Respectively for MSc Biochemistry Students.
- 3). It is decided to offer a paper Health Science and Nutrition for first semester and Bioanalytical Chemistry for second semester for MSc-Chemistry Students.

The meeting ended with vote of thanks, particularly to the External Members of the Board, recollecting their valuable inputs in their tenure.

**CHAIRMAN:**

**1. Dr. A SUBRAMANIAN**

Assistant Professor, Department of Biochemistry

*A. Subramanian* 18/8/2022

**MEMBERS OF THE BOARD:**

**2. Dr. M. JEYARAJ**

Subject Expert & University Nominee,  
Asst Professor and Head, Govt Arts College  
Kumbakonam -01.

*C. O. Jeyaraj* 18.8.2022

**3. Dr. S. MANOHARAN**

Subject Expert  
Professor, Dept of Biochemistry and Biotechnology,  
Annamalai University, Annamalai Nagar, Chidambaram

*S. Manoharan* 18.8.2022

**4. Dr. S. VELAVAN**

Industrialist  
Harman Research Institute, Thanjavur.

*S. Velavan* 18.8.22

**5. Dr. V. MURALI KRISHNAN**

Assistant Professor, Dept. of Biochemistry

*V. Murali Krishnan* 18.8.22

**6. Dr. L. MALARVANNAN**

Assistant Professor, Dept. of Biochemistry

*L. Malarvannan* 18.8.2022

**7. Mrs. G. UMARANI**

Assistant Professor, Dept. of Biochemistry

*G. Umarani* 18.8.22

**8. Dr. S. MAHALAKSHMI**

Assistant Professor, Dept. of Biochemistry

*S. Mahalakshmi* 18/08/22

*J. J. Subramanian*

**RAJAH SERFOJI GOVT.COLLEGE (A), THANAJVUR – 05**

**SUBJECT – M.Sc BIOCHEMISTRY**

(Applicable to the students admitted from the academic year 2022-2023 onwards)

Semester	Part	Course	Code	Title	Hours/ week	C credits	Exam hrs	M marks	Total
<b>I SEMESTER</b>									
III	CC1	A1PBC1	Chemistry of Biomolecules	6	4	3	25	75	100
III	CC2	A1PBC2	Analytical Biochemistry	6	4	3	25	75	100
III	CC3	A1PBC3	Cell biology and Physiology	6	4	3	25	75	100
III	CC4	A1PBC4P	Major Practical – I	5	4	6	40	60	100
III	EC1	A1PBCEL1A	Environmental Biology	5	3	3	2 5	75	100
			Ecology						
			Developmental Biology						
EDEC	A1PCHG1E <sub>1</sub>		Chemistry in Every Day Life	2	2	3	25	75	100
			TOTAL	30	21				600
<b>II SEMESTER</b>									
III	CC5	A2PBC5	Metabolism and Regulation	6	4	3	25	75	100
III	CC6	A2PBC6	Enzymes and Enzyme technology	6	4	3	25	75	100
III	CC7	A2PBC7	Microbiology	6	4	3	25	75	100
III	CC8	A2PBC8P	Major Practical – II	5	4	6	40	60	100
III	EC2	A2PBCEL2A	Endocrinology	5	4	3	2 5	75	100
			Herbal medicine						
			First aid and Management						
IV	EDEC	A2PCHG2E <sub>2</sub>	Food and Additives	2	2	3	25	75	100
			TOTAL	30	23				600

III				III SEMESTER				IA	AE
	III	CC9	A3PBC9	Immunology	6	4	3	25	75 100
	III	CC10	A3PBC10	Clinical Biochemistry	5	4	3	25	75 100
	III	CC11	A3PBC11	Molecular Biology	5	4	3	25	75 100
		CC 12	A3PBC12P	Major Practical – III	5	4	6	40	60 100
		EC3	A3PBCEL3A	Genetic engineering	5	3	3	25	75 100
			A3PBCEL3B	Dairy Microbiology					
			A3PBCEL3C	Intellectual property rights and patenting					
				TOTAL	30	25			700
IV				IV SEMESTER				IA	AE
		CC 13	A4PBC13	Advanced Pharmaceutical Chemistry	6	4	3	25	75 100
		CC 14	A4PBC14P	Major Practical – IV	6	4	3	40	60 100
		CC 15	A4PBCPW	Project Work	4	3	-	20	80 100
		EC4	A4PBCEL4A	Biotechnology	5	3	3	25	75 100
			A4PBCEL4B	Marine Microbiology					
			A4PBCEL4C	Industrial Pollution and safety control					
		EC5	A4PBCEL5A	Biostatistics and Research Methodology	5	3	3	25	75 100
			A4PBCEL5B	Nanotechnology					
			A4PBCEL5C	Environmental Biotechnology					
				TOTAL	30	21			700
				GRAND TOTAL		90			2600

கலை பொறியியல்  
பல்கலைக் கழக  
நடவடிக்கை விதம் (பதினாற்)

No. of papers	Credit
Core courses	15
Elective courses	5
*Extra Credit Course	2
Total	20
	90

\* Not Considered for CGPA

Separate Passing Minimum is prescribed for Internal and External

- a) The Passsing minimum for CIA shall be 40%
- b)The Passing minimum for Autonomous Examinations shall be 40%
- c) The Passing minimum not less than 50% in the aggregate

*பார்வை*

*[Signature]*  
 உதவுப்பிள்ளை  
 உயிர் வெளியீட்டு நிலை  
 தொழில் மற்றும் கலை அரசு கல்லூரி (கோட்டை)  
 திருச்சிராப்பள்ளி 613005.

CONTROLLER OF EXAMINATIONS  
 RAJAH SERFOU GOVERNMENT COLLEGE (AUTONOMOUS)  
 THANJAVUR - 613 005.

Credits	4	Hrs/week	6	Sub Code	A1PBC1	Semester	I	Medium of Instruction	English
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## SEMESTER - I- CORE COURSE -1

**(For the students admitted from 2022-2023 onwards)**

### CHEMISTRY OF BIOMOLECULES

#### **COURSE OBJECTIVES**

To understand the major biomolecules and its properties and its functions.

To learn types of DNA and RNA.

To explore the basic concepts of vitamin, minerals and antioxidants

**Unit I- Carbohydrates-** Definition, structure and biological functions, - mono, oligosaccharides. Homopolysaccharide-chitin, fructans, mannans, xylans, and galactans. Heteropolysaccharides. Structure and biological importance of sugar derivatives- glycosaminoglycans, proteoglycans. Glycoprotein – Blood group and bacterial cell wall polysaccharides, O- linked and N- linked oligosaccharides.

**Unit II-Proteins-Proteins-** Peptide bond ,general properties, denaturation and renaturation. Orders of protein structure – Primary structure – Ramachandran plot, Secondary structure– the  $\alpha$ -helix,  $\beta$ - pleated sheet. Collagen triple helix, Super secondary structure– helix– loop helix, the hairpin  $\beta$  -motif and the  $\beta$ - $\alpha$ - $\beta$ -motif. Forces stabilizing tertiary and quaternary structure. Structure of haemoglobin. Tertiary Structure of myoglobin.

**Unit III- Lipids-Lipids-** general properties, Types of Fatty acids-Essential, Non essential. Structure and biological functions of phospholipids, sphingolipids, glycolipids. Steroids–functions of cholesterol, bile acids, sex hormones, ergosterol. Structure and biological role of prostaglandins, thromboxanes and leukotrienes. Lipoproteins- classification, composition and Functions.

**Unit IV- Nucleic acids-Structure** of purines, pyrimidines, nucleosides and nucleotides. DNA double helical structure. A, B and Z forms of DNA. Triple and quadruple structures. DNA supercoiling and linking number. Properties of DNA: buoyant density, viscosity, hypochromicity, denaturation and renaturation– the cot curve. RNA– types and biological role. Secondary, tertiary structures of RNA.

**Unit V- Minerals, Vitamins and antioxidants**-Minerals in Biological systems and its importance –Iron, calcium, Phosphorous, Iodine, Copper, Zinc. Fat and water soluble Vitamins – Sources, function and

deficiency diseases. Antioxidants-enzymic and nonenzymic antioxidants. Alkaloids and flavanoids- types and their biological importance.

### COURSE OUTCOMES

At the end of the course, the students will be able to		Cognitive level
CO 1	Understand the classification and importance of various carbohydrates. Apply the protein and its structure	Un
CO 2	Learn the important class of lipids and its biological functions Remember the basic structure and functions of nucleic acids	Ap
CO3	Apply the biological functions of minerals and vitamins	Le
CO4		Re
CO5		Ap

(Un- Understand, Ap – Apply, Le- Learn, Re – Remember)

### Text books and Reference books

1. Biochemistry Zubay 4th edition 1998 William C.Brown Publication.
2. Harper's Biochemistry 25th edition McGraw Hill.
3. Biochemistry Stryer 4th edition Freeman.
4. Principles of Biochemistry. Lehninger Nelson Cox Macmillan worth, Publishers, 2000.
5. Biochemistry. Davidson and Sittmann, NMS 4th ed. Lippincott Williams and Wilkins, 1999

Question paper pattern

Max Marks: 75

Exam duration : 3 hours

Part A  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

Part B  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

Part C  $3 \times 10 = 30$  Answer any Three questions (one question from each unit )

Signature of HOD

Credits	4	Hrs/week	6	Sub Code	A1PBC2	Semester	I	Medium of Instruction	English
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## SEMESTER – I- CORE COURSE 2

**(For the students admitted from 2022-2023 onwards)**

### ANALYTICAL BIOCHEMISTRY

#### **COURSE OBJECTIVES**

- To know about the instruments used in biochemistry lab with its applications
- To study types of centrifugation and its applications.
- To demonstrate different types of chromatography with its applications

**Unit I-Ultracentrifuges-** Analytical ultracentrifuge- instrumentation and applications. Preparative ultracentrifuge- types, instrumentation and applications of preparative rotors. Analysis of subcellular fractions and determination of relative molecular mass- sedimentation velocity and sedimentation equilibrium.

Units of radioactivity. Detection and measurement of radioactivity- solid and liquid scintillation counting, Autoradiography. Applications of radioisotopes in biology. Radiation hazards and safety measures.

**Unit II –** Principle, instrumentation and applications of thin layer, gas chromatography, Ion-exchange chromatography, Column chromatography-packing, loading, eluting and detection., Chromatofocusing. Molecular exclusion chromatography-principle, gel preparation, operation and applications. Affinity chromatography- principle, materials, procedure and applications. HPLC- principle, materials, instrumentation and applications.

**Unit III-** Laws of absorption and absorption spectrum. Principle, instrumentation and applications of UV-Visible spectrophotometry, IR, Mass spectrometry, NMR, ESR and spectrofluorimetry. Atomic spectroscopy – principle, method and applications. Plasma emission spectroscopy.

**Unit IV -Electrophoresis:** General principles. Support media. Electrophoresis of proteins- SDS-PAGE, native gels, gradient gels, isoelectric focusing, 2-D PAGE. Detection, estimation and recovery of proteins in gels. Electrophoresis of nucleic acids- agarose gel electrophoresis, pulsed field gel electrophoresis. Capillary electrophoresis and its applications.

