

**M. Sc.**  
**BIOCHEMISTRY**  
**SYLLABUS - 2018**

**SCHOOLS OF EXCELLENCE**  
**with**  
**CHOICE BASED CREDIT SYSTEM (CBCS)**



**SCHOOL OF BIOLOGICAL SCIENCES**  
**St. JOSEPH'S COLLEGE (Autonomous)**

Special Heritage Status Awarded by UGC  
Accredited at 'A' Grade (3<sup>rd</sup> cycle) by NAAC  
College with Potential for Excellence Conferred by UGC  
DBT-STAR & DST-FIST Sponsored College  
**TIRUCHIRAPPALLI - 620 002, INDIA**

## SCHOOLS OF EXCELLENCE WITH CHOICE BASED CREDIT SYSTEM (CBCS)

### POSTGRADUATE COURSES

St. Joseph's College (Autonomous), a pioneer in higher education in India, strives to work towards the academic excellence. In this regard, it has initiated the implementation of five "Schools of Excellence" from the academic year 2014-15, to standup to the challenges of the 21st century.

Each School integrates related disciplines under one roof. The school system allows the enhanced academic mobility and enriched employability of the students. At the same time this system preserves the identity, autonomy and uniqueness of every department and reinforces their efforts to be student centric in curriculum designing and skill imparting. These five schools will work concertedly to achieve and accomplish the following objectives.

- Optimal utilization of resources both human and material for the academic flexibility leading to excellence.
- Students experience or enjoy their choice of courses and credits for their horizontal mobility.
- The existing curricular structure as specified by TANSCH and other higher educational institutions facilitate the Credit-Transfer Across the Disciplines (CTAD) - a uniqueness of the choice-based credit system.
- Human excellence in specialized areas
- Thrust in internship and / or projects as a lead towards research and
- The multi-discipline nature of the newly evolved structure (School System) caters to the needs of stake-holders, especially the employers.

### What is Credit system?

Weightage to a course is given in relation to the hours assigned for the course. Generally, one hour per week has one credit. For viability and conformity to the guidelines credits are awarded irrespective of the teaching hours. The following Table shows the correlation between credits and hours. However, there could be some flexibility because of practical, field visits, tutorials and nature of project work.

For PG courses, a student must earn a minimum of 110 credits as mentioned in the table below. The total number of minimum courses offered by a department are given in the course pattern.

## POSTGRADUATE COURSE PATTERN (June 2018 onwards)

Part	Semester	Specification	No. of Courses	Hours	Credits	Total Credits
1	I-IV	<b>Core Courses</b> Theory Practical	12-14 3-6	84	68	81
	II	<b>Self-Paced Learning</b>	1	-	2	
	III	<b>Interdisciplinary Core</b>	1	6	5	
	IV	<b>Comprehensive Examination Project Work</b>	1 1	- 6	2 4	
2	I-III	<b>Core Electives</b>	3	12	12	12
3	II	<b>IDC (Soft Skills)</b>	1	4	4	12
	III	<b>IDC (WS) IDC (BS)</b>	1 1	4 4	4 4	
4	I	<b>Extra Credit Courses-1 (MOOC)</b>	1	-	(2)	(4)
	III	<b>Extra Credit Courses-2 (MOOC)</b>	1	-	(2)	
5	IV	Outreach Programme (SHEPHERD)	1	-	5	5
		<b>TOTAL</b>		<b>120</b>		<b>110 (+4 extra credits)</b>

*Note:* IDC: Inter-Departmental Courses, BS: Between School, WS: Within School

However, there could be some flexibility because of practical, field visits, tutorials and nature of project work. For PG courses, a student must earn a minimum of 110 credits. The total number of courses offered by a department is given above.

### Course Pattern

The Post-Graduate degree course consists of five vital components. They are core course, core electives, IDCs, Extra credit courses, and the Outreach Programme.

### Core Courses

A core course is the course offered by the parent department related to the major subjects, components like theories, practicals, Inter disciplinary core, self paced learning, comprehensive examination, Project work, field visits, library record and etc.

### Inter-disciplinary Core

Inter-disciplinary Core should be shared by the various Departments of every School. This course should be opted by all the students belonging to the particular school. Each department of the respective school should allocate themselves the schedule and the units of the course.

### Core Elective

The core elective course is also offered by the parent department. The objective is to provide choice and flexibility within the department. There are three core electives. They are offered in different semesters according to the choice of the school.

### Extra Credit Courses

In order to facilitate the students gaining extra credits, the extra credit courses are given. According to the guidelines of UGC, the students are encouraged to avail this option of enriching by enrolling themselves in the Massive Open Online Courses (MOOC) provided by various portals such as SWAYAM, NPTEL etc.

### Inter-Departmental Courses (IDC)

IDC is an interdepartmental course offered by a department / School for the students belonging to other departments / school. The objective is to provide mobility and flexibility outside the parent department / School. This is introduced to make every course multi-disciplinary in nature. It is to be chosen from a list of courses offered by various departments.

There are three IDCs. Among three, one is the Soft-Skill course offered by the JASS in the II Semester for the students of all the Departments. The other one is offered "With-in the school" (WS) and the third one is offered "Between the school" (BS). The IDCs are of application oriented and inter disciplinary in nature.

### Subject Code Fixation

The following code system (9 characters) is adopted for Post Graduate courses:

Year of Revision	PG Code of the Dept	Semester	Specification of Part	Running number in the part
↓	↓	↓	↓	↓
18	P##	x	x	xx
<b>18</b>	<b>PBI</b>	<b>1</b>	<b>1</b>	<b>01</b>

### For Example :

**IMSc - Biochemistry**, first semester '**Biomolecular Chemistry**'

The code of the paper is **18PBI1101**.

Thus, the subject code is fixed for other subjects.

### Specification of the Part

- I - Core Courses: (Theory, Practical, Self paced Learning, Inter-disciplinary Core, Core, Comprehensive Examination, Project work)
- II - Core Electives
- III - Inter Departmental Courses (WS, Soft Skill & BS)
- IV - Extra credit courses
- V - Outreach Programme (Shepherd)

### EXAMINATION

#### Continuous Internal Assessment (CIA):

PG - Distribution of CIA Marks	
Passing Minimum: 50 Marks	
Library Referencing	5
3 Components	35
Mid-Semester Test	30
End-Semester Test	30
<b>CIA</b>	<b>100</b>

### Mid-Semster & End-Semester Tests

Centralised – Conducted by the office of Controller of Examinations

1. Mid-Semester Test & End-Semester Test: (2 Hours each); will have Objective + Descriptive elements; with the existing question pattern PART-A; PART-B; and PART-C
2. CIA Component III for UG & PG will be of 15 marks and compulsorily objective multiple choice question type.
3. The CIA Component III must be conducted by the department / faculty concerned at a suitable computer centres.
4. The 10 marks of PART-A of Mid-Semester and End-Semester Tests will comprise only: OBJECTIVE MULTIPLE CHOICE QUESTIONS; TRUE / FALSE; and FILL-IN BLANKS.
5. The number of hours for the 5 marks allotted for Library Referencing/ work would be 30 hours per semester. The marks scored out of 5 will be given to all the courses (Courses) of the Semester.
6. English Composition once a fortnight will form one of the components for UG General English

## SEMESTER EXAMINATION

Testing with Objective and Descriptive questions

### Part-A: Objective MCQs only (30 Marks)

Answers are to be marked on OMR score-sheet. The OMR score-sheets will be supplied along with the Main Answer Book. 40 minutes after the start of the examination the OMR score-sheets will be collected

### Part-B & C: Descriptive (70 Marks)

**Part-B:** 5 x 5 = 25 marks; inbuilt choice;

**Part-C:** 3 x 15 = 45 marks; 3 out of 5 questions, open choice.

### The Accounts Paper of Commerce will have

**Part-A:** Objective = 25 marks

**Part-B:** 25 x 3 = 75 marks

**Duration of Examination must be rational;** proportional to teaching hours  
90 minute-examination / 50 Marks for courses of 2/3 hours/week (all Part IV UG Courses) 3-hours examination for courses of 4-6 hours/week.

## GRADING SYSTEM

### 1. Grading

Once the marks of the CIA and the end-semester examination for each of the courses are available, they will be added. The marks thus obtained, will then be graded as per the scheme provided in the following Table-1.

From the second semester onwards, the total performance within a semester and the continuous performance starting from the first semester are indicated by Semester **Grade Point Average (GPA)** and **Cumulative Grade Point Average (CGPA)** respectively. These two are calculated by the following formulae:

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

where,

'C<sub>i</sub>' is the Credit earned for the Course-*i*,

'G<sub>i</sub>' 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:** Average GPA of all the Courses starting from the first semester to the current semester.

## 2. Classification of Final Results

- The classification of final results shall be based on the CGPA, as indicated in the following Table-2.
- For the purpose of Classification of Final Results, the candidates who earn the CGPA 9.00 and above shall be declared to have qualified for the Degree as 'Outstanding'. Similarly, the candidates who earn the CGPA between 8.00 and 8.99, 7.00 and 7.99, 6.00 and 6.99, and 5.00 and 5.99 shall be declared to have qualified for their Degree in the respective programmes as 'Excellent', 'Very Good', 'Good', and 'Above Average' respectively.
- Absence from an examination shall not be taken as an attempt.

**Table-1: Grading of the Courses**

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 70	7	B+
50 and above but below 60	6	B
Below 50	NA	RA

**Table-2: Final Result**

CGPA	Classification of Final Results	Corresponding Grade
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	RA	Re-appearance

Credit based weighted Mark System is to be adopted for individual semesters and cumulative semesters in the column 'Marks Secured' (for 100).

A Pass in Outreach Programme (SHEPHERD) will continue to be mandatory although the marks will not count for the calculation of the CGPA.

### Declaration of Result:

Mr./Ms. \_\_\_\_\_ has successfully completed the Post Graduate in \_\_\_\_\_ programme. The candidate's Cumulative Grade Point Average (CGPA) is \_\_\_\_\_ and the class secured \_\_\_\_\_ by completing the minimum of 110 credits.

The candidate has also acquired \_\_\_\_\_ (if any) extra credits offered by the parent department courses.