**Unit V – PCR– basic principle, RT-PCR, quantitative PCR and in situ PCR. Diagnostic and laboratory applications of PCR. Comet assay. Mutagenicity testing– Ames test. DNA finger printing, DNA foot printing. Membrane blotting and hybridization of nucleic acids- Southern, Western, Northern blot and fluorescent insitu hybridization.**

### COURSE OUTCOMES

At the end of the course, the students will be able to		Cognitive level
CO 1	Understand the types of centrifugation with its uses. Apply the different types of centrifugation	Un
CO 2	Learn and apply NMR and IR spectroscopy Remember the basic concepts of electrophoresis	Ap
CO3	Analyse the samples by using PCR and testing mutagenicity	Le
CO4		Re
CO5		An

(Un- Understand, Ap – Apply, Le- Learn, Re – Remember)

### Text Books & Reference books

1. Wilson and Walker. A biologists guide to principles and techniques of Practical biochemistry. 5th ed. Cambridge University Press 2000.
2. Boyer, R. Modern Experimental Biochemistry. 3rd ed. Addison Welslery , Longman, 2000.
3. Upadhyay, Upadhyay and Nath. Biophysical Chemistry Principles and Techniques. Himalaya Publ. 1997

Question paper pattern

Max Marks: 75

Exam duration : 3 hours

Part A  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

Part B  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

Part C  $3 \times 10 = 30$  Answer any Three questions (one question from each unit )

Signature of HOD

Credits	4	Hrs/week	6	Sub Code	A1PBC3	Semester	I	Medium of Instruction	English
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### **SEMESTER – I- CORE COURSE 3**

**(For the students admitted from 2022-2023 onwards)**

### **CELL BIOLOGY AND PHYSIOLOGY**

#### **COURSE OBJECTIVES**

To learn the cell biology and membrane structure , functions.

To understand membrane assembly and membrane transport

To gain knowledge of composition and functions of CSF

**Unit I** –Major classes of cell junctions – anchoring, tight and gap junctions. Major families of cell adhesion molecules (CAMs) – the cadherins (classical and desmosomal). The integrins, connexins. The extracellular matrix of epithelial and nonepithelial tissues. ECM components – collagen, elastin, fibrillin, fibronectin, laminin and proteoglycans.

**Unit II-** Membrane assembly – importins and exportins. Membrane transport. Diffusion (passive and facilitated) active transport (symport, antiport,  $\text{Na}^+ \text{ K}^+$  ATPase), ion gradients, ion selective channels, group translocations, porins, endocytosis and exocytosis. Programmed cell death – Brief outline of apoptosis. Differences between apoptosis and necrosis.

**Unit III-** Composition and functions of blood. Separation of plasma and serum. Plasma proteins in health and disease. Red blood cells – formation and destruction. The RBC membrane – principle proteins (spectrin, ankyrin, glycophorins). Anaemias. Composition and functions of WBCs. Types of Blood groups . Blood coagulation – mechanism and regulation. Fibrinolysis. Anticoagulants.

**Unit IV** –Lymph – composition and functions. CSF – Composition and Clinical significance. Formation of urine – structure of nephron, glomerular filtration, tubular reabsorption of glucose, water and electrolytes. Countercurrent multiplication, tubular secretion. Composition, functions and regulation of saliva, gastric, pancreatic, intestinal and bile secretions.

**Unit- V -** Structure of neuron. Propagation of action potential: structure of voltage – gated ion channels. Neurotransmitters- examples and functions, release and cycling of neurotransmitters. The neuromuscular

junction – activation of gated ion channels. The acetylcholine receptor. Structure of skeletal muscle. Muscle proteins – myosin, actin, troponin and tropomyosin. Source of energy for muscle contraction.

## COURSE OUTCOMES

At the end of the course, the students will be able to		Cognitive level
CO 1	Understand the gap junctions and integrins Study the membrane assembly and membrane transport	Un
CO 2	Learn the composition and functions of blood including membrane proteins	Ap
CO3	Understand the composition and functions of CSF	Le
CO4	Apply the concepts of neuromuscular junctions and ion channels	Un
CO5		Ap

(Un- Understand, Ap – Apply, Le- Learn, )

### Text books and Reference Books :

1. Lodish et.al. Molecular Cell Biology 5th ed. 2003, WH Freeman (for unit 1,2,5).
2. Murray et al. Harper's Biochemistry 26th ed. McGraw Hill 2003
3. Smith et al. Principles of Biochemistry. Mammalian Biochemistry. McGraw, Hill 7th ed.

Question paper pattern

Max Marks: 75

Exam duration : 3 hours

Part A  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

Part B  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

Part C  $3 \times 10 = 30$  Answer any Three questions (one question from each unit )

Signature of HOD

CONTROLLER OF EXAMINATIONS  
RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)  
THANJAVUR - 613 005.

உதவு போகுமிக்க  
உயிர் வெறுமியல் துறை  
மாண்புமரபு அரசு கல்லூரி (ஒன்றாட்சி)  
தாங்காநுர் 013005.

Credits	4	Hrs/week	5	Sub Code	A1PBC4P1	Semester	I	Medium of Instruction	English
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## SEMESTER – I- CORE COURSE 4

**(For the students admitted from 2022-2023 onwards)**

### **MAJOR PRACTICALS-I**

#### **COURSE OBJECTIVES**

To estimate vitamins and starch, glycogen

To analyse and estimate the isolation of starch and glycogen

To demonstrate the separation of compounds by Chromatography

#### **Estimation**

1. Isolation and estimation of starch from potato.
2. Isolation and estimation of glycogen from liver.
3. Estimation of ascorbic acid from fruit.
4. Estimation of  $\beta$ -Carotene from carrot.
5. Estimation of thiamine from cereals/fruits.
6. Estimation of riboflavin.
7. Estimation of lactose from milk.
8. Estimation of lecithin from egg Yolk.
9. Estimation of maltose by calorimetric method.
10. Estimation of RNA –UV and visible methods.
11. Estimation of DNA from spleen /liver – UV and visible methods.
12. Estimation of fructose in fruits.

#### **Demonstration**

1. Separation of amino acids by circular , ascending and descending chromatography.
2. Separation of plant pigments by column chromatography.
3. Separation of lipids by TLC.

## COURSE OUTCOMES

At the end of the course, the students will be able to		Cognitive level
CO 1	Estimate the amount of vitamins and nucleic acids Analyse the lecithin and lactose in the sample	Ev
CO 2	Demonstrate the separation of compounds like amino acids, plant pigments and lipids by chromatography	An
CO3		Le

(Ev- Evaluate, An –Analyse , De- Demonstrate )

### Questions paper pattern

Internal – 40marks , External – 60marks

Major experiment – 30 marks, Minor experiments – 20 marks, Record – 10 marks

Signature of HOD

உதவி பொருளியல்  
உயர் வகுப்பியல் துறை  
உதவி பொருளியல் கல்லூரி (நான்காம் தாண்டு) 613003.

CONTROLLER OF EXAMINATIONS  
 RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)  
 THANJAVUR - 613 005.

Credits	4	Hrs/week	6	Sub Code	A1PBCEL1A	Semester	I	Medium of Instruction	English
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### SEMESTER – I-ELECTIVE COURSE – 1 (A)

**(For the students admitted from 2022-2023 onwards)**

### ENVIRONMENTAL BIOLOGY

#### **COURSE OBJECTIVES**

- To explore basic knowledge on evolution and environmental biology
- To study concepts of ecosystems
- To understand biodiversity and its hotspots.

**UNIT-I**-Evolutionary biology: Origin of life, concepts of evolution, theories of organic evolution-Lamarchism theory and Darwins theory, Natural resources – Forest resources, Afforestation, Deforestation, Hazards of deforestation, Water resources, Terrestrial resources, Soil fertility, conservation of soil fertility.

**UNIT -II**-Environmental Biology - basic concepts, atmosphere, hydrosphere, lithosphere and biosphere.: Concepts of ecosystem, components, food chain and Food web, types of ecosystems, Ecological pyramids, population ecology and biological control, economic importance of microbes, plants and animals.

**UNIT-III** -Biodiversity:- Definition, megabiodiversity of India, hots spots of biodiversity in India, value of biodiversity, distribution and threats to biodiversity, benefits of biodiversity, conservation of biodiversity – insitu and ex situ conservation methods, cryopreservation.

**UNIT- IV**-Environmental Pollution- causes, effects and control of soil, air, water, noise and radioactive pollution. E –Waste and its management. Pollution monitoring and measurements, Bioassays in environmental monitoring, Biosensors in environmental monitoring, biotechnological methods for management of pollution, management of metal pollution.

**UNIT-V**- Biogeological cycles - nitrogen, carbon, phosphorus and sulphur cycles. Heavy metal toxicity – sources, effects of cadmium, lead and mercury. Global environmental problems- Green house gases, Green House effect and global warming and its impact on biodiversity, Role of human to control green house effect, Problem of ozone, effects of ozone depletion, acid rain.

Credits	<b>5</b>	Hrs/week	<b>6</b>	Sub Code	A2PBC5	Semester	<b>II</b>	Medium of Instruction	English
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## **SEMESTER – II-CORE COURSE 5**

**(For the students admitted from 2022-2023 onwards)**

### **METABOLISM AND REGULATION**

#### **COURSE OBJECTIVES**

To understand the basic metabolic pathway of biomolecules with its regulations.

To study overview intermediary metabolism

To explore the metabolism of purine and pyrimidines

**Unit I-**Free energy and entropy. Oxidation and reduction reactions. Enzymes involved in redox reactions.High energy phosphate compounds.The electron transport chain-organization and role in electron capture.Oxidative phosphorylation- electron transfer reactions in mitochondria. F1-F0 ATPase- structure and mechanism of action. The chemiosmotic theory. Inhibitors of respiratory chain and oxidative phosphorylation- uncouplers, ionophores. Mitochondrial transport systems- ATP/ADP exchange, malate / glycerophosphate shuttle.

**Unit II-** Overview of intermediary metabolism . Glycolysis and gluconeogenesis– pathway, key enzymes and co-ordinate regulation. Mechanism of pyruvate dehydrogenase multienzyme complex and the regulation of this enzyme through reversible covalent modification. The citric acid cycle and regulation. The pentose phosphate pathway. Metabolism of glycogen and regulation

**Unit III-**Fatty acid biosynthesis and its regulation. Synthesis and Regulation of triacylglycerol, phospholipids and cholesterol.  $\alpha$ ,  $\beta$ ,  $\gamma$ , Oxidation of fatty acids– Role of carnitine cycle in the regulation of  $\beta$ - oxidation. Ketogenesis and its control. Lipoprotein metabolism - exogenous and endogenous pathways.Metabolism of prostaglandins and leukotriens.

**Unit IV-**Overview of biosynthesis of nonessential amino acids. Catabolism of amino acids- transamination, deamination, ammonia formation, the urea cycle and its regulation Importance of glutamate dehydrogenase. Metabolism of purines- de novo and salvage pathways for purine biosynthesis,. Purine catabolic pathway. Metabolism of pyrimidines biosynthesis and catabolism. regulation of biosynthesis of Purine and pyrimidine nucleotides.

**Unit 5-** Key junctions in metabolism— glucose-6-phosphate, pyruvate and acetyl CoA. Metabolic profiles of brain, muscle, liver, kidney and adipose tissue. Metabolic inter relationships in various nutritional and hormonal states— obesity, aerobic, anaerobic endurance, exercise, pregnancy, lactation, IDDM, NIDDM and starvation.

### COURSE OUTCOMES

At the end of the course, the students will be able to		Cognitive level
CO 1	Study the free energy and entropy Understand the overview of metabolism	Re
CO 2	Learn fatty acid biosynthesis and its regulation Attain basic knowledge on purine and pyrimidine metabolism with its regulation	Un
CO3	Apply the concepts of hormonal balance	Le
CO4		Re
CO5		Ap

(Un- Understand, Re- Remember, Ap – Apply, Le- Learn, )

### Text books and reference Books

1. Stryer. Biochemistry. Freeman. 5th ed. 2002.
2. Murray et al. Harper's Biochemistry. 5th ed. Mc. GrawHill, 2000.
3. Nelson Cox. Lehninger's Principles of Biochemistry. 3rd ed. McMillan Worth, 2000.
4. Donald Voet, J.G. Voet, John Wiley, Biochemistry, 1995.

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

Part B  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

Part C  $3 \times 10 = 30$  Answer any Three questions (one question from each unit )

Signature of HOD

கலை மற்றும் பாரிசு  
உயிர் வெளியீடு கலை  
நகர் அரசுவீதி அரசு கலைக் கல்லூரி (ஒன்றிய)  
திட்டாந்தி 613005.

CONTROLLER OF EXAMINATIONS  
RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)  
THANJAVUR - 613 005.

Credits	5	Hrs/week	6	Sub Code	A2PBC6	Semester	II	Medium of Instruction	English
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## SEMESTER – II-CORE COURSE 6

**(For the students admitted from 2022-2023 onwards)**

### ENZYMES AND ENZYME TECHNOLOGY

#### **COURSE OBJECTIVES Objective**

To learn enzyme classification and its nomenclature

To understand enzyme kinetics

To demonstrate enzyme isolation and purification

**Unit I-** Enzymes- Nomenclature and classification of enzymes, Active site. Enzyme modification using chemicals. multienzyme complexes. Lock and Key model of enzyme action. Enzyme Specificity. Turnover number of enzymes. Measurement of enzymatic reactions - Spectrophotometry and radio assay.Units of enzyme activity. Affinity labeling.

**Unit II-** Enzyme kinetics- Factors affecting enzyme activity.- Effect of Substrate concentration, pH, temperature, activators. Derivation of Michaelis- Menten equation. Lineweaver- Burk plot. Significance of Km and Vmax. Allosteric enzymes- MWC and KNF models. Bisubstrate reactions- Types and mechanism . Covalent modification of enzymes.

**Unit III -** Source of enzymes – Microbial source, plant and animal source. Methods of Extraction of enzymes, Enzyme purification by ion exchange, gel filtration and affinity chromatography. Bulk enzyme production in industry. Enzyme inhibition- irreversible enzyme inhibition, Reversible enzyme inhibition - competitive, noncompetitive, uncompetitive. Mechanism of enzyme action- acid base catalysis (Lysozyme) covalent catalysis, (Chymotrypsin).

**Unit IV-** Coenzymes -Structure and functions of FAD, NAD, TPP, Biotin , pyridoxal phosphate. Isoenzymes. *Enzyme regulation:* General mechanism of enzyme regulation, feedback inhibition and feed forward stimulation. Zymogens – examples and activation. Immobilized enzymes – Techniques and applications . Biosensors – Types and Applications. Antioxidant enzymes.

**Unit V-** Enzymes as diagnostic reagents, Sale value of industrial enzymes, Applications of proteolytic enzymes in detergent industry, cheese manufacturing, meat tenderization, leather industry .Enzyme

electrodes, Sources and applications of amylases, glucoamylase, glucose isomerases, cellulose, Enzymes as thrombolytic agents, anti-inflammatory agents, debriding agents, digestive aids. Therapeutic use of enzymes.

## COURSE OUTCOMES

At the end of the course, the students will be able to		Cognitive level
CO 1	Remember the classification and nomenclature of enzymes Demonstrate the enzyme Kinetics with its significance	Re
CO 2	Learn the structure and functions of coenzymes Gain knowledge on isoenzyme and enzyme regulation	Un
CO3	Apply the concepts of applications of enzyme in industry and clinical field	Le
CO4		Re
CO5		Ap

(Un- Understand, Re- Remember, Ap – Apply, Le- Learn, )

## Text book and Reference books

1. T.Palmer. Understanding enzymes. Prentice Hall.
2. Principles of Biochemistry – Zubay 4th ed. 1998, William C.Brown Publ..
3. Dixon and Webb. Enzymes 3rd ed. Longmans, 1979.
4. Stryer. Biochemistry 5th ed. Freeman, 2002.

**Question paper pattern                  Max Marks: 75                  Exam duration : 3 hours**

Part A  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

Part B  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

Part C  $3 \times 10 = 30$  Answer any Three questions (one question from each unit )



Signature of HOD

ராஜ அரசு பொது மனை  
உயிர் வெளியீடு துறை  
மாண்பு முபொலி அரசு கல்லூரி (+ 91) 98400 41300  
திருவாரூர் 613 005.

  
**CONTROLLER OF EXAMINATIONS**  
**RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)**  
**THANJAVUR - 613 005.**

Credits	4	Hrs/week	6	Sub Code	A2PBC7	Semester	II	Medium of Instruction	English
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## SEMESTER – II-CORE COURSE 7

**(For the students admitted from 2022-2023 onwards)**

### MICROBIOLOGY

#### **COURSE OBJECTIVES**

- To learn the ultrastructure of microbes
- To Understand the growth of microbes
- To study the classification and strcture of viruses

**Unit I-** Ultrastructure of bacteria, fungi, algae and protozoa. Classification of microbes, molecular taxonomy. Cell membrane of gram positive and gram- negative bacteria. Cell wall and cell membrane synthesis, flagella and motility, cell inclusions like endospores, gas vesicles. Microscopy- types of microscope, and their application- simple, compound, phase contrast and SEM microscope.

**Unit II -** Microbial growth- definition. Mathematical expression of growth, growth curve, measurement of growth and growth yields, synchronous growth, continuous culture, factors affecting growth. Microbial metabolism- overview. Role of chlorophylls, carotenoids and phycobilins, Chemolithotrophy, methanogenesis and acetogenesis, nitrogen fixation- mechanism and its importance.

**Unit III-** Methods in microbiology. Currents methods in microbial identification. Pure culture techniques. Theory and practice of sterilization. Principles of microbial nutrition, Preparation of culture media, Enrichment culture techniques for isolation of chemoautotrophs, chemoheterotrophs and photosynthetic microbes. Staining techniques.

**Unit IV-** Bacterial, plant, animal and tumor viruses. Classification and structure of viruses. Lytic cycle and lysogeny. DNA viruses; positive and negative strand, Double stranded RNA viruses. Replication-example of Herpes, pox, adenoviruses, Retroviruses. Viroids and prions.

**Unit V -** Disease reservoirs; Epidemiological terminologies. Infectious disease transmissions. Respiratory infections caused by bacteria and viruses; Tuberculosis, sexually transmitted diseases including AIDS; Vector borne diseases, Water borne diseases. Public health and water quality. Antimicrobial agents - Penicillins, Streptomycin, Tetracyclin and cephalosporins,

## COURSE OUTCOMES

At the end of the course, the students will be able to		Cognitive level
CO 1	Know the structure of bacteria and other microbes Understand the method of microbial growth	Re
CO 2	Learn the techniques involved in microbial culture Gain knowledge on virus classification and structure	Un
CO3	Apply the theory of diseases caused by microbes	Le
CO4		Re
CO5		Ap

(Un- Understand, Re- Remember, Ap – Apply, Le- Learn, )

### Text Books and Reference Books

1. Madigan et al. Brock Biology of microorganisms 10th ed. Prentice Hall, 2002.
2. Davis et al Microbiology 4th ed. Lippincott Williams and Wilkins, 1989.
3. Joklik et al. Zinsser's Microbiology Mc Graw-Hill Professional, 1995.
4. Pelczar et al. Microbiology 5th ed. Mc Graw Hill, 2000.

Question paper pattern

Max Marks: 75

Exam duration : 3 hours

Part A  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

Part B  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

Part C  $3 \times 10 = 30$  Answer any Three questions (one question from each unit )

Signature of HOD

கலை பூர்வோதா  
உயிர் வெளியீடு துறை  
நாணா சுப்பா அரசு கல்லூரி (கா. எ. -  
தஞ்சாவூர் 613005.

CONTROLLER OF EXAMINATIONS  
RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)  
THANJAVUR - 613 005.

Credits	4	Hrs/week	6	Sub Code	A2PBC8P2	Semester	II	Medium of Instruction	English
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## SEMESTER – II-CORE COURSE 8

**(For the students admitted from 2022-2023 onwards)**

### MAJOR PRACTICAL – II

#### **COURSE OBJECTIVES**

To demonstrate the enzyme kinetics experiments

To Determine the factors affecting enzyme activity

To carry out the staining techniques and antibiotic sensitivity

#### **ENZYME KINETICS**

1. Determination of total and specific activity of amylase.
2. Effect of pH on Amylase activity
3. Effect of temperature on Amylase activity .
4. Effect of substrate concentration on amylase activity and determination of Km value.
5. Effect of enzyme concentration on amylase activity.
6. Effect of inhibitor on activity of amylase/urease.
7. Effect of activator on activity of amylase/urease.
8. Determination of total and specific activity of alkaline phosphatase.
9. Determination of total and specific activity of acid phosphatase.

#### **DEMONSTRATION:**

1. Isolation of pure culture- serial dilution , pour plate , spread plate, and streak plate.
2. Staining techniques- simple, gram and acid fast staining.
3. Antibiotic sensitivity and assay of different microbes.

## COURSE OUTCOMES

At the end of the course, the students will be able to		Cognitive level
CO 1	Determine the enzyme kinetics Understand the effect of various factors affecting enzyme activity	De
CO 2	Demonstrate the isolation and staining techniques	Un
CO3		De

(Un- Understand, De- Demonstrate / determine )

## Questions paper pattern

Internal – 40marks , External – 60marks

Major experiment – 30 marks, Minor experiments – 20 marks, Record – 10 marks

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THANJAVUR - 613 005.

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உதவு மூலம் பாடப்பள்ளி  
உதவு மூலம் பாடப்பள்ளி (நிதானி)  
புதுநகர் 613005.

Credits	4	Hrs/week	6	Sub Code	A2PBCEL2A	Semester	II	Medium of Instruction	English
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## SEMESTER – II- ELECTIVE COURSE – 2 (A)

(For the students admitted from 2022-2023 onwards)

### ENDOCRINOLOGY

#### **COURSE OBJECTIVES**

To understand the basics of endocrinology and its functions .

To learn Gonadal hormones

To study signal transduction pathways

**Unit I-** Hormones – classification, biosynthesis, circulation in blood, modification and degradation. Hormone receptors – structure and regulation. Mechanism of hormone action. Hypothalamic and pituitary hormones. Anterior pituitary hormones : biological actions, and disorders of growth hormones, ACTH, gonadotrophins and prolactin. Posterior pituitary hormones – biological actions and regulation of vasopressin.Oxytocin. Hypopituitarism.

**Unit II** -Thyroid hormones – synthesis, secretion, regulation, transport, metabolic fate and biological actions. Antithyroid agents. Thyroid functions tests. Hyper and hypothyroidism. Secretion and biological actions of PTH, calcitonin and calcitriol. Hypercalcemia and hypocalcemia.

**Unit III** -Adrenal cortical hormones. Synthesis, regulation, transport, metabolism and biological effects. Adrenal function tests. Cushing's syndrome, aldosteronism, congenital adrenal hyperplasia, adrenal hormone deficiency. Adrenal medullary hormones – synthesis, secretion, metabolism, regulation and biological effects of catecholamines. Phaeochromocytoma.

**Unit IV-** Gonadal hormones : Biosynthesis, regulation, transport, metabolism and biological actions of androgens. Hypogonadism and gynecomastia. Biosynthesis, regulation, transport, metabolism and biological effects of oestrogen and progesterone. Ovulation- its Phases. Pregnancy – diagnostic tests and biochemical changes. Amenorrhoea. Pancreatic hormones – synthesis, regulation, biological effects and mechanism of action of glucagons, and insulin.

**Unit V** - Fundamentals concepts and definitions of signals, ligands and receptors, endocrine, paracrine and autocrine signaling. Receptors and signaling pathways – cell surface receptors, ion channels, G-protein coupled receptors, receptor kinases (tyr, ser/thr). Signal transduction through cytoplasmic and

nuclear receptors. The Ras-raf MAP kinase cascade, second messengers – cyclic AMP, cyclic GMP, phosphotidyl inositol and calcium ions.

#### **Text Books and Reference Books**

1. Williams Textbook of Endocrinology – Wilson and Foster 8th ed.
2. Mechanisms of hormone action – Autind and Short.
3. Harper's Biochemistry – Murray et al. 26th ed. McGraw Hill, 2003.
4. Principles of Biochemistry – Mammalian Biochemistry – Smith et al. McGraw Hill 7th ed.