**M.Sc. BIOCHEMISTRY**  
**Course Pattern - 2018 Set**

Sem.	Code	Course	Hours	Credit
I	18PBI1101	Core 1 – Biomolecular chemistry	6	5
	18PBI1102	Core 2 - Molecular Biology	6	5
	18PBI1103	Core 3 – Bioenergetics and Enzymology	6	5
	18PBI1104	Core 4 - Lab course – 1	8	6
	18PBI1201A	Core Elective 1A – Developmental Biology (OR)	4	4
	18PBI1201B	Core Elective 1B- Biochemistry of Natural products		
	18PBI1401	Extra credit course-1		(2)
<b>Total</b>			<b>30</b>	<b>25 + 2*</b>
II	18PBI2105	Core 5 - Microbiology	4	4
	18PBI2106	Core 6 - Research methodology	5	4
	18PBI2107	Core 7 – Human Physiology	5	4
	18PBI2108	Core 8 - Lab course 2	8	6
	18PBI2109	Self-paced learning - Advanced Nutrition	-	2
	18PBI2202A	Core Elective 2A- Life sciences for competitive examinations-I (OR)	4	4
	18PBI2202B	Core Elective 2B- Molecular diagnostics		
	18PSS2301	IDC 1- Soft skills	4	4
<b>Total</b>			<b>30</b>	<b>28</b>
III	18PBI3110	Core 9 –Pharmaceutics and Nanotechnology	4	3
	18PBI3111	Core 10 – Genetic Engineering	4	3
	18PBI3112	Core 11 - Lab course 3	4	4
	18SBS3101	Inter-disciplinary Core: Solid Waste Management	6	5
	18PBS3101B	Inter-disciplinary Core: Immunology		
	18PBI3203A	Core Elective 3A- Life Sciences for Competitive Examinations –II (OR)	4	4
	18PBI3203B	Core Elective 3B- Pharmaceutical Biochemistry		
	18PBI3301	IDC WS (within schools) – Herbal Technology	4	4
	18PBI3302	IDC BS (between schools)- First Aid Management	4	4
	18PBI3402	Extra credit course-2	-	(2)
<b>Total</b>			<b>30</b>	<b>27+ 2*</b>
IV	18PBI4113	Core 12 - Clinical Biochemistry	6	5
	18PBI4114	Core 13 – Advanced Endocrinology	6	4
	18PBI4115	Core 14 – Laboratory Course -4	5	5
	18PBI4116	Core 15 –Laboratory course -5	5	5
	18PBI4117	Comprehensive examination	-	2
	18PBI4118	Project Work	8	4
<b>Total</b>			<b>30</b>	<b>25</b>
	18PCW4501	Outreach Programme (SHEPHERD)	-	5
<b>Total for all semesters</b>			<b>120</b>	<b>110+4*</b>

\* Extra Credits

**Programme Outcomes (POs):**

1. Graduates are prepared to be creators of new knowledge leading to innovation and **entrepreneurship employable** in various sectors such as private, government, and research organizations.
2. Graduates are trained to evolve new technologies in their own discipline.
3. Graduates are groomed to engage in lifelong learning process by exploring their knowledge independently.
4. Graduates are framed to design and conduct experiments /demos/create models to analyze and interpret data.
5. Graduates ought to have the ability of effectively communicating the findings of Biological sciences incorporating with existing knowledge.

**Programme Specific Outcomes (PSOs):**

1. Graduates are prepared to be creators of new knowledge in the field of life sciences, causing innovation and entrepreneurship, employable in various sectors such as private, government, and clinical /biomedical research organizations.
2. Graduates are trained to study and evolve the biomolecular mechanisms for the life processes in health and diseases, in living beings.
3. Graduates are groomed to carry on research in biology on chemical basis, by exploring their knowledge independently.
4. Graduates are encouraged to design and conduct experiments, to analyze and interpret biological problems, behind the research process.
5. Graduates ought to have the ability of effectively communicating the findings of Biological sciences with existing knowledge.
6. Appreciate proficiency in related disciplines such as molecular biology, endocrinology and immunology.
7. Graduates are instructed to work as a team to solve problems with traditional and modern laboratory tools.
8. Finally the graduates identify a plan for higher education or career in diverse fields.

Semester I  
18PBI1101

Hours/Week: 6  
Credits : 5

### BIOMOLECULARCHEMISTRY

#### Course Outcomes:

The course assures to provide the students with

1. A basic understanding of the molecular makeup of the living cells.
2. A thorough knowledge on the types, structure and functions of carbohydrates.
3. The metabolism of dietary and endogenous carbohydrates.
4. The fundamental insight on the types, structures and functions of amino acids and proteins.
5. The biosynthesis and chemical reactions of lipids.
6. The denovo synthesis and degradation pathways of nucleic acids.
7. The integration of various metabolic pathways.
8. At the end of the course, the students will be able to demonstrate the biomolecular constitution and metabolic processes

#### Unit – I: The molecular logic of life:

The chemical unity of diverse living organisms, composition of living matter: Water – Physiochemical properties, biomolecular reactions. Macromolecules and their monomeric subunits: Carbohydrates – classification, structure and isomerism. Monosaccharides, oligosaccharides & polysaccharides – structure and properties. Amino acids - structures, classification and properties. Proteins – classification, types, characteristics and structures, functions. Lipids – classification, sources and biological functions. Nucleic acids- bases, nucleosides & nucleotides.

#### Unit – II: Metabolism of Carbohydrates

Glycolysis, Citric acid cycle, HMP shunt, Glucuronic acid pathway, Gluconeogenesis, Glycogenesis, Glycogenolysis, Glyoxylate cycle. Regulations of Glycolysis and Gluconeogenesis. Metabolism of Amino sugars - Sialic acids, Mucopolysaccharides and glycoproteins.

#### Unit – III: Metabolism of Proteins and Amino acids

Biosynthesis of aspartate, pyruvate and aromatic amino acid families, Amphibolic activity of amino acids. Methods for determining protein conformations, symmetry and functional properties, protein folding, denaturation & renaturation. Ramachandran plot, solid state synthesis of peptides and sequence determination. Degradation of proteins and amino acids. Urea cycle and its significance.

#### Unit – IV: Metabolism of lipids

Biosynthesis of fatty acids, hydroxy fatty acids, acylglycerols and their regulation. Membrane lipids - phospholipids, sphingolipids & eicosanoids. Cholesterol biosynthesis and its regulation. Fatty acid degradation. Lipoproteins- types and functions. Methods of inter organ transport of fatty acids. Formation of ketone bodies.

#### Unit – V: Metabolism of nucleic acids

Structure of RNAs and DNA, forces stabilizing nucleic acid structures. Fractionation, sequencing and chemical synthesis of oligonucleotides. Denaturation and hybridization. Synthesis of purines and pyrimidines, synthesis of deoxy ribonucleotides. Biosynthesis of nucleotide coenzymes, nucleotide degradation.

#### Text books for study:

1. Robert K. Murray *et al*, 2000. Harper's Biochemistry, Appleton and Lange Stamford Publishers, Connecticut.
2. Lehninger, A. L. *et al.*, 1993. Principles of Biochemistry, Worth Publishers. Inc. USA.

#### References

1. Stryer, I., 1988. Biochemistry (2nd Edition), W.H. Freeman & Co., New York.
2. White, A. *et al.*, 1959. Principles of Biochemistry, McGraw Hill Book Co., New York.
3. Donald Voet and Judith, G. Voet. 2011. Biochemistry. (4th Edition). John Wiley and Sons, New York.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester I	Course Outcomes (COs)	Code 18PBI1101	Title of the Paper BIOMOLECULAR CHEMISTRY												Hours 6	Credits 5
			Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								
Mean Score of COs																
CO1	2	3	2	2	3	4	5	5	3	2	3	2	4	3.07		
CO2	2	4	3	4	4	0	4	3	4	3	5	4	5	3.46		
CO3	4	4	3	0	5	4	5	3	5	4	3	4	3	3.61		
CO4	3	3	4	2	3	4	2	0	4	5	3	4	5	3.23		
CO5	4	5	3	2	4	3	4	3	4	3	3	4	3	3.46		
CO6	5	5	3	4	3	2	2	3	4	3	5	4	3	3.53		
CO7	4	3	5	3	4	2	4	3	5	3	4	3	4	3.61		
CO8	5	3	4	2	4	3	5	4	3	5	4	3	4	3.76		
Overall Mean Score for COs																
3.53																

Result: The Score for this Course is 3.53 (High Relationship)

Note:

Mapping Scale	1-20%	21-40%	41-60%	61-80%	81-100%
Relation	1	2	3	4	5
Quality	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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Semester I  
18PBI1102

Hours/Week: 6  
Credits : 5

## MOLECULAR BIOLOGY

### Course Outcomes:

The course assures to provide the students with

1. The pioneering experiments involved in molecular biology.
2. A basic understanding of the mobile genetic elements.
3. The molecular machinery of replication.
4. The mechanisms of different types of recombination.
5. The steps involved in the induction of transcription.
6. The gene expression and the regulation of cellular functions in cells.
7. The various steps involved in translation.
8. The errors and correction mechanisms of informational molecules

### Unit – I: Introduction:

Terms and definitions – DNA is the Genetic Material: Griffith's Experiment, Avery, Hershey & Chase Experiment. RNA as the Genetic Material: Conrat & Singer Experiment with TMV – Central Dogma. Viral genome – types of RNA and their role.

Organization of Chromosome: Structural organization of eukaryotic chromosomes. Types and basic structure of chromosomes. Chromosomal Proteins – Histones and Protamines – nucleosomes – levels in the organization of Metaphase Chromosome. Organization of prokaryotic DNA. Special types of Chromosomes: Polytene and Lamp brush chromosomes. Duplication & segregation of Chromosomes.

### Unit – II: Transposons:

Discovery of IS elements, Transposons in Bacteria (Tn elements), Maize (Ac/Ds and Sp/Dsp elements), Drosophila (P elements) and Yeast (Ty elements). Transposition, Genetic and evolutionary significance of transposons.

Extra chromosomal DNA: Maternal Inheritance, Structure, gene contents and functions of Chloroplast and Mitochondrial DNA, theory of prokaryotic endosymbionts. Plasmids: Definition, Types, Structure, Properties, gene content. Use in rDNA technology.

### Unit – III: DNA replication:

Models – Messelson & Stahl Experimental proof for Semi-conservative replication - Rules, requirements, problems and molecular mechanism of the replication of linear and circular (Rolling circle Model) DNA in prokaryotes

and eukaryotes. DNA polymerases – structure and function. Replication of RNA – RNA and DNA mediated.

Recombination: Homologous and non-homologous recombination- Site specific recombinations & transposition of DNA.

#### Unit – IV: Transcription:

RNA types (tRNA, mRNA, rRNA, Ribozyme, snRNA, hnRNA ,RNAi, RNA-P and microRNA), structure and functions. Transcription mechanism in prokaryotes and eukaryotes – initiation, elongation and termination, Post transcriptional modifications. Antibiotic inhibitors of transcription.

Translation: Genetic code and its features. Wobbling hypothesis. Machinery, initiation, elongation and termination of translation in bacteria and eukaryotes. Translational proof reading, translational inhibitors, post-translational modifications, chaperones and protein targeting- translocation, heat shock proteins, glycosylation; SNAPs and SNAREs. Bacterial signal sequences. Mitochondrial, chloroplast and nuclear protein transport. Endocytosis – viral entry. Ubiquitin TAG protein destruction.

#### Unit – V: Chromosomal changes and consequences:

Changes in the chromosome number: euploidy and aneuploidy and related genetic disorders. Changes in the chromosome structure: addition, deletion, inversion and translocation and related genetic disorders.

Mutation: Definition, chemical basis and types. Mutagens: Physical and chemical. Mutant types– lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis. DNA repair mechanism: thymine dimer, light activation, excision, recombinational, SOS and mismatch repair.

#### Text books for study

1. David Freifelder, 2008. Molecular Biology. (Ed: 2). Narosa Publications. New Delhi.
2. Jeoffrey M. Cooper & Rober E. Hausman. 2000. The Cell: A Molecular Approach ASM Press, Washington D.C.

#### References

1. Ajoy Paul. 2007. Textbook of Cell and Molecular Biology. Books and Allied, Kolkata
2. De Robertis and De Robertis. 1990. Cell and Molecular Biology. Saunders, Philadelphia.
3. Gerald Karp. 2008. Cell and Molecular Biology. (Ed: 5). John Wiley and Sons, New York.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester I	Code 18PB1102	Title of the Paper MOLECULAR BIOLOGY													Hours 6	Credits 5
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8			
CO1	2	3	4	2	3	4	3	5	3	4	3	3	4	3.30		
CO2	4	3	2	3	4	5	3	3	4	3	3	4	3	3.38		
CO3	5	2	3	2	2	4	3	5	3	2	3	4	4	3.23		
CO4	3	3	4	3	2	3	4	3	2	2	3	2	3	2.84		
CO5	4	3	5	3	3	4	4	2	3	4	2	4	4	3.46		
CO6	3	4	3	2	3	4	3	2	3	2	4	4	3	3.07		
CO7	4	3	4	3	5	4	3	4	3	2	3	2	3	3.30		
CO8	3	2	3	2	1	2	3	2	3	4	3	4	5	2.84		
Overall Mean Score for COs														3.18		

Result: The Score for this Course is 3.18 (High Relationship)

Note:

Mapping Scale	1-20%	21-40%	41-60%	61-80%	81-100%
Relation	1	2	3	4	5
Quality	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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### BIOENERGETICS AND ENZYMOLOGY

#### Course Outcomes:

1. An understanding of bioenergetics.
2. The uniqueness of enzyme catalyzed reactions - activation energy.
3. A knowledge concerning biotransformation reactions involving enzymes.
4. Mechanism of action of selected enzymes.
5. Enzyme reactions and its characteristics along with the production and purification process
6. The methods in enzyme inhibition.
7. The understanding of enzyme kinetics and
8. The applications of enzymes in various fields.

#### Unit – I: Thermodynamics:

Terms, basic concepts and types of thermodynamic systems. Enthalpy and biochemical reactions, biological thermodynamic standard state, activation energy. Biological oxidation, reduction reactions. ETC and oxidative phosphorylation. High-energy phosphate compounds, role of ATP in biological system; energy transfer; acyl-phosphate group transfer.

#### Unit – II: Basics of Enzymology:

Historical aspects of enzymology, nomenclature and classification of enzymes according to IUB-EC-1964. Intracellular localization of enzymes, homogenization techniques, isolation and fractionation of enzymes – classical methods of purification and crystallization - separation based on molecular size, electric charge, solubility difference and selective adsorption, criteria of purity, units of enzyme activity. Turn over number, specific activity, specificity. Active site- definition, organization and determination of active site residues.

#### Unit – III: Criteria of chemical reactions:

Collision & transition state theories, specificity of enzymes. Mechanism of catalysis: Proximity and orientation effects, general acid-base catalysis, concerted acid - base catalysis, nucleophilic and electrophilic attacks, catalysis by distortion, metal ion catalysis. Theories on mechanism of catalysis. Coenzymes - structure and functions, Mechanism of enzyme action: mechanism of action of lysozyme, chymotrypsin, carboxypeptidase and DNA

polymerase. Isoenzymes. Multienzymes system- mechanism of action and regulation of pyruvate dehydrogenase, LDH and fatty acid synthase complex.

#### Unit – IV: Kinetics of catalysed reaction:

Single substrate reactions, bisubstrate reactions, concept and derivation of Michaelis–Menten equation, Briggs Haldane relationship, Determination and significance of kinetic constants, limitations of Michaelis – Menten kinetics. Inhibition kinetics- competitive, non-competitive and uncompetitive. Allosteric inhibition, cooperative, cumulative, feedback inhibition.

#### Unit – V: Applications of Enzymes:

Various methods of immobilization - ionic bonding, adsorption, covalent bonding (based on R groups of amino acids), microencapsulation and gel entrapment. Immobilized multienzyme systems. Biosensors - glucose oxidase, cholesterol oxidase, urease and antibodies as biosensors. Abzymes and ribozymes. Enzymes of clinical importance and diagnostic significance. Enzyme engineering.

#### Text books for study

1. Dixon, M. and Webb, J.F., 1979, Enzymes, Longman Publishing, London.
2. Price and Stevens, 1999, Fundamentals of Enzymology, Oxford University Press, UK.

#### References

1. Trevor Palmer, 1991, Understanding Enzymes, 3rd Edition, Ellis Harwood, UK.
2. Lehninger, A. H. *et al.*, 1993, Principles of Biochemistry, Worth Publ. Inc., USA.
3. Jeremy M .Berg., John L Tymoczko and Lubert Stryer. 2007. Biochemistry. (6th Edition). W H Freeman and Co, New York.

**Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes**

Semester I	Code 18PBH1103	Title of the Paper BIOENERGETICS AND ENZYMOLOGY												Hours 6	Credits 5
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	2	3	3	4	2	2	4	3	3	4	3	4	3	3.07	
CO2	3	2	4	3	2	2	4	3	2	4	3	4	3	3.00	
CO3	3	2	3	4	2	3	3	2	3	2	3	2	3	3.07	
CO4	4	3	2	3	2	3	2	2	4	3	4	3	4	3.15	
CO5	4	2	4	2	2	3	4	4	3	3	2	3	3	3.00	
CO6	3	4	2	3	4	2	3	4	2	3	4	3	3	3.07	
CO7	3	4	3	3	2	3	2	4	3	4	3	4	2	3.07	
CO8	3	4	2	3	4	3	3	2	3	4	3	2	3	3.00	
Overall Mean Score for COs															3.05

**Result: The Score for this Course is 3.0 (High Relationship)**

*Note:*

<b>Mapping Scale</b>	<b>1-20%</b>	<b>21-40%</b>	<b>41-60%</b>	<b>61-80%</b>	<b>81-100%</b>
<b>Relation</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>Quality</b>	<b>0.0-1.0 Very poor</b>	<b>1.1-2.0 Poor</b>	<b>2.1-3.0 Moderate</b>	<b>3.1-4.0 High</b>	<b>4.1-5.0 Very High</b>

*Values Scaling:*

<b>Mean Score of COs</b> = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	<b>Mean Overall Score for COs</b> = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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**Semester I  
18PBI1104**

**Hours/Week: 8  
Credits : 6**

**Laboratory Course-1: BIOCHEMISTRY AND ENZYMOLOGY**

**Course Outcomes:**

1. Basic skills in the biochemistry lab.
2. Accurate use of pipettes, making solutions for enzyme and biochemical study.
3. The analyzes of the nutritive value of oils.
4. The estimation of vitamin C from fruits and vegetables.
5. The isolation and estimation of nucleic acids.
6. Safety measurements along with the quantification of biomolecules.
7. Purification methods of enzymes.
8. Kinetics of selected enzymes with influencing factors.

**BIOCHEMISTRY**

1. Estimation of liver glycogen.
2. Estimation of amino acids by Sorenson's formal titration.
3. Estimation of Iodine value of oil.
4. Estimation of Acid value of oil.
5. Estimation of Reducing sugars by Benedict's titration.
6. Estimation of Tryptophan
7. Estimation of Vitamin C (Titration)
8. Extraction and Estimation of DNA and RNA

**ENZYMOLOGY**

1. Assay of acid phosphatase.
2. Factors influencing reaction rates of acid phosphatase
  - i) Effect of Temperature
  - ii) Effect of Time
  - iii) Effect of pH
  - iv) Effect of Enzyme concentration
  - v) Effect of substrate concentration
  - vi) Measurements of Vmax & Km

**References**

1. Praful. B. Godkar, 2014, Text book of Medical laboratory technology; III edition, Volume I and II, Bhalani Publishing house.
2. Alan H. Gowenlock, Varley's Practical Clinical Biochemistry, 6th Edition; CBS publishers.
3. Sadasivam, S. and Manickam, A. 2010. Biochemical Methods. (3rd Edition), New Age International (P) Ltd., New Delhi.
4. David T. Plummer. 1988. Practical Biochemistry. (3rd Edition). Tata McGraw Hill Publishers, New Delhi.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester I	Code 18PB1104	Title of the Paper Laboratory Course-I: BIOCHEMISTRY AND ENZYMOLOGY										Hours 8	Credits 6	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	4	3	3	5	4	3	4	3	4	5	4	4	5	3.92
CO2	3	4	3	3	4	5	2	4	1	4	5	4	3	3.46
CO3	3	4	2	4	3	4	3	5	4	3	5	2	4	3.53
CO4	3	4	4	5	4	2	4	4	3	4	4	3	4	3.69
CO5	3	2	4	4	3	4	5	4	5	2	3	5	3	3.61
CO6	4	5	4	4	3	4	5	4	2	3	4	3	3	3.69
CO7	4	3	5	4	3	4	5	3	4	2	5	4	3	3.76
CO8	4	3	5	4	3	2	5	4	3	5	4	3	4	3.76
Overall Mean Score for COs														3.68

Result: The Score for this Course is 3.68 (High Relationship)

Note:

Mapping Scale	1-20%	21-40%	41-60%	61-80%	81-100%
Relation	1	2	3	4	5
Quality	0.0-1.0 Very poor	1.1-2.0 Poor	2.1-3.0 Moderate	3.1-4.0 High	4.1-5.0 Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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Semester I  
18PB11201A

Hours/Week: 4  
Credits : 4

### Core Elective-1A DEVELOPMENTAL BIOLOGY

#### Course Outcomes:

1. The cellular basis of development.
2. Fundamental knowledge of animal embryonic development.
3. The process and mechanisms of sex determination in mammals.
4. The axis formation and somites in the organisms.
5. The insight to the development of various organs.
6. Learn how genes function to control phenotype of an organism.
7. Learn how genes function to cause tissue differentiation.
8. The role of environment in the developmental process.