#### **COURSE OUTCOMES**

<b>At the end of the course, the students will be able to</b>		<b>Cognitive level</b>
CO 1	Know the basics of endocrine and its functions Understand the thyroid hormones.	Re
CO 2	Learn the gonadal hormones. Knowledge on adrenal hormones.	Un
CO3	Apply the theory of signal pathways.	Le
CO4		Re
CO5		Ap

(Un- Understand, Re- Remember, Ap – Apply, Le- Learn, )

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

Part B  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

Part C  $3 \times 10 = 30$  Answer any Three questions (one question from each unit )

*பார்த்*  
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RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)  
THANJAVUR - 613 005.**

Signature of HOD

எனி சுகுமார் பிளே  
உதவு ஏற்று எடு செய்து (கலைச்  
கல்லூரி) 613005

redits	4	Hrs/week	6	Sub Code	A2PBCEL2B	Semester	II	Medium of Instruction	English
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## SEMESTER – II- ELECTIVE COURSE – 2 (B)

(For the students admitted from 2022-2023 onwards)

### HERBAL MEDICINE

#### COURSE OBJECTIVES :

To explore the history and importance of herbal medicine.

To Understand ethnomedicine.

To learn the traditional knowledge.

#### **Unit I**

Ethnomedicine – definition, history and its scope – Inter disciplinary approaches in ethnobotany – Collection of ethnic information.

#### **Unit II**

Importance of medicinal plants – role in human health care – health and balanced diet (Role of proteins, carbohydrates, lipids and vitamins).

#### **Unit III**

Tribal medicine – methods of disease diagnosis and treatment – Plants in folk religion – *Aegle marmelos*, *Ficus benghalensis*, *Curcuma domestica*, *Cyanodon dactylon* and *Sesamum indicum*.

#### **Unit IV**

Traditional knowledge and utility of some medicinal plants in Tamilnadu –*Solanum trilobatum*, *Cardiospermum halicacabum*, *Vitex negundo*, *Adathoda vasica*, *Azadirachta indica*, *Gloriosa superba*, *Eclipta alba*, *Aristolochia indica* and *Phyllanthus fraternus*.

#### **Unit V**

Plants in day today life – *Ocimum sanctum*, *Centella asiatica*, *Cassia auriculata*, *Aloe vera*. Nutritive and medicinal value of some fruits (Guava, Sapota, Orange, Mango, Banana, Lemon, Pomegranate) and vegetables - Greens (*Moringa*, *Solanum nigrum* Cabbage).

## COURSE OUTCOMES

At the end of the course, the students will be able to		Cognitive level
CO 1	Know the basics of ethnomedicine. Understand the importance of medicinal plants.	Re
CO 2	Learn the tribal medicine. Knowledge on Traditional medicine	Un
CO3	Nutritive value of medicinal plants	Le
CO4		Re
CO5		Ap

(Un- Understand, Re- Remember, Ap – Apply, Le- Learn, )

### Text book and Reference Books

- 1.Ethnobiology – R.K.Sinha & Shweta Sinha. Surabhe Publications – Jaipur.2001
- 2.Tribal medicine – D.C. Pal & S.K. Jain Naya Prakash, 206, Bidhan Sarani,Calcutta , 1998
- 3.Contribution to Indian ethnobotany – S.K. Jain, 3rd edition, Scientificpublishers, B.No. 91, Jodhpur,India. 2001 A Manual of Ethnobotany – S.K.Jain, 2nd edition, 199.

**Question paper pattern              Max Marks: 75              Exam duration : 3 hours**

Part A  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

Part B  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

Part C  $3 \times 10 = 30$  Answer any Three questions (one question from each unit )




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RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)  
THANJAVUR - 613 005.

தாயின் கல்லூரி தெரு  
உதவை மற்றும் அரசு நிறுவனம் (அ.ஏ.ஏ.ஏ.)  
தாங்கூர் 613005.

Credits	4	Hrs/week	6	Sub Code	A2PBCEL2C	Semester	II	Medium of Instruction	English
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### **SEMESTER – II- ELECTIVE COURSE – 2 (C)**

(For the students admitted from 2022-2023 onwards)

#### **FIRST AID AND MANAGEMENT**

##### **COURSE OBJECTIVES :**

To know about first aid and its management, emergency care.

To understand First Aid assessment

To learn First aid for Various injuries.

**Unit I – First Aid - Introduction— Issues in Providing Care — Primary Assessment & Basic Life Support — Secondary Assessment Circulatory Emergencies Respiratory Emergencies — Soft Tissue Injuries — Bone & Joint Injuries — Environmental Illness & Injury**

**Unit II- Circulatory Emergencies , External Bleeding , Internal Bleeding , Heart Attack & Angina — Stroke & TIA — Shock Of Tissue Injuries.**

**Unit – III - Burns , Electrocution , Chest & Abdominal Injuries, Respiratory Emergencies , Anaphylactic Shock , Asthma & Hyperventilation , Obstructed Airway, Bone & Joint Injuries**

**Unit – III - Musculoskeletal Injuries , Immobilization ,Head & Facial Injuries, Suspected Spinal Injury, Environmental Illness & Injury**

**Unit – IV- Heat-Related Illness & Injury ,Cold-Related Illness & Injury ,Pressure-Related Illness & Injury Medical Conditions & Poisoning**

**Unit – V - Diabetes — Seizures — Mental Health Emergency — Poisoning, Wilderness First Aid — Marine First Aid — Extended Assessment, Airway Management — Oxygen Administration — Automated External Defibrillation — Triage first aid kits**

##### **Text books and Reference books**

1. First Aid and Management of Minor Injuries by Jon Dallimore - Preppers , 2003
2. Anatomy of First Aid: A Case Study Approach by Ronald A. Bergman - Anatomy Atlases , 2004
3. First Aid and Beyond by Dan Wolfe - Smashwords , 2014.

## COURSE OUTCOMES

At the end of the course, the students will be able to		Cognitive level
CO 1	Know the basics of first aid assessment Understand the first aid for heart diseases.	Re
CO 2	Learn the first aid for injuries and burns Knowledge the first aid for heat related injuries	Un
CO3	Apply the method for poison emergency	Le
CO4		Re
CO5		Ap

4. (Un- Understand, Re- Remember, Ap – Apply, Le- Learn, )

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

Part B  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

Part C  $3 \times 10 = 30$  Answer any Three questions (one question from each unit )



**Signature of HOD**

தயிர் வெள்ளியல் நிலை  
நகர் அமைச் சபை கல்லூரி (உடனடியான்  
துற்காலிக் 613005.

CONTROLLER OF EXAMINATIONS  
RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)  
THANJAVUR - 613 005.

Credits	5	Hrs/week	6	Sub Code	A3PBC9	Semester	III	Medium of Instruction	English
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### **SEMESTER – III- CORE COURSE - 9**

(For the students admitted from 2022-2023 onwards)

#### **IMMUNOLOGY**

**Objective :**

To learn the elements of immunology , immunotechniques

To explore the process of complement activation.

To demonstrate immunological techniques.

**Unit I-** Types of immunity- innate and acquired. Humoral and cell mediated immunity. Central and peripheral lymphoid organs- Thymus, bone marrow, spleen, lymph nodes and other peripheral lymphoid tissues- GALT. Cells of the immune system- lymphocytes, mononuclear phagocytesdendritic cells, granulocytes, NK cells and mast cells, cytokines. Lymphokines, and interleukins. Antigens vs immunogens, Haptens. Factors influencing immunogenicity.

**Unit II-** Complement activation and its biological consequences. Clonal selection theory. T-cell, B-cell receptors, Antigen recognition- processing and presentation to Tcells. Immunological memory. Cell mediated cytotoxicity, immunotolerance, immunosuppression. Immunoglobulins structure, classification and functions. Isotypes, allotypes and idiotypes.

**Unit III - MHC -** Role of MHC antigens in immune response, MHC antigens in transplantation. Transplantation types and mechanism. Immune responses to infectious diseases- Viral, bacterial and protozoal. Hypersensitivity- types and mechanisms

**Unit IV- Immunization practices-** active and passive immunization. Vaccines- killed, attenuated- toxoids. DNA vaccines, synthetic peptide vaccines. Production of polyclonal and monoclonal antibodies- hybridoma technology. Principles, techniques and application. Genetically engineered antibodies. Autoimmunity- autoimmune disease in human and animal models.

**Unit V- Immuno-electrophoresis, RIA, immunoblotting,Avidin-biotin mediated immune assay.**

Immunohistochemistry- immunofluorescence, Fluorescent immunoassay. ELISA and ELISPOT.

Abzymes. Experimental animal models: inbred strains, SCID mice, nude mice, knock out Mice.

### **Text books and Reference Books**

1. Roitt et al. Roitt's. Essential Immunology. 10th ed. Blackwell Sci. 2001.
2. Richard A. Goldsby et al. Kuby Immunology. 4th ed. WH Freeman & Co. 2003.
3. Abbas et al. Cellular and Molecular Immunology. W.B. Saunders Company, 2000.16
4. Eli Benjamini AU et al. Immunology: A short course. 4th ed. Wiley-Liss, 2000.

### **COURSE OUTCOMES**

At the end of the course, the students will be able to		Cognitive level
CO 1	Know the types of immunity Understand the complement activation.	Re
CO 2	Learn the role of MHC and its antigens. Knowledge on autoimmunity	Un
CO3	Apply the immunological techniques	Le
CO4		Re
CO5		Ap

1. (Un- Understand, Re- Remember, Ap – Apply, Le- Learn, )

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

Part B  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

Part C  $3 \times 10 = 30$  Answer any Three questions (one question from each unit )

**Signature of HOD**

உதவுமிகு அரசு  
நாட்டு பொறுப்பு தலை நகரம் (கோயில்)  
நகராட்சி 613005.

**CONTROLLER OF EXAMINATIONS  
RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)  
THANJAVUR - 613 005**

Credits	5	Hrs/week	6	Sub Code	A3PBC10	Semester	III	Medium of Instruction	English
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### **SEMESTER – III- CORE COURSE 10**

**(For the students admitted from 2022-2023 onwards)**

### **CLINICAL BIOCHEMISTRY**

#### **COURSE OBJECTIVES**

- To learn the disorders of biomolecule metabolism.
- To understand disorders of carbohydrate, protein metabolism.
- To Study heart , liver and kidney function test.

**Unit I**-Disorders of carbohydrate metabolism– glycogen storage diseases, galactosemia, fructose intolerance and fructosuria. Blood sugar homeostasis: Role of tissues and hormones in the maintenance of blood sugar. Hypoglycemia, hyperglycemia, glycosuria. Diabetes mellitus – classification, Complications, diagnosis and management. GTT. Disorders of lipid metabolism – lipoproteinaemias. Lipid storage diseases – Gaucher's, Tay Sach's Niemann Pick disease. Fatty liver. Atherosclerosis.

**Unit – II**- Disorders of amino acid metabolism– amino aciduria, Phenylketonuria, Hartnup disease, alkaptonuria, albinism, cystinuria, cystinosis, homocystinuria and maple syrup urine disease. Disorders of purine, pyrimidine metabolism: Hyperuricemia and gout. Hypouricemia. Orotic aciduria. Serology: C-Reactive protein test, Rheumatoid arthritis (RA) test.

**Unit III** - Jaundice- Causes, consequences, biochemical findings, treatment in jaundice, hepatitis and cirrhosis. Liver function test. Tests related to excretory (bile pigments) synthetic (plasma proteins, prothrombin time) detoxifying (hippuric acid, NH<sub>3</sub>, aminopyrine) and metabolic (galactose) functions. Gall stones. Gastric function tests- Stimulation tests – insulin and pentagastrin. Peptic ulcer, gastritis and Zollinger Ellison syndrome.

**Unit IV**-Kidney function- Biochemical findings in glomerulonephritis, renal failure and nephritic syndrome. Nephrolithiasis. Kidney function tests - Glomerular function tests – inulin, urea and creatinine clearance tests, renal plasma flow, plasma \_2-microglobulin. Tubular function tests – water load, concentration and acid excretion tests. Normal and abnormal constituents of urine.

Clinical enzymology - Serum enzymes and isoenzymes in health and disease – Transaminases (AST, ALT) acid , alkaline phosphatases, LDH and CK.

**Unit V-** Serological Diagnosis of viral infections, amniotic fluid and maternal serum, ailment in pregnancies. Oncology: Cancer cell – morphology and growth characteristics. Biochemical changes in tumor cells. Differences between benign and malignant tumors. Tumor markers – AFP, CEA and HcG Agents causing cancer – radiation, viruses, chemicals. Multistep carcinogenesis – initiation, promotion, progression. Oncogenes and proto-oncogenes – mechanisms of proto-oncogene activation. Tumor suppressor genes – p53.

#### **Text and Reference Books**

1. Clinical Chemistry in diagnosis and treatment Mayne ELBS.
2. Clinical Chemistry Marshall 3rd edition Mosby.
3. TietZ textbook of Clinical Chemistry – 1998 3rd edition Saunders

#### **COURSE OUTCOMES**

At the end of the course, the students will be able to		Cognitive level
CO 1	Know the basics of disorders of carbohydrate metabolism. Understand the disorders of protein metabolism Learn the disorders of nucleic acid metabolism Knowledge on the test used for heart failure Apply the method for liver and kidney function tests	Re
CO 2		Un
CO3		Le
CO4		Re
CO5		Ap

(Un- Understand, Re- Remember, Ap – Apply, Le- Learn, )

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

Part B  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

Part C  $3 \times 10 = 30$  Answer any Three questions (one question from each unit )

Signature of HO

காந்தி பொருளியல்  
பயிர் வெதியியல் மூலம்  
மனம் முனைக் கருத கல்லூரி (கலை...  
தாமஸ்கர் 313005.

**CONTROLLER OF EXAMINATIONS**  
**RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)**  
THANjavur - 613 005.

Credits	5	Hrs/week	6	Sub Code	A3PBC11	Semester	III	Medium of Instruction	English
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### SEMESTER – III- CORE COURSE 11

**(For the students admitted from 2022-2023 onwards)**

#### MOLECULAR BIOLOGY

##### **COURSE OBJECTIVES**

To explore the replication, transcription and translation process.

To Learn gene mutation.

To Understand the regulation of gene expression .

**Unit I-** Chromosomal organization of genes , Mobile elements (Transposons) - bacterial transposons, viral transposons, viral retro transposons, structural organization of eukaryotic chromosomes, histone proteins, chromatin , Telomeres and telomerase. Gene mutation and chromosomal aberration. DNA damage and DNA repair.

**Unit- II-** Replication of DNA: DNA in prokaryotes and eukaryotes. Enzymes involved in replication, events on the replication fork and termination, mechanism of replication. Inhibitors of DNA replication. Mutation - point mutation and frame shift mutation, Suppressor mutations , nonsense and missense mutation.

**Unit-III-** Basic principles of transcription- initiation, elongation and termination in prokaryotes. Inhibitors of transcription. Regulation of transcription in prokaryotes- Lac, Tryp and Ara operon. Eukaryotic RNA polymerases- structure and functions of RNA pol I, II and III. Post transcriptional processing of mRNA, rRNA and t-RNA. Alternative splicing.

**Unit IV** -The genetic code- general features. Components of protein synthesis, Mechanism of protein synthesis in bacteria and eukaryotes- amino acid activation, initiation, elongation and termination. Inhibition of protein synthesis. protein glycosylation in ER and Golgi complex. Protein targeting- the signal sequence hypothesis, targeting proteins to membranes, nucleus and intracellular organelles. Protein degradation: the ubiquitine pathway. Protein folding- models, molecular chaperones.

**Unit V-** Levels of gene expression. Principles of gene regulation, Upregulation, downregulation, induction, gene regulation by DNA methylation. Methods to study gene expression. Cytotoxicity and viability assays, molecular markers – markers based on DNA hybridization, Basic principle, Restriction fragment length polymorphism (RFLP), Random Amplified polymorphic DNA (RAPD), Cytogenetic bioassays- chromosomal damage micronuclease test, Ames test.

#### ***Text books and Reference Books***

1. Lewin. Genes VII. Oxford University Press 2000.
2. Twyman. Advanced Molecular Biology Viva Publ. 2nd ed 1998.
3. Alberts. Molecular Biology of the Cell. 4th ed. Garland Sci. 2002.

#### **COURSE OUTCOMES**

<b>At the end of the course, the students will be able to</b>		<b>Cognitive level</b>
CO 1	Know the chromosomal organization of gene. Understand the DNA Replication.	Re
CO 2	Learn the process of transcription. Knowledge on protein degradation.	Un
CO3	Apply the principles of gene regulation.	Le
CO4		Re
CO5		Ap

(Un- Understand, Re- Remember, Ap – Apply, Le- Learn, )

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

Part B  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

Part C  $3 \times 10 = 30$  Answer any Three questions (one question from each unit )

**Signature of HOD**

வினா வெளியிட்ட நால்  
உதவி போடுதல் திட்டம் (தொடர்)  
குறைபாடு 013005.

**CONTROLLER OF EXAMINATIONS  
RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)  
THANJAVUR - 613 005.**

redits	4	Hrs/week	6	Sub Code	A3PBC12P	Semester	III	Medium of Instruction	English
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## SEMESTER – III- CORE COURSE 12

**(For the students admitted from 2022-2023 onwards)**

### MAJOR PRACTICALS - III

#### **COURSE OBJECTIVES**

- To estimate the cholesterol and lipid
- To demonstrate the estimation of blood sugar.
- To demonstrate the purification of enzymes.

#### **CLINICAL BIOCHEMISTRY**

1. Preparation and preservation of blood and urine samples.
2. Estimation of HDL Cholesterol in serum
3. Estimation of triglycerides in serum
4. Estimation of LDH in serum
5. Estimation of Hemoglobin in Blood.
6. Estimation of ceruloplasmin in serum.
7. Estimation of blood sugar.
8. Estimation of urine creatinine.
9. Estimation of urea in urine.
10. Estimation of chloride in urine.
11. Estimation of serum total bilirubin.
12. Estimation of albumin in serum .

#### **Demonstration:**

1. Purification of enzyme by ammonium sulphate precipitation.
2. Extraction of nucleic acids from plant leaves.
3. Separation of DNA by agarose gel electrophoresis.
4. Separation of protein by SDS-PAGE
5. Isolation of mitochondria from plant leaves

## COURSE OUTCOMES

At the end of the course, the students will be able to		Cognitive level
CO 1	Estimate the Level of cholesterol and LDH Analyse the estimation of urine compounds.	Es
CO 2	Demonstrate the purification of enzymes	An
CO3		De

(Es- Estimate, An- Analyse , De- Demonstrate )

### Questions paper pattern

Internal – 40marks , External – 60marks

Major experiment – 30 marks, Minor experiments – 20 marks, Record – 10 marks



Signature of HOD



உதவி வேலையின் துறை  
பல்லார் ஏஜன்சி அமைச்சரி (சென்னை)  
திருச்சாமுகம் 613005.

CONTROLLER OF EXAMINATIONS  
RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)  
THANJAVUR - 613 005.

Credits	4	Hrs/week	6	Sub Code	A3PBCEL3A	Semester	III	Medium of Instruction	English
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### SEMESTER – III- ELECTIVE COURSE 3 (A)

**(For the students admitted from 2022-2023 onwards)**

### GENETIC ENGINEERING

#### **COURSE OBJECTIVES**

To enlighten the gene cloning and gene transfer methods .

To understand vectors and plasmids

To gene transfer techniques.

#### **UNIT I**

Introduction to gene cloning : Isolation and purification of plasmid DNA, bacteriophage DNA, restriction enzymes, ligases, basic principles of rDNA technology.

#### **UNIT-II**

Cloning and expression vectors: Plasmids, PBR322, bacteriophages, M13, Lambda and PUC vectors. Cosmid vectors, YAC, BAC, HAC , Ti plasmids.

#### **UNIT-III**

Cloning and expression strategies: DNA cloning, genomic library, cDNA library, expression of cloned genes in E.Coli and Yeast.

#### **UNIT- IV**

Gene transfer methods: Electroporation, microinjection, liposome mediated methods, calcium phosphate method, nature gene transfer methods: transformation, transduction and conjugation.

#### **UNIT-V**

Applications of genetic engineering in agriculture, health and industry, stem cell and its applications. Gene therapy. GM Foods.

Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005

M.Sc., Chemistry – CBCS Pattern

(From the academic year 2022 – 23 onwards Generic Elective (A1PCHGE1)

Hours: 2

Credits: 2

### SEMESTER – I

(For students admitted from 2022 onwards)

### Chemistry In Every Day Life

#### Objectives

- ❖ To learn about Cleaning agents
- ❖ To acquire the knowledge of Cosmetics
- ❖ To study the various concepts of Paints and varnishes.
- ❖ To understand the various Fertilizers

#### UNIT – I

Cleaning agents – soaps- detergents- types-composition-manufacture – foaming, colouring and building agents . shampoo, washing powder and bleaching powder.

#### UNIT – II

Cosmetics- Face powder-constituents uses-side effects. Nail polish, hairdye- composition and side effects . Tooth powder- composition and manufacturing .

#### UNIT – III

Medicines in day- to-day life - analgesics, anti pyretics, anti inflammatory, antibiotics, antiseptic and disinfectants- definition, examples and uses.

#### UNIT – IV

Paints and varnishes-constituents, manufacturing-medium -binder –pigments- types of paints -requirements of a good paints,

#### UNIT – V

Fertilizers- fertilizer industries in India .Manufacture of ammonium salts, urea, super phosphates.

#### Learning Outcomes

At the end of the course, the student will be able to

- ❖ Understand the basic concept of applicable of chemistry in day today life.

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THANJAVUR - 613 005.

துறைத்தலைவர்  
வெளியியல் துறை  
மன்னாரபோசி அரசுக் கல்லூரி  
துஞ்சொட்டர் - 5.

**Rajah Serfoji Govt. College (Autonomous), Thanjavur – 613 005**  
**M.Sc., Chemistry – CBCS Pattern**  
**(From the academic year 2022 – 23 Generic Elective (A2PCHGE2)**

**Hours:2**

**Credits : 2**

**SEMESTER – II**  
**(For students admitted from 2022 onwards)**

**FOOD AND ADULTERANTS**

**Learning Outcomes:** After successful completion of the course, students will be able to:

1. Get basic knowledge on various foods and about adulteration.
2. Understand the adulteration of common foods and their adverse impact on health
3. Comprehend certain skills of detecting adulteration of common foods.
4. Be able to extend their knowledge to other kinds of adulteration, detection and remedies.
5. Know the basic laws and procedures regarding food adulteration and consumer protection.

**UNIT I Food Adulteration:**

Definition, reasons. Characteristics of Adulteration. Classification and types of Adulterants- Intentional Adulterants, Incidental adulterants, Packaging Hazard and Metallic Contaminants.

**UNIT II Foods Commonly Adulterated**

Food grains like wheat, rice, pulses and their products like wheat flour, semolina (*sufi*) and gram flour.

Edible oils and fats like groundnut oil, sunflower oil, mustard oil and vanaspati.

Sweetening agents like sugar, honey and Jaggery.

Non-alcoholic beverages like aerated drinks, squashes and juices.

**UNIT III Food Laws and Standards:**

Codex Alimentarius , Prevention of Food Adulteration (PFA) Act, Agmark, Fruit Products Order (FPO), Meat Products Order (MPO), Bureau of Indian Standards (BIS) and Food Standards and Safety Authority of India( FSSAI)

**UNIT IV Harmful Effects of Adulterants:**

Toxic adulterants in milk and their ill-effects, Toxic adulterants in oil and their ill-effects,

Toxicity of food colours.