#### Unit – I: Basic concepts:

General principles of cell-cell communication in development: cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, paracrine factors. General concept of organisms development: Potency, commitment, specification, induction, competence, determination & differentiation; morphogenetic gradients; cell fate & cell lineages; genomic equivalence and cytoplasmic determinants; imprinting.

#### Unit – II: Fertilization, development and sex determination in humans:

Gametogenesis - Sperm & Egg formation; ultra structure of sperm and ovum, egg types, egg membrane. Fertilization, cleavage, Morula, Implantation, blastulation, gastrulation, formation of germ layers, axis formation - anterior and posterior. Sex determination - chromosomes and environment.

#### Unit – III: Organogenesis - I:

Central nervous system and the epidermis - Formation of neural tube, Differentiation of the neural tube, tissue architecture of the central nervous system, origin of cutaneous structures. Neural crest cells and axonal specificity - specification, Trunk neural crest, pattern generation in the nervous system.

#### Unit – IV: Organogenesis - II:

Paraxial and intermediate mesoderm - Somites formation, Osteogenesis, Urogenital system. Lateral plate mesoderm and endoderm - Heart formation, digestive tube and its derivatives.

### Unit – V: Implications of developmental biology:

Medical implications of developmental biology - genetic disorders in human development, environmental assaults on human development, Future therapies and developmental biology, Environmental regulation of animal development - Environment as a part of normal development, Polyphenisms and plasticity, Learning system.

### Text books for study

1. Gilbert S.F. 2010. Developmental Biology, (Ed: 9) Sinauer Associates Inc. Massachusetts.

### References

1. Alberts B. *et al.* 2002. Molecular Biology of the Cell, (Ed: 3) Garland Science, NY.
2. Harvey Lodish., Arnold Berk and Paul Matsudaira. 2008. Molecular Cell biology. (5th Edition). W. H. Freeman and Company, New York.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester I	Code 18PB11201A	Title of the Paper Core Elective-IA: DEVELOPMENTAL BIOLOGY					Hours 4	Credits 4							
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	3	4	2	2	4	2	3	2	3	3	2	0	3	3.15	
CO2	2	3	4	2	1	2	3	4	3	5	1	2	3	3.30	
CO3	4	2	3	4	3	3	4	2	5	3	4	3	4	3.38	
CO4	2	3	4	3	2	5	2	3	3	2	3	2	3	3.23	
CO5	3	2	3	2	4	3	2	3	2	3	4	2	3	2.76	
CO6	4	3	2	3	4	3	2	3	4	3	2	4	3	3.07	
CO7	4	3	4	2	3	4	3	2	3	4	3	2	5	3.23	
CO8	4	5	4	3	2	3	4	4	3	5	4	3	4	3.69	
Overall Mean Score for COs															3.23

Note:

Mapping Scale	1-20%	21-40%	41-60%	61-80%	81-100%
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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Semester I  
18PBI1201B

Hours/Week: 4  
Credits : 4

**Core Elective-1B**  
**BIOCHEMISTRY OF NATURAL PRODUCTS**

**Course Outcomes:**

1. The occurrence, properties and economic importance of natural products from plants, animals and microbes.
2. The Classification of the natural compounds based on chemistry and applications
3. The isolation strategies of natural products
4. The therapeutic importance of those natural products.
5. The identification of the commercially important natural products.
6. The medicinal importance of saponins
7. The therapeutic importance of Terpenoids
8. The therapeutic applications of secondary metabolites

**Unit – I: General aspect of sources of medicinal plant products**

Introduction to primary and secondary metabolites, types of secondary metabolites, production under stress, isolation of active constituent from plant material.

**Unit – II: Alkaloids**

Definition, general properties, classification based on nitrogen heterocyclic ring, types - phenylalkylamines, pyridine alkaloids, tropane alkaloids, quinolizidine and pyrrolizidine alkaloids, isoquinoline alkaloids, quinoline, monoterpene, indole alkaloids, purine alkaloids, ruta alkaloids, medicinal importance of each type. Role of alkaloids in plants.

**Unit – III: Saponins and Steroids**

Definition, general properties, medicinal importance of saponins. Important saponins of plant origin - diosgenin, hecogenin, glycyrrhizin, aescin and ginseng. Steroids: General properties, classification. Introduction and medicinal importance of - cardiac glycosides from *Digitalis*, *Strophanthus*, *Urginea*, steroids from *Withania somnifera*, *Holarrhena* and *Solanum*.

**Unit – IV: Terpenoids**

Definition, general properties, classification, introduction and medicinal importance of terpenoids. General account and medicinal importance of myrcene, ocimene, citronellol, menthol and camphor. Tannins, lignins and pectins: General properties and classification.

**Unit – V: Plant pigments**

Occurrence, classification, introduction and applications of carotenoids, xanthophylls, anthocyanins, flavones, flavonols. Acetate pathway and Shikimic acid pathway. Definition, general properties and importance of Pyrethroids and rotenones of plant origin. Natural products of therapeutic importance from animals- Zootherapy -Venom, Body fluids as medicines – Urine, Saliva and Faeces. Isolation, qualitative and quantitative analysis of secondary metabolites (Skill component).

**Text books for Study**

1. K. G. Ramawat and J. M. Merillon (Eds.), 2010, Biotechnology - secondary metabolites, Oxford & IBH publishing Co. Pvt. Ltd.
2. J. Mann, R. S. Davidson, J. B. Hobbs, D. V. Banthrope, J. B. Harborne, 1994, Natural Products: Their Chemistry and Biological Significance, Longman Pub Group.

**References**

1. Chemistry and biology of herbal medicine: V. P. Agrawal and V. P. Khamboj, (Eds.) (Society of Biosciences).
2. G. E. Trease and W. C. Evans, 2002, Pharmacognosy and Phytochemistry, 15th Edition, W.B. Saunders Edinburgh, New York.
3. Gurdeep Chatwal, 1995, Organic chemistry of natural products, Himalaya Publishing House, India.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester I	Code 18PB1201B	Title of the Paper Core Elective-IB: BIOCHEMISTRY OF NATURAL PRODUCTS												Hours 4	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	4	3	2	3	4	3	4	2	3	4	5	3	2	3.23	
CO2	3	2	3	4	3	4	3	2	1	5	3	2	4	3.15	
CO3	3	2	3	4	3	5	3	2	4	3	5	4	3	3.38	
CO4	4	3	4	2	2	4	3	2	3	4	2	3	3	3.23	
CO5	4	5	4	3	5	4	3	3	4	3	4	3	4	3.76	
CO6	4	4	3	2	5	3	4	3	4	5	3	4	3	3.61	
CO7	5	4	3	4	2	3	4	3	4	5	4	3	4	3.69	
CO8	4	4	2	3	5	4	3	4	3	4	3	4	3	3.53	
Overall Mean Score for COs															3.45

Result: The Score for this Course is 3.45 (High Relationship)

Note:

Mapping		1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1		2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0	
Quality	Very poor	Poor	Moderate	High	Very High	

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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Semester II  
18PB12105

Hours/Week: 4  
Credits : 4

## MICROBIOLOGY

### Course Outcomes:

1. The basic classification and characteristic features of microbes;
2. The implications of microbes in the environment;
3. Awareness on the infectious diseases, their diagnosis and treatment options;
4. The microbial metabolism.
5. The etiology of infectious diseases.
6. The molecular mechanisms of infection.
7. The applications of microbiology in various industries.
8. The use of microbes for producing nutrients for mankind.

### Unit – I: General microbiology

Introduction and scope of microbiology. Brief study of structure and organization of major groups of microorganisms - Archaeobacteria, cyanobacteria, eubacteria, fungi, algae, protozoa and viruses. Culture of microorganisms – batch, continuous and pure cultures. Control of microorganisms – physical, chemical and chemotherapeutic agents. Preservation of microorganisms.

### Unit – II: Environmental microbiology

Microbiology of soil – soil microflora, role of soil microbes in biogeochemical cycles (C,N,S) - Marine and fresh water microbiology. Contamination of domestic and marine waters. Water purification and sewage treatment. Microbes in waste water treatments. Microbiology of air.

### Unit – III: Industrial microbiology

Selection of industrially useful microbes. Fermentors and fermentation technology. Industrial production of alcohol, vinegar, lactic acid, antibiotics, enzymes and amino acids. Microbiology of food: sources of contamination, food spoilage and food preservation methods.

### Unit – IV: Clinical microbiology

Epidemic, endemic, pandemic and sporadic diseases. Pathogenicity, virulence and infection. Epidemiology of infectious diseases. Bacterial diseases of human (typhoid, cholera, syphilis, gonorrhoea and pertusis). Fungal diseases of human (superficial, cutaneous, subcutaneous and systemic mycoses) Mycotoxins. Viral diseases of human (AIDS, hepatitis, polio, rabies and

measles). Mycoplasmal, Chlamydial, Rickettsial and protozoan diseases of human.

### Unit – V: Applied Microbiology

Role of microbes in the manufacture of antibiotics and vaccines. Microorganisms as biofertilizers. Microbes as foods - SCP production. Role of microbes in biogas production, petroleum industry and mining. Microbial degradation of lignin, cellulose and pesticides. Microbial immobilization. Microbes in biological warfare.

### Text books for study

1. Ananthanarayan, R. and Jayaram Paniker, C.K. 2007. Text Book of Microbiology. (7th Edition). Orient Longman Ltd., Chennai.
2. Lansing M Prescott, John P Harley and Donald A Klein. 2007. Microbiology. (7th Edition). Mc Graw Hill, New York.

### References

1. Martin Alexander (1969): Introduction to soil microbiology. Wiley International, NY
2. Gladwin and Trattler, 2013, Clinical Microbiology Made Ridiculously Simple (6th Edition), Medmaster, UK.
3. Mackie and McCarthy, 1994. Medical Microbiology, (4th Edition). Churchill Livingstone, New York.
4. Michael Pelczar, Microbiology 5th Edition, 2001. Mcgraw Higher Ed Publisher.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester II	Code 18PB12105	Title of the Paper MICROBIOLOGY										Hours 4	Credits 4		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	4	5	3	2	4	4	3	3	5	4	1	2	2	3.23	
CO2	3	4	2	4	3	5	2	3	4	2	5	3	4	3.07	
CO3	4	2	3	4	5	2	4	3	5	4	2	4	4	3.38	
CO4	3	5	4	2	3	5	4	2	4	3	2	4	5	3.53	
CO5	4	5	3	5	4	2	2	4	4	3	2	5	3	3.15	
CO6	5	4	3	4	5	4	3	2	3	4	3	4	5	3.76	
CO7	4	3	4	5	4	3	3	4	3	4	4	4	4	3.76	
CO8	5	4	3	3	3	4	3	4	3	4	4	3	4	3.61	
Overall Mean Score for COs															3.44

Result: The Score for this Course is 3.44 (High Relationship)

Note:

Mapping Scale	1-20%	21-40%	41-60%	61-80%	81-100%
Relation	1	2	3	4	5
Quality	0.0-1.0 Very poor	1.1-2.0 Poor	2.1-3.0 Moderate	3.1-4.0 High	4.1-5.0 Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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## RESEARCH METHODOLOGY

### Course Outcomes:

1. The working principles, construction and applications of the instruments used in the studies related to various disciplines of biological sciences.
2. The operation of centrifuges
3. The principles and practical methods of electrophoresis
4. The knowledge on spectroscopic methods.
5. The safety protocols in research labs.
6. The statistical concepts and their significance.
7. The importance of research and to learn the art of data collection.
8. The nuances of scientific writing and publishing.