**UNIT V**

**Methods for Detection of Some Adulterants:**

Milk, milk product, Ghee, butter Oils and fats, Black pepper ,Mustard seeds, Coffee ,Chilly or Turmeric powder

**Reference Books and Websites:**

1. A first course in Food Analysis –A.Y.Sathe, New Age International(P)Ltd.,1999
2. Food Safety, casestudies–Ramesh.V.Bhat, NIN, 1992 3.
3. Shakuntala Manay N and Shadaksharawamy M. Foods-facts and principles. 3rd edition New age International
4. <https://www.fssai.gov.in/>
5. Principles & Techniques of Practical biochemistry by Wilson N . Walker
6. Mohini Sethi and Eram S Rao. Food science experiments and applications. CBS publishers.

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**துறைத்தலைவர்  
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மன்னர் சுபோளி அரசுக் கல்லூரி  
தஞ்சாவூர் - 5.**

**SEMESTER-I NON MAJOR ELECTIVE**  
**(For the students admitted from 2022-23 onwards)**

**HEALTH SCIENCE & NUTRITION**

**First Semester**

**(For M.Sc Chemistry)**

**COURSE OBJECTIVES**

To understand the basics in nutrition and health education

To learn the basic of nutrition and its energy level

To know food preservatives

**UNIT - I**- Introduction to Nutrition -Definition, General introduction, Classification of nutrients, Energy - Definition of Kilocalories, Joule, energy value of foods, basal metabolic rate (BMR).

**UNIT II**- Definition, Source, and biological functions of carbohydrates, proteins, and lipids.

Vitamins - Source , functions and deficiency diseases of vitamin A, D, C , folic acid.  
Recommended Dietary allowance (RDA)-Protein energy malnutrition- Marasmus, Kwashiorkor.

**UNIT III**- Food preservation-general principles and methods. Preservation by addition of sugar. General principles and methods of preparation of jams, jellies . Food adulteration. Guide lines for good health.

**UNIT IV**- Life Style Changes - Urbanization, Westernization, Work style, Food habits and Food behavior changes, drug addiction and harmful effects .Weight related disorders - Underweight-Etiology, assessment, dietary management, Role of dietary fibre and health.

**UNIT V**- Health education - Definition, importance of health education, Personal hygiene.

Physical education – Meaning & scope, role of exercises and yoga in improving health.

Health insurance scheme (Government & Non Government) – Mediclaim Policy, Employee State Insurance Scheme, Specialised Insurance Scheme.

## COURSE OUTCOMES

At the end of the course, the students will be able to		Cognitive level
CO 1	Learn types of nutrition and related diseases	Le
CO 2	Understand the vitamin and its deficiency diseases	Un
CO3	Apply the knowledge of food preservatives	Ap
CO4	Create awareness on life style changes	Un
CO5	Gain knowledge on health insurance policies , WHO, UNICEF	Ap

(Un- Understand, Le-Learn, Ap – Apply)

### Text books & Reference Books

1. Nutrition and Dietetics by Shubhagini, Tata Mc Graw Publishers, 3<sup>rd</sup> edition, (2010)
2. Human Nutrition by B.Srilakshmi, New Age Publishers, 2<sup>nd</sup> edition (2008)

Question paper pattern      Max Marks: 75

Exam duration : 3 hours

Part A  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

Part B  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

Part C  $3 \times 10 = 30$  Answer any Three questions (one question from each unit )

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THANJAVUR - 613 005

Signature of HOD  
Dr. K. JEYAPRAKASH  
M.Sc., M.Phil., Ph.D., PGDCA  
Head, Dept. of Biochemistry  
Rajah Serfoji Govt. College  
Thanjavur - 613 005

**SEMESTER -II- NON MAJOR/ELECTIVE****BIOANALYTICAL CHEMISTRY**

(For M.Sc Chemistry )

**COURSE OBJECTIVES**

To know about the basic biochemical techniques and its applications.

To learn principle, and applications of chromatographic techniques

To understand the principle and applications of electrophoresis

**UNIT - I**

pH meter, pH scale, Henderson- Hasselbach equation, Buffer solutions, Buffer systems of blood – Hb, Protein and Phosphate/Buffer systems.

**UNIT - II**

Chromatography- Principle, materials, methods & Applications of paper chromatography, HPLC, ion exchange, affinity chromatography and Gel filtration chromatography.

**UNIT - III**

Electrophoresis- Principles, instrumentation and applications of paper electrophoresis, agar gel, starch gel, SDS PAGE, immuno electrophoresis.

**UNIT IV**

Principle, instrumentation and application of colorimetry, Spectrophotometry, Fluorimetry and Flame photometry.

**UNIT V**

Tracer and other techniques – radioactive decay, unit of radioactivity , GM Counter, scintillation counter, applications of radio isotopes in biological and medical sciences.

**COURSE OUTCOMES**

At the end of the course, the students will be able to		Cognitive level
CO 1	Demonstrate the types of buffer systems	Re
CO 2	Learn the principle and applications of chromatographic techniques	An

CO3	Understand the method of electrophoresis with its applications	Un
CO4	Understand the method of colorimetry	Un
CO5	Explore the techniques of GM counter and its applications	Ev

(Un- Understand, Ap – Apply, An- Analyse, Ev- Evaluate, Re – Remember)

### Text books and Reference books

1. Instrumental methods of chemical analysis by Sharma B.K
2. Instrumental method of chemical analysis by Kudesia V.P, Sawhaney H
3. An introduction to practical biochemistry by David T.Palmer.

Question paper pattern

Max Marks: 75

Exam duration : 3 hours

Part A  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

Part B  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

Part C  $3 \times 10 = 30$  Answer any Three questions (one question from each unit)

Signature of HOD

Dr. K. JEYAPRAKASH  
M.Sc., M.Phil., Ph.D., PGDCA  
Head, Dept. of Biochemistry  
Rajah Serfoji Govt. College  
Thanjavur - 613 005

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### Text books and Reference Books

- Primrose.S.B, Twyman and Old. Principles of gene manipulation, Blackwell Scientific Publications, 6th Edition, 2001.
- Glick,B and Pasternack,J.J. Molecular Biotechnology, ASM Press, Third Edition, 2003.
- Brown,T.A. Gene Cloning and DNA analysis –An introduction, Blackwell Science, Fourth Edition, 1995.

### COURSE OUTCOMES

At the end of the course, the students will be able to		Cognitive level
CO 1	Know the basic of plasmid isolation. Understand the vectors used in gene cloning .	Re
CO 2	Learn the cDNA, and Genomic library Knowledge on gene transfer techniques	Un
CO3	Application of genetic engineering	Le
CO4		Re
CO5		Ap

(Un- Understand, Re- Remember, Ap – Apply, Le- Learn, )

Question paper pattern

Max Marks: 75

Exam duration : 3 hours

Part A  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

Part B  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

Part C  $3 \times 10 = 30$  Answer any Three questions (one question from each unit )

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Signature of HOD  
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கல்லூரி கல்வியின் மேல்  
தாங்கள் தொடர்பு கொண்டு வருகிறீர்கள். (நீ வீரன்)  
தாங்கள் 613005.

Credits	4	Hrs/week	6	Sub Code	A3PBCEL3B	Semester	III	Medium of Instruction	English
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### **SEMESTER – III- ELECTIVE COURSE- 3 (B)**

**(For the students admitted from 2022-2023 onwards)**

### **DAIRY MICROBIOLOGY**

#### **COURSE OBJECTIVES**

To know the quality of milk, microbial contamination and preservation of milk,

To understand the principles of dairy foods.

To Microbial sensors

**Unit I- Importance of Microbiological Quality and Safety Assurance System in Dairy Industry: Principles of Quality and Safety Management Systems; Plant hygiene and sanitation in dairy industry.**

**Unit II -General principles for the establishment and application of microbiological criteria for dairy foods: Definition, purpose and components of Microbiological criteria; Mandatory and advisory criteria; Establishment of microbiological standards, guidelines and specifications for different milk and milk products by BIS.**

**Unit III -Enumeration and detection of indicator organisms and dairy pathogens: Indicator Organisms; Selection criteria for their use as quality and safety indicators; Conventional and rapid detection methods including commercial detection kits for indicator organisms and pathogenic bacteria in milk and milk products.**

**Unit IV -Microbial bio-sensor for monitoring pathogens and non-microbial contaminants in dairy foods: components of microbial bio-sensors; Detector system i.e. Electrochemical; Optical; Mechanical devices; Application of microbial bio-sensor in monitoring pathogenic bacteria, antibiotic residues and aflatoxin M1 in milk and milk products.**

**Unit V -Establishment and accreditation of QA Lab in dairy processing unit: Introductory information on Quality assurance lab in dairy processing unit; Bio-safety definition, principles and safety levels; FDA requirements for establishing biosafety laboratory in dairy industry.**

## COURSE OUTCOMES

At the end of the course, the students will be able to		Cognitive level
CO 1	Know the microbial quality Understand the principles and guidelines for safety.	Re
CO 2	Learn the detection of indicator organism Knowledge on monitoring pathogens	Un
CO3	Apply the principles of accreditation of lab.	Le
CO4		Re
CO5		Ap

(Un- Understand, Re- Remember, Ap – Apply, Le- Learn)

### Text Books and Reference Books

1. Adams MR and Moss MO 2008 Food Microbiology. 3rd Ed. RSC Publisher, Cambridge, UK
2. Frances PD and Keith ITO 2001 Compendium of Methods for the Microbiological Examination of Foods. 4th Ed. American Public Health Association (APHA), Washington DC, USA.
3. JM Jay, Martin JL and David AG 2005 Modern Food Microbiology. 7th Ed. Food Sciences Text Series, New York, USA.

Question paper pattern

Max Marks: 75

Exam duration : 3 hours

Part A  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

Part B  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

Part C  $3 \times 10 = 30$  Answer any Three questions (one question from each unit )



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நிலை அரசுப் பள்ளி அமைச்சரியின் கீழ்  
தஞ்சாவூர் 613005.

Credits	4	Hrs/week	6	Sub Code	A3PBCEL3C	Semester	III	Medium of Instruction	English
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### **SEMESTER – III- ELECTIVE COURSE- 3 (C)**

**(For the students admitted from 2022-2023 onwards)**

#### **INTELLECTUAL PROPERTY RIGHTS AND PATENTING**

##### **COURSE OBJECTIVES :**

To understand the basics of intellectual property rights .

To study the Principles of IPR

To learn Trade law and copy rights .

**UNIT - I:** Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

**UNIT - II:** Trade Marks: Purpose and function of trade marks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

**UNIT - III:** Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law. Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

**UNIT - IV:** Trade Secrets: Trade secret law, determination of trade secret status, liability for misappropriations of trade secrets, protection for submission, trade secret litigation.

Unfair competition: Misappropriation right of publicity, False advertising.

**UNIT - V:** New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international - trade mark law, copy right law, international patent law, international development in trade secrets law.

## COURSE OUTCOMES

At the end of the course, the students will be able to		Cognitive level
CO 1	Know the introduction of IPR Understand the trade mark.	Re
CO 2	Learn the process of copy right Knowledge on trade secret laws.	Un
CO3	Apply the principles on international patent law	Le
CO4		Re
CO5		Ap

(Un- Understand, Re- Remember, Ap – Apply, Le- Learn, )

### Text Books and Reference Books

1. Intellectual property right, Deborah, E. Bouchoux, cengage learning.
2. Intellectual property right - Unleashing the knowledge economy, prabuddha ganguli, Tata Mc Graw Hill Publishing Company Ltd.

**Question paper pattern              Max Marks: 75              Exam duration : 3 hours**

Part A  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

Part B  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

Part C  $3 \times 10 = 30$  Answer any Three questions (one question from each unit )



Signature of HOD

தென் புாரிட்டன்  
உயிர் வெற்றியல் துறை  
பல்கலை மனை அரசு கல்லூரி (கல்லூரி)  
தஞ்சை 613005.



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THANJAVUR - 613 005.

Credits	5	Hrs/week	6	Sub Code	A4PBC13	Semester	IV	Medium of Instruction	English
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### SEMESTER – IV- CORE COURSE 13

**(For the students admitted from 2022-2023 onwards)**

### ADVANCED PHARMACEUTICAL CHEMISTRY

#### **COURSE OBJECTIVES**

To understand the drugs , metabolism and drug allergy and drug prescription.