### Unit – I:

Electrochemical techniques – Principles, electrochemical cells and reaction – pH and buffers. Measurement of pH – glass electrode and titration curves. Ion selective and gas sensing electrodes, oxygen electrode, and their applications. Chromatographic techniques – General principle; adsorption and partition chromatography. Techniques and application of paper, column, thin layer, normal phase and reverse phase - ion-exchange chromatography, exclusion chromatography, affinity chromatography, GLC and HPLC, HPTLC.

### Unit – II:

Centrifugation: Principles, differential and analytical centrifugation, density gradient centrifugation; Analysis of sub cellular fractions, ultracentrifuge and its application.

Electrophoresis: Principles, electrophoretic mobility, factors influencing electrophoretic mobility – paper, disc, slab gel electrophoresis. Isoelectric focussing, 2D PAGE, blotting techniques, capillary electrophoresis.

### Unit – III:

Spectroscopy – Properties of EMR, absorption spectrum, absorption  $V_s$  emission spectrophotometry, AAS & flame photometer, UV / VIS spectroscopy, IR, NMR, GCMS, MALDI-TOF, LC-MS.

Tracer technique: Nature of Radioactivity: Patterns of decay, half life and its application, Geiger Muller Counter- principle and applications. Scintillation counter – Principle, types and applications. Use of isotopes in biological studies.

### Unit – IV:

Research Methodology: Selection of research problems – hypothesis – definition and characteristics. Experimental approaches – biological, physical and chemical methods.

Sources of information: Journals, e-journals, books, biological abstracts, Preparation of index cards, Review writing, Article writing – structure of article. Selection of journals for publication- Impact factor – Citation index and H index. Proposal writing for funding.

Biostatistics: Basics and uses of Measures of Central values, Measures of Dispersion (Standard Deviation and coefficient of variation) in data analysis and presentation. Sample Testing: Large samples (Z), small sample test: t, Chi-square, ANOVA - one way & two way, SPSS.

### Unit – V:

Bioinformatics: Introduction to Bioinformatics, Bioinformatics and its applications, Information networks - EMB net and NCBI. Databases; Primary Nucleic acid databases - EMBL; Gene Bank and DDBJ. Structure of Gene bank entries. Protein sequences databases; primary databases PIR, MIPS, SWISS - PROT, TrEMBL, NRL-3D. Structure of SWISS - PROT entries. Secondary Databases; PROSITE, PROFILES, PRINTS, Pfam, BLOCKS and IDENTITY. Composite protein Databases.

### Text books for study

1. Avinash Upadhyay, Kakoli Upadhyay and Nirmalendu Nath, 2014 Biophysical Chemistry (Principles and Techniques) (4th Edition,) Himalaya Publishing House, India.
2. Research Methodology, Methods and Techniques C.R. Kothari, (2ndEdn), New Age International Publishers. New Delhi.

### References

1. Wayne W. Daniel, 2006, Biostatistics: A Foundation for Analysis in the Health Sciences (9th Edition), John Wiley and Sons Inc., USA.
2. Attwood, T. K., and Parry-Smith, D.J. 1999. Introduction to bioinformatics. Pearson Education Ltd., Delhi, India.
3. Rodney F. Boyer. 1993. Modern Experimental Biochemistry. (2nd Edition), Benjamin-Cummings Publishing, Redwood City, CA.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester II	Code 18PB12106	Title of the Paper RESEARCH METHODOLOGY												Hours 5	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	3	2	4	2	3	4	2	3	2	3	4	3	2	2.84	
CO2	4	2	2	2	3	5	2	4	3	3	3	2	2	3.30	
CO3	3	2	4	3	2	3	2	4	4	2	4	5	4	3.23	
CO4	3	4	3	5	2	4	2	1	5	2	2	3	3	3.07	
CO5	4	3	2	5	2	4	2	2	2	3	3	3	4	3.15	
CO6	3	2	4	3	2	3	2	3	2	3	4	3	3	2.84	
CO7	2	4	3	2	3	4	3	2	3	2	3	4	3	2.92	
CO8	2	3	4	4	3	2	3	4	3	2	3	4	3	3.07	
Overall Mean Score for COs															3.05

Result: The Score for this Course is 3.05 (High Relationship)

Note:

Mapping Scale	1-20%	21-40%	41-60%	61-80%	81-100%
Relation	1	2	3	4	5
Quality	0.0-1.0 Very poor	1.1-2.0 Poor	2.1-3.0 Moderate	3.1-4.0 High	4.1-5.0 Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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Semester II  
18PB12107

Hours/Week: 5  
Credits : 4

## HUMAN PHYSIOLOGY

### Course Outcomes:

1. The anatomy of the body
2. The functional mechanisms of Gastrointestinal tract.
3. The mechanisms of cardiovascular system and respiration
4. The structure and functions of nervous system.
5. The functional mechanisms of neuromuscular junction.
6. Recognition of the interrelationships within and between anatomical and physiological systems of the human body.
7. The mechanisms of urine formation.
8. The knowledge on the influence of environment and feelings in the physiological processes.

### Unit – I:

General and Cellular Physiology - Cell as the living unit of the body. The internal environment- homeostasis. Control systems, organization of a cell, transport across cell membranes, functional systems in the cells, blood – composition of body fluids and compartments. Homeostasis –Mechanisms, Homeostatic regulation of water and electrolytes. Plasma proteins and its function. Formed elements – development and function. Hemoglobin – structure and function. Blood Clotting mechanisms.

### Unit – II:

Gastro-intestinal System - General principles of GI function - mastication & swallowing, esophageal motility, salivary secretion, gastric mucosal barrier, pancreatic & biliary secretion, gastrointestinal motility, digestion & absorption, functions of colon, pathophysiology of peptic ulcer, gastrointestinal hormones and their actions, absorption of carbohydrates, fats and proteins, vitamins, water and electrolytes.

### Unit – III:

Cardio-vascular and Respiratory Physiology - Properties of cardiac muscle, cardiac cycle, heart as a pump, cardiac output, specialized tissues of the heart, coronary circulation, generation & conduction of cardiac impulse, control of excitation & conduction, electrocardiogram-arrhythmias. Cardiac failure, circulatory shock. Respiration – functional anatomy of respiratory system, pulmonary ventilation, alveolar ventilation, mechanics of respiration, pulmonary circulation, principles of gaseous exchange - oxygen &

carbondioxide transport, regulation of respiration, hypoxia, oxygen therapy & toxicity, artificial respiration.

#### Unit – IV:

Nerve and Muscle Physiology - General design of nervous system: Classification and Properties of nerve fibers, nerve conduction, Classification of somatic senses, sensory receptors, sensory transduction. Special senses - vision, hearing, smell, taste and their perceptions. Autonomic nervous system, limbic system and hypothalamus. EEG, sleep, emotions & behavior. Learning & memory. Functional anatomy of skeletal muscle, mechanisms of muscle contraction, smooth muscles.

#### Unit – V:

Renal Physiology - Structure and function of kidney – Structure of nephron, glomerular filtration, tubular reabsorption of glucose, water and electrolytes. Tubular secretion. Urine formation, renal mechanisms for the control of blood volume, blood pressure, micturition, diuretics, renal failure.

Environmental physiology - physiology of hot and cold environment, high altitude, aviation physiology, space physiology, deep sea diving & hyperbaric conditions.

#### Text books for study

1. Arthur C. Guyton, 2005, Text Book of Medical Physiology, WB Saunders's, USA.
2. C. C Chatterjee, 1985, Human Physiology Vol I & Vol II. 11th Edn, Kalyani Mukerjee Publications, Kolkata, India.

#### References

1. Kathleen, J.W. Wilson and Anne Waugh. 1998. Ross and Wilson Anatomy and Physiology in health and illness. (8th Edition). Churchill Livingstone, New York.
2. Gerald J. Tortora and Sandra Reynolds. 2003. Principles of Anatomy and Physiology. (10th Edition). John Wiley and Sons. Inc. Pub. New York
3. Abraham White., Philip Handler and Emil L. Smith. 1983. Principles of Biochemistry. (6th Edition). Tata Mc Graw – Hill Publishing Company, New Delhi.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester II	Code 18PB12107	Title of the Paper HUMAN PHYSIOLOGY												Hours 5	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	3	5	4	2	5	4	2	3	2	3	5	4	4	3.46	
CO2	5	3	2	4	2	3	3	3	2	5	5	5	4	3.53	
CO3	4	2	3	5	4	2	3	4	5	2	3	4	4	3.46	
CO4	5	3	2	3	3	4	4	2	3	3	3	5	4	3.38	
CO5	2	3	4	2	3	5	2	1	4	2	3	2	3	2.76	
CO6	3	3	4	3	2	3	3	4	2	3	2	3	4	3.00	
CO7	4	3	3	3	4	2	2	3	4	4	4	3	3	3.23	
CO8	3	4	2	3	4	3	4	3	4	2	3	2	3	3.07	
Overall Mean Score for COs															3.24

Result: The Score for this Course is 3.24 (High Relationship)

Note:

Mapping Scale	1-20%	21-40%	41-60%	61-80%	81-100%
Relation	1	2	3	4	5
Quality	0.0-1.0 Very poor	1.1-2.0 Poor	2.1-3.0 Moderate	3.1-4.0 High	4.1-5.0 Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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**Semester II**  
**18PBI2108**

**Hours/Week: 8**  
**Credits : 6**

**Laboratory Course-2:**  
**MICROBIOLOGY, PHYSIOLOGY & MOLECULAR TECHNIQUES**

**Course Outcomes:**

1. Demonstrate various staining techniques, used to identify gram positive and negative bacteria.
2. Explain about different types of microbial culture media, their preparation and isolation methods of pure culture.
3. Explain the characterization of individual microbial species.
4. Demonstrate the determination of quality of food samples.
5. Understand the importance of the blood circulation and changes in the physiology of the circulation during exercise.
6. Demonstrate the procedures concerned with isolation of nucleic acids.
7. Learn the basic molecular separation techniques(DNA) through electrophoresis.
8. Prepare seeds artificially.

**MICROBIOLOGY**

1. Media preparation and Culture techniques.
2. Staining techniques (simple, differential and capsular)
3. Biochemical Characterization of Microbes.
  - Amylase activity
  - Methyl Red test – VP test
  - TSI Agar test
  - Citrate Utilization test
4. Qualitative test for Milk.
  - Methylene Blue Reductase Test.
  - Phosphatase test.
5. Antibiotic sensitivity test.

**PHYSIOLOGY**

1. Blood Pressure - Measurement – Effect of exercise and postural variation on BP.
2. ECG recording
3. Body Mass index calculation

**MOLECULAR TECHNIQUES**

1. Agarose gel electrophoresis of Nucleic acids (DNA & RNA)
2. Polyacrylamide gel electrophoresis (protein)

3. Isolation of chromosomal DNA from blood samples by Phenol-Chloroform method.
4. Preparation of genomic DNA from bacteria
5. Synthetic seed preparation

**References:**

1. Lansing M Prescott, John P Harley and Donald A Klein. 2007. Microbiology. (7th Edition). Mc Graw Hill, New York.
2. James G. Cappuccino and Sherman Natalie 2005. Microbiology – A Laboratory Manual. (7th edition). Pearson education India, New Delhi.
3. Glick R. and J. J. Pasternak. 2002. Molecular Biotechnology (3rd Edition). ASM Press, Washington, USA.
4. Old R.W and S.B Primrose. 1989. Principles of gene manipulation(Ed:4). Blackwell Scientific Publications, London.
5. Praful.B.Godkar, 2014, Text book of Medical laboratory technology; III Edition , Volume I and II , Bhalani Publishing house.
6. Alan H .Gowenlock, Varley's Practical Clinical Biochemistry, 6th Edition; CBS publishers.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester II	Code 18PBI2108	Title of the Paper Laboratory Course-3: MICROBIOLOGY, PHYSIOLOGY & MOLECULAR TECHNIQUES										Hours 8	Credits 6	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	3	4	4	3	4	3	2	1	4	2	3	3	3.07
CO2	3	4	3	4	5	2	4	3	4	3	4	3	4	3.53
CO3	4	4	3	5	3	4	2	3	4	3	4	3	4	3.53
CO4	3	4	5	3	4	4	3	4	5	4	3	4	4	3.84
CO5	3	5	4	3	4	3	2	4	2	4	3	4	3	3.38
CO6	2	4	5	3	5	3	2	3	4	3	5	2	2	3.30
CO7	2	2	3	5	3	5	2	5	2	3	5	3	4	3.38
CO8	2	3	4	3	4	2	5	3	2	4	2	5	3	3.23
Overall Mean Score for COs														3.41

Result: The Score for this Course is 3.41 (High Relationship)

Note:

Mapping Scale	1	1-20%	21-40%	41-60%	61-80%	81-100%
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5
Quality	Very poor	Poor	Moderate	High	Very High	

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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Semester II  
18PBI2109

Hours/Week: -  
Credits : 2

### Self-paced Learning: ADVANCED NUTRITION

#### Course Outcomes:

1. The proximate principles of nutrition with reference to RDA.
2. The quantification of nutritional content of the food items.
3. The disorders associated with nutrition.
4. The nutritional significance of vitamins.
5. The role of minerals in metabolism.
6. The basic requirement of nutrition at different stages of life.
7. The experiments concerned with energy metabolism and nutritional assessment.
8. At the end of the course the students would be able to assess the nutritional status and design diet plans.

#### Unit – I: Energy Metabolism

Basal metabolism – Basal metabolic rate – Factors affecting BMR - determination of BMR, direct and indirect methods - Benedict's Roth apparatus - respiratory quotient – Biological oxygen demand. Anthropometry; Height, Weight, Skin fold thickness and arm circumference - Their importance in nutrition.

#### Unit – II: Introduction to Nutritional Biochemistry

Carbohydrate ; Source of energy; Glycogen , Fibre in diet. Proteins – essential amino acids and non essential amino acids – sources, functions – relation with Marasmus, Kwashiorkor disease. Biological value of proteins.

Fats: Sources- Saturated and unsaturated fatty acids, essential and non-essential fatty acids – disorders concerned with fatty acid metabolism – Refsum's disease, Atherosclerosis.

#### Unit – III: Vitamins

Fat soluble and water soluble vitamins – their source, daily requirements and deficiency manifestations. Role of Vitamins as co-factors- in Electron transport chain; and enzyme reactions; Vitamins involved in haemopoiesis; Role as antioxidants.

#### Unit – IV: Minerals

Micro, macro and trace elements – daily requirements – functions – deficiency manifestations – Role as electrolytes.- sodium and potassium. Food fads and Facts



### Unit – V: Nutrition at different Stages of life:

During infancy, School children, adolescence, pregnancy, lactation and aging.  
Assessment of nutritional status, - methods – intake, Biochemical and clinical methods.

### Text books for study

1. Swaminathan, M. 2004, Essentials of Food and Nutrition. The Bangalore Printing and Publishing Co. Ltd., Bangalore.
2. Anthony A. Albanase (1972), Newer Methods of Nutritional Biochemistry (Academic Press, New York)

### References

1. Garrow, J. S. and James, W. P. T. 2000. Human Nutrition and Dietetics. (10th Edition). Churchill Livingstone Publishers, UK.
2. Wong, D. W. S. 1996. Mechanism and Theory in Food Chemistry. CBS, New Delhi.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester II	Code 18PB12109	Self-paced Learning: ADVANCED NUTRITION					Title of the Paper								Hours -	Credits 2
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8			
CO1	3	2	4	2	3	4	2	3	3	3	4	3	2	2.92		
CO2	4	2	2	2	3	5	2	4	3	4	3	2	4	3.07		
CO3	4	2	4	3	4	3	2	4	4	2	4	5	4	3.46		
CO4	3	4	3	5	3	4	2	2	5	2	2	3	3	3.15		
CO5	4	3	2	5	2	4	3	2	2	3	4	3	2	3.00		
CO6	3	2	3	4	2	3	3	2	3	4	3	4	5	3.15		
CO7	3	3	4	3	4	2	2	3	4	2	3	4	4	3.15		
CO8	4	3	4	3	4	2	4	3	4	3	4	5	4	3.61		
Overall Mean Score for COs															3.19	

Note:

Mapping Scale	1-20%	21-40%	41-60%	61-80%	81-100%
Relation	1	2	3	4	5
Quality	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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**Semester II**  
**18PBI2202A**

**Hours/Week: 4**  
**Credits : 4**

**Core Elective-2A:**

**LIFE SCIENCES FOR COMPETITIVE EXAMINATIONS-I**

**Course Outcomes:**

1. Fundamental knowledge on the classification.
2. Preparation of herbarium.
3. The knowledge on the role of hormones in plants.
4. The knowledge on the plant physiological process.
5. The understanding on the role of nitrogen in plants.
6. The topics of the CSIR UGC – NET and SET syllabus that are not included in the core courses.
7. The principles of ecosystems.
8. The realization on the environmental health.

**Unit – I:**

Basics of Taxonomy: Principles & methods of taxonomy, classical & modern methods of taxonomy of plants, animals and microorganisms. Levels of structural organization: Unicellular, colonial and multicellular forms. Levels of organization of tissues, organs & systems. Herbarium preparation.

**Unit – II:**

System of classifications: Outline classification of plants, animals & microorganisms, structural details: Important criteria used for classification in each taxon. Classification of plants (Bentham and Hooker), animals (Whitaker's) and microorganisms. Prokaryote and eukaryote cell: structural and function of cell wall, mitochondria, chloroplast, ribosomes, E.R., Golgi complex and nucleus.

**Unit – III:**

Plant hormones and Nitrogen metabolism: Plant hormones - Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action. Sensory photobiology & Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins; stomatal movement; photoperiodism and biological clocks. Nitrogen metabolism- Nitrate and ammonium assimilation.

**Unit – IV:**

Photosynthesis and plant physiology: Photosynthesis – Light reaction and dark reaction fixation C<sub>3</sub>, C<sub>4</sub> and CAM pathways, photorespiratory pathway. Translocation of water, ions, solutes and macromolecules from soil-xylem

and phloem, transpiration, introduction to sec metabolites. Stress physiology. Response of plants to biotic (pathogens and insects) and abiotic (water, temp and salt) stresses.

**Unit – V:**

Environmental hazards and management: Environmental pollution; global environmental change; biodiversity: status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches. Bioremediation; Phytoremediation; Solid waste management: toxic effects and treatments, methods, technologies for management of hospital waste – incineration, autoclaving, mechanical/chemical, microwave, plasma torch, detoxification, advanced wet oxidation and thermal, dry heat.

**Text books for study**

1. Verma P. S & V. K. Agarwal, 2003, Cytology, Genetics, Evolution and Ecology, S. Chand & Co Ltd., New Delhi.
2. S. K. Verma, 1999, Text Book of Plant Physiology, S. Chand & Co Ltd., New Delhi.

**References**

1. Lawrence G H M, 1995, The Taxonomy of Vascular Plants, Mac Millan Publishers, NY
2. Noggle G. R and Fritz G J, 1976, Introductory Plant Physiology, Prentice-Hall Publishers, India.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester II	Code 18PBI2202A	Title of the Paper Core Elective-2A: LIFE SCIENCES FOR COMPETITIVE EXAMINATIONS-I										Hours 4	Credits 4	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	3	2	3	4	4	4	3	5	4	5	4	2	3.46
CO2	3	4	5	2	1	3	5	4	2	5	4	3	2	3.30
CO3	3	2	4	3	4	2	3	4	4	3	5	2	4	3.23
CO4	3	4	1	3	4	2	3	4	2	4	5	4	2	3.15
CO5	1	2	3	4	2	1	4	2	4	3	1	4	3	2.61
CO6	3	4	3	2	4	3	2	4	3	2	4	2	4	3.07
CO7	4	3	2	3	2	3	4	2	3	4	3	2	3	2.92
CO8	3	4	5	2	2	3	4	5	3	4	2	2	3	3.23
Overall Mean Score for COs														3.12

Result: The Score for this Course is 3.12 (High Relationship)

Note:

Mapping Scale	1	1-20%	21-40%	41-60%	61-80%	81-100%
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5
Quality	Very poor	Poor	Moderate	High	Very High	

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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Semester II  
18PBI2202B

Hours/Week: 4  
Credits : 4

## Core Elective-2B: MOLECULAR DIAGNOSTICS

### Course Outcomes:

1. The molecular basis of diseases.
2. The various molecular diagnostic tools available for these diseases.
3. The transmission mechanisms of single gene disorders.
4. The applications of karyotyping procedures.
5. The tissue matching procedures.
6. The progress and developments in animal cell culture techniques.
7. The outlines for forensic methodologies.
8. The detection methods of cancer and HIV.