To study the basic of drug metabolism.

To explore the importance of medicinal plants.

**Unit I**-Drugs –Sources and classification of drugs, dosage forms and routes of administration . Drugs – structural features and prodrug concept. Absorption , factors modifying drug absorption. Distribution of drugs. Mechanism of action of drugs. Different types of Dosage forms - Factors modifying drug action. Rational therapy & P drugs

**Unit –II**- Drug metabolism – General pathways of drug metabolism , reactions in Phase I and Phase II reactions, Role of Cytochrome P450 in Metabolism of Drugs. Excretion of drugs. Factors affecting drug metabolism.Drug receptors- types, model and theories. G-protein coupled receptors and ion channel linked receptors. Drug receptors interations. Agonist and antagonists.

**Unit III**- Mechanism of action of drugs in therapy of Respiratory systems – cough, bronchial, asthma and tuberculosis.Antimicrobial drugs – sulfonamides, penicillins, tetracyclines, streptomycin, and chloramphenicol.Cancer chemotherapy - uses, mechanism of action , and side effects of Methotrexate, Vincristin, Cisplatin,Thyroid and antithyroid drugs, insulin and oral antidiabetic drugs, drug therapy in Alzheimers disease and infertility.

**Unit IV** History and Importance of medicinal plants, Use of herbs in our daily life. Principles and Development of drug discovery. Extraction and purification of active principles (alkaloids, flavonoids) from medicinal plants, Role of medicinal plants in drug industry.Genetically engineered protein and peptides. Anti AIDS drug development, Production of secondary metabolites . Drugs prescribing in old age, infants, children, pregnancy.

**Unit V**- General and local anaesthetics, Preservatives and antiinfectants, Antihypertensive drugs, Psychotropic drugs, antidepressant drugs, Parkinsons disease and drugs therapy for parkinsons disease, Antiinflammatory drugs, Treatment of acute poisoning, Method of prescription writing with examples.

Heavy metal poisoning – Sources, harmful effects and management of cadmium, mercury and lead.  
Patenting of drug.

### Text books and Reference Books

1. Text Book of pharmaceutical chemistry by Jayashree Ghosh , S.Chand publishers (2010) (For Unit 1 , 2 & 3)
2. Pharmaceutical chemistry by Tripathi, Jaypee Publishers, 6<sup>th</sup> edition (2008) (For Unit 4 &5)
3. Pharmacology by satoskar, Elsevier Publications (2008).

### COURSE OUTCOMES

At the end of the course, the students will be able to		Cognitive level
CO 1	Know the classification of drugs. Understand the method of drug metabolism.	Re
CO 2	Learn the mechanism of action of drugs. Knowledge on importance of medicinal plants.	Un
CO3	Apply the principles of preservatives	Le
CO4		Re
CO5		Ap

(Un- Understand, Re- Remember, Ap – Apply, Le- Learn, )

Question paper pattern

Max Marks: 75

Exam duration : 3 hours

Part A  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

Part B  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

Part C  $3 \times 10 = 30$  Answer any Three questions (one question from each unit )



Signature of HOD

உயர் வைத்துவம் துறை  
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தாங்கள் 613005.

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RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)  
THANJAVUR - 613 005.

Credits	5	Hrs/week	6	Sub Code	A4PBCP14P	Semester	IV	Medium of Instruction	English
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## SEMESTER – IV- CORE COURSE 14

**(For the students admitted from 2022-2023 onwards)**

### MAJOR PRACTICALS – IV

#### **COURSE OBJECTIVES**

To demonstrate the estimation of phenol and other phytochemicals

To estimate lactose in milk

To determine enzyme activity

#### **EXPERIMENTS**

1. Estimation of total phenols
2. Estimation of alkaloids
3. Lactose estimation in milk samples.
4. Estimation of anthocyanin in plant pigments
5. Determination of lipase from germinating seeds
6. Determination of protease from germinating seeds
7. Measurement of bacterial growth curve
8. Assay of TBARS.
9. Determination of SOD
10. Determination of Catalase
11. Estimation of vinegar in food samples
12. Isolation and estimation of phospholipids from egg yolk.
13. Biochemical tests for identification of bacteria
14. Determination of free amino acid content in germinating seeds.

#### **DEMONSTRATION**

15. Enzyme Linked Immunosorbent Assay
16. Isolation of Plasmid DNA.
17. Isolation of chromosomal DNA from blood samples
18. Restriction digestion.
19. Pregnancy test
20. Widal Test
21. Detection of adulterants in milk samples
22. Extraction of Caffeine from Tea
23. isolation of  $\beta$  -Amylase from Sweet Potato
24. Extraction of DNA from Fish Fins
25. Spotters
26. Industrial Visit to various Pharma/Research/ Clinical / Educational Institutions.

## COURSE OUTCOMES

At the end of the course, the students will be able to		Cognitive level
CO 1	Estimate the Level of lactose in milk Determine enzyme activity	Es
CO 2	Demonstrate the isolation of DNA and Plasmid	An
CO3		De

### Questions paper pattern

Internal – 40marks , External – 60marks

Major experiment – 30 marks, Minor experiments – 20 marks, Record – 10 marks



Signature of HOD  
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 கல்லூரி வெளியீடு துறை  
 மாண்புமிகு அரசு கல்லூரி (கலைஞர்)  
 தான்ஜவூர் 613005.

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 RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)  
 THANJAVUR - 613 005.

Credits	4	Hrs/week	6	Sub Code	A4PBCEIAA	Semester	IV	Medium of Instruction	English
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### **SEMESTER – IV- ELECTIVE COURSE 4 (A)**

**(For the students admitted from 2022-2023 onwards)**

## **BIOTECHNOLOGY**

### **COURSE OBJECTIVE**

To learn microbial , medical biotechnology and its applications .

To Understand the types of bioreactors.

To isolate microorganism.

**UNIT I- Bioreactors :** types, operation of conventional bioreactor, fermentor, fermentation- solid substrate fermentation, media for industrial fermentation, sterilization of culture media. Safety measures of reactors.

**Types of culture. Downstream processing -** solid-liquid separation, release of intracellular products, concentration, purification and formulation.

**UNIT II - Isolation of microorganism, microbial metabolic products-** primary and secondary metabolites, genetic improvement of strains. production of Organic solvents – alcohol, organic acids – citric acid and lactic acid, antibiotics – penicillin and streptomycin, vitamins – riboflavin and ascorbic acid. Single Cell Protein (SCP)

**UNIT III- DNA in disease diagnosis :** DNA probes, DNA in diagnosis of infectious diseases, genetic diseases, Pharmaceutical products of DNA technology : Human protein replacement, therapeutic agents for human diseases. Recombinant vaccines : subunit vaccines, DNA vaccines, attenuated recombinant vaccines, plants as edible subunit vaccines

**UNIT IV - Plant cell and tissue culture:** cell culture media, cell culture techniques , protoplast culture, protoplast fusion. Methods of gene transfer in plants: Agrobacterium mediated transformation.

**Animal cell culture :** fundamentals and applications. Culture media for animal cells, cultured cells– Biology and characterization, primary culture and cell lines, cell viability and cytotoxicity,.

**UNIT V- Environmental pollution :** Types of pollution, pollution monitoring, biotechnological methods for management of pollution. Biodegradation : xenobiotic compounds. Bioremediation : Types of bioremediation, genetic engineering for efficient bioremediation, bioremediation of contaminated soil and waste land. Microbial mining.

## Text Books and Reference Books

1. Satyanarayana, U. Biotechnology, Uppala Author - Publisher Interlinks, First Edition, 2005.
2. Singh, B.D. Biotechnology – expanding horizons, Kalyani Publishers, First Edition, 2004.
3. Cruger, W. and Cruger, A. Biotechnology – A text book of Industrial Microbiology, Panima Publishing Corporation, Second Edition, 2000.

## COURSE OUTCOMES

At the end of the course, the students will be able to		Cognitive level
CO 1	Know the types of bioreactors. Understand the method of microbes isolation.	Re
CO 2	Learn the mechanism of plant tissue culture. Knowledge on importance of media for tissue culture	Un
CO3	Apply the principles of environmental pollution.	Le
CO4		Re
CO5		Ap

(Un- Understand, Re- Remember, Ap – Apply, Le- Learn, )

Question paper pattern

Max Marks: 75

Exam duration : 3 hours

Part A  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

Part B  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

Part C  $3 \times 10 = 30$  Answer any Three questions (one question from each unit )



Signature of HOD

உயிர் கலெக்டிவில் துறை  
மன்ற கலெக்டரி அரசு கல்லூரி (குடியிருப்பு)  
தஞ்சாவூர் 613005

CONTROLLER OF EXAMINATIONS  
RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)  
THANJAVUR - 613 005.

Credits	4	Hrs/week	6	Sub Code	A4PBCEL4B	Semester	IV	Medium of Instruction	English
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### **SEMESTER – IV- ELECTIVE COURSE 4 (B)**

**(For the students admitted from 2022-2023 onwards)**

#### **MARINE MICROBIOLOGY**

##### **COURSE OBJECTIVES**

To know about marine microflora, marine microbial plants

To understand the cultivation of marine microbes.

To learn sea food microbiology

**Unit I - Marine Microbial Habitats and Diversity** Marine environment–properties of seawater , chemical and physical factors of marine environment-Ecology of coastal, shallow and deep sea microorganism - significance of marine microflora. Diversity of microorganism - Archaea, bacteria, actinobacteria, cyanobacteria, algae, fungi, viruses and protozoa in the mangroves and coral environments

**Unit II- Cultivation of Marine microbes and Nutrient cycling.** Methods of studying marine microorganisms- sample collection- isolation and identification: Cultural, Morphological, physiological, biochemical and Molecular characteristics- Preservation methods of marine microbes.

**Unit III-Marine extremophiles and Bioremediation** Survival at extreme environments – starvation – adaptive mechanisms in thermophilic, alkalophilic, osmophilic and barophilic, psychrophilic microorganisms – hyperthermophiles, halophiles and their importance.

**Unit IV- Seafood microbiology** Pathogenic microorganisms, distribution, indicator organisms, prevention and control of water pollution, quality standards, International and National standards. Microbiology of processed finfish and shellfish products. Rapid diagnosis of contamination in seafoods and aquaculture products.

**Unit V- Marine microbial products** Marine microbial products – Carrageenan, agar-agar, sea weed fertilizers – Astaxanthin,  $\beta$  carotene – enzyme – antibiotics – antitumour agents- polysaccharide – biosurfactants and pigments. Preservation methods of sea foods. Quality control and regulations for microbial quality of fishes, shellfish and Marine living resources used for food and drugs .

### **Text books and Reference books**

1. Belkin S and Colwell RR. Ocean and health: Pathogens in the Marine Environment, Springer. 2005.
2. Bhakuni DS and Rawat DS. Bioactive marine natural products. Anamaya Publishers, New Delhi. 2005.
3. Elay AR. Microbial food poisoning. Chapman and Hall, London. 1992.

### **COURSE OUTCOMES**

<b>At the end of the course, the students will be able to</b>		<b>Cognitive level</b>
CO 1	Know the marine diversity. Understand the marine microbes.	Re
CO 2	Learn the mechanism of bioremediation. Knowledge on sea food microbiology.	Un
CO3	Application of marine products.	Le
CO4		Re
CO5		Ap

(Un- Understand, Re- Remember, Ap – Apply, Le- Learn, )

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

**Part A**  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

**Part B**  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

**Part C**  $3 \times 10 = 30$  Answer any Three questions (one question from each unit )

  
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THANJAVUR - 613 005.**

  
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Thanjavur - 613005.**

Credits	4	Hrs/week	6	Sub Code	A4PBCEL4C	Semester	IV	Medium of Instruction	English
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### **SEMESTER – IV- ELECTIVE COURSE 4 (C)**

**(For the students admitted from 2022-2023 onwards)**

### **INDUSTRIAL POLLUTION AND SAFETY CONTROL**

#### **Objective**

To understand the industry, types of industrial pollution, safety management .