### Unit – I: Molecular mechanisms of diseases

Detection of genetic defects, detection of infectious agents, tumor diagnosis markers and grading. Molecular genetics of B- cell neoplasia. Liver specific expression of cloned human genes, technology of carrier erythrocytes: a tool for diagnosis and therapy. Diagnosis of single gene disorders - spinal muscular atrophy, DMD and BMD, Fragile X syndrome.

### Unit – II: Restriction Fragment Length Polymorphism (RFLP)

DNA probes detection of mutations and deletions in gene. Eg: thalassemia, haemophilia, sickle cell anemia, retinoblastoma. DNA finger printing. Genetic disease probes. Chromosomal DNA probes for prenatal diagnosis of X-linked retinitis pigmentosa, prenatal sex determination.

### Unit – III: Hereditary persistence of fetal hemoglobin

Model for abnormal development regulation. Apolipoprotein genes, DNA polymorphism and hyperlipidemia, cDNA of human protein C for diagnosis of protein C deficiency. Prenatal diagnosis and carrier detection of phenylketonuria by gene, fluorescent *in situ* hybridization (FISH). DNA probes - fluorescent labeling, chromosome painting and spectral karyotyping, peptide mapping.

### Unit – IV: Approaches in hybridoma technology

Hybridoma variants affecting isotype, antigen binding and idiotype: isolation of class and subclass switch variants by selection. MHC locus, HLA polymorphisms, HLA nomenclature, molecular analysis of the MHC, serological analysis DNA-based typing, combining typing results, HLA

test discrepancies, coordination of HLA test methods, additional recognition factors, minor histocompatibility antigens, nonconventional MHC antigens, killer cell immunoglobulin-like receptors, MHC & its disease association.

#### Unit – V: Polymerase Chain Reaction in diagnosis:

Its applications in diagnosis of infectious diseases - eg: HIV, hepatitis B and tuberculosis. Identification of gene mutations and deletions - eg: p53 mutations. Use in solving paternity disputes and crime detection. Molecular oncology-classification of neoplasms, molecular basis of cancer, analytical targets of molecular testing- gene and chromosomal mutations in solid tumors, microsatellite instability, loss of heterozygosity. Enzyme linked immunosorbent assay (ELISA) - Diagnosis of infectious diseases and cancer antigens, HIV detection.

#### Text books for study

1. Lela Buckingham, Maribeth L. Flaws, 2007, Molecular Diagnostics - Fundamentals, Methods, & Clinical Applications, F.A. Davis & Company, Philadelphia.

#### References

1. Gath, D. D, 1994. PCR-based diagnostics in infectious diseases. Blackwell Scientific, UK.
2. Fazal Ahmed, 1984, Advances in Gene technology: human genetic disorders, ICSU, Paris.
3. Stanely, A *et al*, 1994, Vaccines, W. B. Saunders & Co., USA.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester II	Code 18PB12202B	Title of the Paper Core Elective-2B: MOLECULAR DIAGNOSTICS					Hours 4	Credits 4							
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	3	2	3	4	4	2	3	4	2	3	2	3	2	3.07	
CO2	4	1	2	3	4	2	3	4	2	3	4	3	4	3.38	
CO3	3	4	5	2	1	2	1	3	4	2	3	4	1	3.07	
CO4	4	3	2	1	2	3	4	2	4	3	2	1	4	3.23	
CO5	4	3	2	4	2	2	2	3	1	4	2	4	2	2.92	
CO6	3	4	3	2	3	4	2	3	4	3	2	4	4	3.15	
CO7	5	3	4	2	3	4	2	3	4	2	3	4	3	3.23	
CO8	3	4	2	4	3	4	2	3	4	5	3	4	2	3.30	
Overall Mean Score for COs															3.17

Note:

Mapping Scale	1-20%	21-40%	41-60%	61-80%	81-100%
Relation	1	2	3	4	5
Quality	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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Semester II  
18PSS2301

Hours/Week: 4  
Credits : 4

**IDC: SOFT SKILLS**

**Course Outcomes:**

1. Students are taught the various nuances of grooming such as, good manners and etiquettes and they are trained to practice them in the class rooms.
2. Students are empowered with public speaking skills via extempore speeches and prepared speeches, presented before the class and assessed by the trainer as well as the companions which eventually helps build self confidence of the students.
3. Students learn the different types of resumes and different types of interview skills and write and print their own resumes and present before the interview panel for their mock interview.
4. Students actively learn the ten parameters of group discussion, perform on the stage with their colleagues, which is videotaped, reviewed and evaluated.
5. As students go through their teenage, self discovery becomes a tool to develop their personality facilitated with scientific psychological personality tests.
6. Students are guided to knowing their SWOT (Strengths, Weaknesses, Opportunities and Threats) and setting their short term and long term goals for their lives.

**Module 1: Basics of Communication:** Definition of communication, Process of Communication, Barriers of Communication, Non-verbal Communication, **Effective Communication:** The Art of Listening, Exercises in Kinesthetics, Production of Speech, Organization of Speech, Modes of delivery, Conversation Techniques, Dialogue, Good manners and Etiquettes, Politeness markers & Listening links.

**Module II: Resume Writing:** What is Resume? Types of Resume? Chronological, Functional and Mixed Resume, Steps in preparation of Resume, structure and framework for writing resume, Intensive training / personalized training on resume writing. **Interview Skills:** Common interview questions, Attitude, Body Language, The mock interviews, Phone interviews, Behavioral interviews.

**Module III: Group Discussion:** Group Discussion Basics, GD Topics for Practice, Points for GD Topics, Case-Based and Article based Group Discussions, Points for Case Studies, and Notes on Current Issues for GDS & Practicum with video coverage. **Team Building:** Team Vs Group – Synergy,

Stages of Team Formation, Broken Square-Exercise, Win as much as you win- Exercise, Leadership – Styles, Work ethics.

**Module IV: Personal Effectiveness:** Self Discovery, Self Esteem, Goal setting, Problem-solving, Conflict and Stress Management

**Module V: Numerical Ability:** Average, Percentage, Profit and Loss, Problems on ages, Simple Interest, Compound Interest, Area, Volume and Surface Area, Time and Work, Pipes and Cisterns, Time and Distance, Problems on Trains, Boats and Streams, Calendar, Clocks, Permutations and Combinations, Probability.

**Module VI: Test of Reasoning:** Series Completion, Analogy, Data Sufficiency, Blood Relations, Assertion and Reasoning, Logical Deduction, Direction.

**Non-Verbal Reasoning:** Series, Classification

**Text Book**

1. Melchias, G., Balaiah John., John Love Joy (Eds) 2015. *Winners in the making*. St. Joseph's College, Trichy-2

**References**

1. Aggarwal, R. S. *Quantitative Aptitude*, S.Chand & Sons
2. Aggarwal, R.S. (2010). *A Modern Approach to Verbal and Non Verbal Reasoning*. S. Chand & Co, Revised Edition.
3. Covey, Stephen. (2004). *7 Habits of Highly effective people*, Free Press.
4. Egan Gerard (1994). *The Skilled Helper* (5<sup>th</sup> Ed). Pacific Grove, Brooks/ Cole.
5. Khera, Shiv (2003). *You Can Win*. Macmillan Books, Revised Edition.
6. Murphy, Raymond. (1998). *Essential English Grammar*. 2<sup>nd</sup> ed., Cambridge University Press.
7. Prasad, L. M. (2000). *Organizational Behaviour*, S.Chand & Sons.
8. Schuller, Robert. (2010). *Positive Attitudes*. Jaico Books.
9. Trishna's (2006). *How to do well in GDs & Interviews*, Trishna Knowledge Systems.
10. Yate, Martin. (2005). *Hiring the Best: A Manager's Guide to Effective Interviewing and Recruiting*.

Modules	Topics	Examination Pattern	
		CIA	Online
I	Basics of Communication	15	5
II	Resume Writing & Interview Skills	15	5
III	Group Discussion & Team Building	10	5
IV	Personal Effectiveness	10	5
V	Numerical Ability (Common Session)	5	10
VI	Test of Reasoning (Common Session)	5	10
Total		60	40

**Semester III**  
**18PBI3110**

**Hours/Week: 4**  
**Credits : 3**

**PHARMACEUTICS AND NANOTECHNOLOGY**

**Course Outcomes:**

1. Study the preparation and packaging methodologies in pharmaceuticals.
2. Demonstrate various drug delivery systems.
3. Learn the types and preparation methods of tablets.
4. Learn the types and preparation methods of capsules.
5. Learn the methods of quality control.
6. Know the basics of nanotechnology and its potential as medicines.
7. Recognize with the prospective of placement in the pharmaceutical industries.
8. Demonstrate the characterization methods of nanoparticles.

**Unit – I:**

Tablets - Characteristics, advantages and disadvantages. Types of tablets, excipients, granulation methods and machinery involved. Tablet compression operation-single punch and rotary tablet presses, processing problems, evaluation, packaging. Tablet coating: Types-sugar coating, film coating, compression coating, electrostatic and enteric coating. Film forming materials, formulation of coating solution, equipments for coating, Processing problems in coating, evaluation.

**Unit – II:**

Capsules: Advantages and disadvantages of capsules. Materials and method of production of hard gelatin capsule, size of capsules, Formulation, method of filling, equipments involved, finishing techniques and evaluation. Storage of capsules. Soft gelatin capsules-shell and capsule content, manufacture, processing and control. Sterilization of injections, formulations, aerosols, ophthalmic preparations, Surgical ligatures and sutures, Blood products and plasma substitutes.

**Unit – III:**

Packaging materials: Types of glasses and plastics employed for packing and their evaluation. Cosmetics. Introduction, fundamentals of cosmetic science. Formulation, preparation, packaging and evaluation of following Cosmetics- cosmetics for skin and face, Nail polish, lipstick, rouge, Hair preparation-Shampoo, Hair dyes, depilatories, shaving cream, after shave lotion. Oral hygiene preparation-dentifrices, mouth washes.

**Unit – IV:**

Controlled drug delivery systems: Advantages of controlled drug delivery systems. a) An introduction to novel drug delivery systems- Liposomes, niosomes, nanoparticles and osmotically controlled systems b) Micro encapsulation c) Transdermal drug delivery systems- Formulation and evaluation.

**Unit – V:**

Introduction to Nanotechnology: Properties and Types of Nanomaterials (Quantum dots, Nanoparticles, Nanocrystals, Dendrimers, Buckyballs, Nanotubes), Green synthesis, characterization of Nano material; Absorption, Fluorescence, and Resonance; Microscopy measurements: SEM, TEM, AFM and STM. Confocal and TIRF imaging. Applications of nanotechnology in medicine & health, food, agriculture, livestock, aquaculture, forestry and sustainable environment.