To learn textile industry.

To safety management .

**UNIT I :** Tanneries and Distillary Production of leather, vegetable tanning and chrome tanning processes. Sources and characteristics of wastes. Effect of tannery effluent and other wastes on receiving bodies and treatment methods of the wastes. Sugar mills and Distilleries - their manufacturing processes, sources and characteristics of their wastes. On receiving bodies, Treatment of their wastes and disposal.

**UNIT II :** Paper and Pulp, and textile industries Manufacturing processes, sources and characteristics of wastes. Effect of wastes. Treatment processes of the wastes. Textile mills - manufacturing processes, sources and characteristics of wastes. Effects of the wastes on receiving bodies. Treatment of the wastes.

**UNIT III :** Cement and energy Industries Manufacturing process, sources of pollution and wastes. Effect of wastes. Control technique of pollution. Oil refineries and thermal power plantsprocesses involved. Sources of pollution characteristics of pollutants and their effects. Pollution control techniques.

**UNIT IV :** Fertilizer and pharmaceutical Industries Manufacturing processes, sources and characteristics of wastes and their effects. Treatment processes pharmaceutical plants: manufacturing processes sources and characteristics of wastes and their effects. Treatment of wastes.

**Unit V :** Safety Management and Industrial Acts Industrial safety- Causes of accident, Accident reporting system, Accident prevention, Disaster planning, Safety committee. Hazards control Elimination, Control, Isolation, Substitution, Personal protective equipment, medical first aid- management of medical emergencies.

### Text books and Reference Books

1. Austin GT, Shreves, (1977). Chemical processes in industries. McGraw Hill Book Co., New York
2. Khudesia VP, (1986). Industrial pollution control. Pragati Prakasham, Meerut
3. Mahajan SP, (1986). Pollution Control in process industries. Tata McGraw Hill Co. Ltd., New Delhi
4. Rao MN and Datta, (1982). Wastewater treatment. Oxford and IBH, New Delhi.

### COURSE OUTCOMES

At the end of the course, the students will be able to		Cognitive level
CO 1	Know the principles tannery. Understand the method of Cement technology.	Re
CO 2	Learn the pollution waste. Knowledge on importance of fertilizer.	Un
CO3	Apply the principles of industrial safety.	Le
CO4		Re
CO5		Ap

(Un- Understand, Re- Remember, Ap – Apply, Le- Learn, )

Question paper pattern

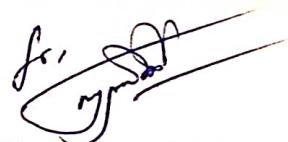
Max Marks: 75

Exam duration : 3 hours

Part A  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

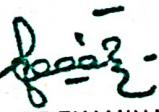
Part B  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

Part C  $3 \times 10 = 30$  Answer any Three questions (one question from each unit )



Signature of HQD

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மன்றங் துபாக் கிடாக்காரி (துறைமுகங்)  
தஞ்சாவூர் 613005.

  
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**THANJAVUR - 613 005.**

Credits	4	Hrs/week	6	Sub Code	A4PBCELSA	Semester	IV	Medium of Instruction	English
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### **SEMESTER – IV- ELECTIVE COURSE 5 (A)**

**(For the students admitted from 2022-2023 onwards)**

### **BIOSTATISTICS AND RESEARCH METHODOLOGY**

#### **COURSE OBJECTIVES**

To understand the basics of biostatistics, research design and research methodology.

To learn Classification of data

To study and applications of data.

**Unit I-** Definition of Biostatistics , Data, sample, variable. Collection of data – Organization of statistical investigation, Planning of statistical investigation, Primary and secondary data,. Methods of data collection, Sampling – Methods of sampling, Advantages and disadvantages of sampling.

**Unit II-** Classification of data – Types of classification, Methods of classification, Frequency distribution, Types and illustration,Diagrammatic presentation of data- Line diagram, Bar diagram, Pie diagram, Pictogram. Graphical presentation of data- Line graph, histogram, Frequency polygon, Frequency curve, Ogive curve.

**Unit III-** Measures of central tendency –Definition of Average, Arithmetic mean- Direct method and short cut method for continuous series, Discrete series, Median – Definition, Calculation of median for individual series, Discrete series,Continuous series, Difference between mean and median,Mode- Definition, Calculation of mode for individual series, Continuous series, Discrete series.

**Unit V-Measures of dispersion –** Definition of dispersion,Properties and classification of dispersion. Standard Deviation – Definition, Calculation of Standard deviation for individual series, Discrete series, Continous series,Merits and demerits of S.D., Definition – Variance, Standard error, Coefficient of variation.

Correlation analysis –Definition, Uses, causation of correlation, Degree of correlation, Types of correlation-, Methods of studying correlation.Karl pearsons correlation for individual series, continuous series and discrete series.Analysis of variance- one way ANOVA and Two way ANOVA.

**Unit V- Principles and method of research designs –experimental and non experimental design, sectional, prospective and retrospective studies. Time scheduling – lab and field facilities, Research duration, choice of research topic, methodology procedure. Preparing, writing and documentation of research reports. Role of computers in biological research and practice.**

#### **Text books and Reference Books**

1. Biostatistics analysis, zar, J.H, Prentice Hall, New Jersey (1984).
2. Statistical methods for biologists, Palanichamy. S and Manoharan. M (1990).
3. Statistical methods by S.P Gupta. S.Chand&Co., (2011).

#### **COURSE OUTCOMES**

<b>At the end of the course, the students will be able to</b>		<b>Cognitive level</b>
CO 1	Know the principles of biostatistics. Understand the method of classification of data.	Re
CO 2	Learn the measure of central tendency. Knowledge on measure of dispersion	Un
CO3	Apply the principles of biostatistics in research	Le
CO4		Re
CO5		Ap

(Un- Understand, Re- Remember, Ap – Apply, Le- Learn, )

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

Part B  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

Part C  $3 \times 10 = 30$  Answer any Three questions (one question from each unit )



**Signature of HOD**

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மாண்பும் அமைச்சர் (சென்றெலி)  
தகுதான் ₹13000/-

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THANJAVUR - 613 005.**

<b>Credits</b>	<b>4</b>	<b>Hrs/week</b>	<b>6</b>	<b>Sub Code</b>	<b>A4PBCEL5B</b>	<b>Semester</b>	<b>IV</b>	<b>Medium of Instruction</b>	<b>English</b>
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### **SEMESTER – IV- ELECTIVE COURSE 5 (B)**

**(For the students admitted from 2022-2023 onwards)**

### **NANOTECHNOLOGY**

#### **COURSE OBJECTIVES**

To learn the basic of nanotechnology and its applications.

To Understand the bionanotechnology

To study Recombinant technology .

**Unit I:** Introduction- Definition, about Bionanomachines, Molecular Bionanotechnology. History of Bionanotechnology; Richard Feynman and his contributions. Biotechnology versus Bionanotechnology. Natural Bionanomachines.

**Unit II:** Structural Principles of Bionanotechnology-Environment in which the Bionanomachines Functions. Principles behind design of Natural Bionanomachines- Covalent bonding, Dispersions and repulsion forces. Hydrogen bonding, Electrostatic Interaction, Hydrophobic effect. Hierarchical strategy in construction of Bionanomachines - Selfassembly, Self- organization. Concept of Molecular recognition.

**Unit III:** Functional Principles of Bionanotechnology- Information storage- Nucleic acid, Ribosomes as assembler to construct proteins. Energetics- Energy from Light, electron transport pathways, electrochemical gradient. Biocatalysts- Enzymes and its regulation. Biomaterials. Biomolecular motors. Molecular sensing- Biosensors.

**Unit IV:** Tools and technique required for Bionanotechnology- Recombinant DNA technology; site directed mutagenesis, Fusion proteins. X-Ray Crystallography, NMR, Electron Microscopy, Atomic force Microscopy. Bioinformatics- Molecular Modeling, Docking, Computer assisted Molecular design.

**Unit V: Applications of Bionanotechnology- Nanomedicines; Immunotoxins, Liposomes as drug carriers, Gene therapy, Personalised Medicines; Lab on chip concept. DNA Computers, Artificial Life, Hybrid materials, Biosensors.**

**Text books and Reference books :**

- 1.Goodsell – Bionanotechnology
- 2.Parag Diwan and Asish Bharadwaj, . - Nanomedicines Pentagan Press, 2006.
- 3.Vladimir P Torchilin, Nanoparticles as Drug Carriers. Imperial College Press, North Eastern University,USA. 2006

**COURSE OUTCOMES**

At the end of the course, the students will be able to		Cognitive level
CO 1	Know the molecular nanotechnology. Understand the method of nanomedicine.	Re
CO 2	Learn the nanomaterials. Knowledge on importance of x ray crystallography	Un
CO3	Applications of nanotechnology	Le
CO4		Re
CO5		Ap

(Un- Understand, Re- Remember, Ap – Apply, Le- Learn, )

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

Part B  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

Part C  $3 \times 10 = 30$  Answer any Three questions (one question from each unit )

  
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பாராமரிசு அரசு கல்லூரி (குடும்ப துறை) 313005.**

Credits	4	Hrs/week	6	Sub Code	A4PBCEL5C	Semester	IV	Medium of Instruction	English
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### **SEMESTER – IV- ELECTIVE COURSE 5 (C)**

**(For the students admitted from 2022-2023 onwards)**

### **ENVIRONMENTAL BIOTECHNOLOGY**

#### **COURSE OBJECTIVES**

To understand the environmental pollutions and its management .

To study waste water treatment.

To learn bioleaching

**UNIT – I :** Environmental pollution and its control measures. Renewable and NonRenewable resources of energy . Conventional and Modern fuels. Microbial hydrogen Production.

**UNIT – II :** Bioremediation of soil & water contaminated with oil spills, heavy metals and detergents. Degradation of lignin and cellulose using microbes. Degradation of pesticides and other toxic chemicals by micro-organisms. Degradation aromatic and chlorinates hydrocarbons and petroleum products.

**UNIT – III:** Treatment of municipal waste and Industrial effluents. Bio-fertilizers Role of symbiotic and asymbiotic nitrogen fixing bacteria. Algal and fungal bio-fertilizers (VAM).

**UNIT – IV :** Bioleaching Enrichment of ores by microorganisms ( gold, copper, and Uranium). Environmental significance of genetically modified microbes, plants and animals.

**UNIT – V :** Restoration of degraded land – reforestation through micro propagation. Development of stress tolerant plants – use of mycorrhiza in reforestation. Use of microbes in soil fertility ( N2 fixing bacteria and Actinomycetes).

#### **Text books and Reference books**

1. Microbial Biotechnology (1995) Alexander n. Glazer Hiroshi Nikaido W.H.Freeman and Company

2. Molecular biotechnology: Principles and Applications of Recombinant DNA – Bernad R. Glick and Jack J. Pasternak ASM Press. Washington, D.C (1994).

3. Fungal Ecology and Biotechnology (1993) Rastogi Publications, Meerut.

### COURSE OUTCOMES

At the end of the course, the students will be able to		Cognitive level
CO 1	Know the principles of environmental pollution. Understand the bioremediation.	Re
CO 2	Learn the waste water treatment. Knowledge on bioleaching.	Un
CO3	Apply the principles of nitrogen fixation.	Le
CO4		Re
CO5		Ap

(Un- Understand, Re- Remember, Ap – Apply, Le- Learn, )

Question paper pattern

Max Marks: 75

Exam duration : 3 hours

Part A  $10 \times 2 = 20$  Answer all questions (Two Questions from each unit)

Part B  $5 \times 5 = 25$  Answer all questions (either or type two questions from each unit)

Part C  $3 \times 10 = 30$  Answer any Three questions (one question from each unit )

  
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மதுவு மற்றும் தொழில் (பொது துறை)  
தாமானி 613005.