**Text books for study**

1. Theory and practice of industrial pharmacy; by Leon Lachman, Herbert. A. Lieberman, Joseph. L. Kanig; Third edition ; Lea & Febiger.
2. Pharmaceutics, The Science of Dosage Form Design: Michael. E. Aulton; Second edition; English language book society/Churchill Livingstone.

**References**

1. Pharmaceutical dosage forms: Tablets, Volume 1, 2, 3; Herbert. A. Lieberman, Leon Lachman & Joseph. B. Schwartz; Marcel Dekker INC.
2. Nanobiotechnology: Concepts, Applications and Perspectives, Christ of M. Niemeyer (Editor), Chad A. Mirkin (Editor) , Wiley-VCH; 1 edition, 2004.
3. NanoBioTechnology: BioInspired Devices and Materials of the Future by Oded Shoseyov and Ilan Levy, Humana Press; 1 edition 2007.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester III	Code 18PBI3110	Title of the Paper PHARMACEUTICS AND NANOTECHNOLOGY										Hours 4	Credits 3
Course Outcomes (COs)	Programme Outcomes (POs)		Programme Specific Outcomes (PSOs)								Mean Score of COs		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	4	3	2	2	3	3	4	4	3	2	2	4	3
CO2	3	4	2	2	3	4	3	3	2	4	2	3	4
CO3	3	2	3	4	3	2	2	3	4	2	3	2	2
CO4	3	2	3	4	3	3	3	3	4	2	3	3	4
CO5	3	3	4	3	3	2	3	4	4	3	4	3	4
CO6	4	3	2	4	3	4	3	2	4	3	5	3	2
CO7	4	2	3	4	3	4	2	3	4	5	2	4	3
CO8	3	4	2	4	3	4	3	2	5	3	4	2	2
Overall Mean Score for COs													3.09

Result: The Score for this Course is 3.09 (High Relationship)

Note:

Mapping Scale	1-20%	21-40%	41-60%	61-80%	81-100%
Relation	1	2	3	4	5
Quality	0.0-1.0 Very poor	1.1-2.0 Poor	2.1-3.0 Moderate	3.1-4.0 High	4.1-5.0 Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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Semester III  
18PBI3111

Hours/Week: 4  
Credits : 3

## GENETICENGINEERING

### Course Outcomes:

1. Study the various underlying principles of genetic engineering and enzymes concerned with it.
2. Study the construction of gene cassettes and vectors.
3. Study the methodologies of gene transfer.
4. Acquire knowledge on the general principles of generating transgenic plants, animals and microbes.
5. Learn strategizing research methodologies employing genetic engineering techniques.
6. Study the methods of recombinant selection.
7. Learn the analytical procedures involving DNA.
8. Learn the applications of recombinant DNA in forensic department.

### Unit – I: Introduction to Recombinant DNA technology

Isolation (Mechanical, cDNA, Shot gun) & purification of nucleic acid, PCR; Enzymes in molecular biology – restriction endonuclease, ligases, reverse transcriptase, nucleases, polymerase, alkaline phosphatase, terminal transferase, T4 polynucleotide kinase; linker, adaptors & homopolymers.

### Unit – II: Expression cassette

Promoters (constitutive, inducible, tissue specific), terminators, reporters, markers (antibiotic resistant, herbicide resistant, antimetabolite), Vectors in gene cloning – Plasmids (pBR322, pUC), Bacteriophages (Phage  $\phi$ , M13), cosmids, phagemids, yeast plasmid vector, viral vectors (adenovirus, adeno associated virus, baculo virus, herpes virus, retrovirus, cauliflower mosaic virus, tobacco mosaic virus, potato virus X), artificial chromosome (BAC, YAC, HAC), shuttle vector, Expression vector.

### Unit – III: Gene transfer methods

Transformation – physical method (electroporation, micro-injection, particle bombardment, liposome mediated transfer), chemical method (PEG mediated, DEAE Dextran mediated, CaPO<sub>4</sub> mediated gene transfer), Biological method (*Agrobacterium* mediated gene transfer). Expression systems – prokaryotes (Bacteria) and eukaryotes (yeast, mammalian and, insect cell lines).

### Unit – IV: Screening and selection methods

Insertional inactivation, blue-white selection, colony- *in situ* hybridization, *in vitro* selection, *in vitro* translation, radioactive antibody test,

immunological techniques, DNA labelling, dot blot hybridization, Molecular beacons. Gene Silencing, RNA interference, antisense therapy, gene knockout. Blotting techniques – southern, northern, western and south-western.

### Unit – V: Molecular Techniques

RFLP, RAPD, AFLP, DNA Finger printing, DNA Foot printing, Microarray (DNA & Non-DNA). Libraries - Genomic library; C-DNA library & its types; BAC library; YAC library; Methyl filtration libraries; COT fractionation based libraries. Bioethics & Biosafety in genetic engineering; IPR & Patenting.

### Text books for Study

1. Glick R. and J. J. Pasternak. 2002. Molecular Biotechnology (3rd Edition). ASM Press, Washington, USA.
2. Old R.W and S.B Primrose. 1989. Principles of gene manipulation(Ed:4). Blackwell Scientific Publications, London.

### References

1. David M Glove. 1984. Gene cloning - The mechanisms of DNA manipulations. Chapman and hall, New York.
2. Ernst L Winnacker. 2002. From genes to clones - Introduction to gene technology. VCR Pub., Weinheim.
3. James D Watson. *et al.* 1992. Recombinant DNA. WH freeman and co., NY

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester III	Code 18PB13111	Title of the Paper GENETIC ENGINEERING														Hours 4	Credits 3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs			
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8				
CO1	4	3	3	4	3	3	4	3	3	2	3	2	3	3.07			
CO2	3	4	3	2	3	3	4	3	4	3	3	4	3	3.23			
CO3	4	3	4	3	4	3	4	4	3	4	3	4	3	3.53			
CO4	3	2	2	3	4	4	3	2	3	4	3	4	3	3.07			
CO5	3	3	3	3	4	4	3	3	4	3	4	3	3	3.30			
CO6	3	5	2	3	4	2	3	4	5	2	3	4	3	3.24			
CO7	3	4	3	2	4	3	3	4	5	4	2	3	4	3.28			
CO8	3	4	2	4	3	5	4	3	5	4	3	2	3	3.28			
Overall Mean Score for COs															3.25		

Result: The Score for this Course is 3.25 (High Relationship)

Note:

Mapping Scale	1-20%	21-40%	41-60%	61-80%	81-100%
Relation Quality	0.0-1.0 Very poor	1.1-2.0 Poor	2.1-3.0 Moderate	3.1-4.0 High	4.1-5.0 Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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Semester III  
18PBI3112

Hours/Week: 4  
Credits : 4

**Laboratory Course-3:  
IMMUNOLOGY, ANDROLOGY AND HISTOPATHOLOGY**

**Course Outcomes:**

1. Learn immunotechniques in diagnosis.
2. Analyze sperm morphology and sperm count.
3. Analyze the viability of the sperm.
4. Analyze the allergy susceptibility of the individuals.
5. Learn about the histopathological screening of the various organs in animal models.
6. Study the principles and protocols in hormone assay.
7. Learn the basics of laboratory animal handling.
8. Learn the extraction procedures of metabolites from the plant source.

**I. Immunology techniques**

1. Widal test – rapid slide test for typhoid
2. VDRL test – test for syphilis
3. Latex agglutination test for rheumatoid factor and Pregnancy
4. Immunoelectrophoresis
5. Skin Prick Test.

**II. Andrology**

1. Total sperm count.
2. Motility Test.
3. Fructose estimation.

**III. Hormone Assay**

1. ELISA (TSH, T3, T4, Estrogen and Progesterone – Any Two)

**IV. Miscellaneous**

1. Extraction of phytochemicals using Soxhlet apparatus.
2. Identification of active principles by spectral studies (FTIR, UV-Vis)
3. Histopathology
4. Laboratory animal handling and maintenance

**V. Visit to National Research Centers.**

**Reference Books:**

1. Kuby Richard, A. Goldsby., Thomas J. Kint and Barbara. A. Osborne. 2000. Immunology. (4th Edition), W.H. Freeman and Company, New York.
2. Ivan M. Roitt and Peter J. Delves. 2005. Roitt's Essential Immunology. (10<sup>th</sup> Edition). Blackwell Scientific Publishers, New York.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester III	Code 18PBI3112	Title of the Paper Laboratory Course-3: IMMUNOLOGY, ANDROLOGY AND HISTOPATHOLOGY												Hours 4	Credits 4	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8			
CO1	3	4	3	4	2	4	4	5	4	2	3	4	2	3	3.30	
CO2	5	4	3	4	2	4	4	4	2	3	3	4	3	4	3.46	
CO3	4	4	3	4	4	4	3	4	5	1	4	2	3	4	3.46	
CO4	4	3	5	4	5	4	4	3	4	2	4	3	3	4	3.69	
CO5	4	5	3	4	3	4	4	3	2	4	3	2	4	5	3.53	
CO6	3	4	5	3	4	2	4	4	5	3	4	3	4	2	3.53	
CO7	2	3	4	5	3	4	4	2	3	4	5	2	4	3	3.38	
CO8	3	4	2	4	3	2	2	3	4	2	4	4	5	2	3.23	
Overall Mean Score for COs															3.45	

**Result: The Score for this Course is 3.45 (High Relationship)**

*Note:*

Mapping Scale	1-20%	21-40%	41-60%	61-80%	81-100%
Relation	1	2	3	4	5
Quality	Very poor	Poor	Moderate	High	Very High

*Values Scaling:*

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$		Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$	
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**Semester III**  
**18SBS3101**

**Hours/Week: 6**  
**Credits : 5**

**Inder Disciplinary Core:**  
**SOLID WASTE MANAGEMENT**

**Course Outcomes:**

1. To understand the importance of solid waste management.
2. To study the methods of collection of wastes.
3. To acquire knowledge on decomposition of organic matter.
4. To know the methods of solid waste management.
5. To learn the technology of vermicomposting.
6. To learn the technique of Mushroom cultivation.
7. To understand the importance and medicinal values of mushroom.
8. To understand the preparation of recipes of mushroom

**Unit-I**

Definition-scope and importance of solid waste management-Types of solid wastes-garbage, rubbish, agricultural, hospital and domestic wastes. Collection-transport and processing of solid wastes.Waste as a resource-organic compost-process of composting-Role of microbes in composting. Significance of organic compost.

**Unit-II**

Organic matter decomposition- Decomposition of litter, cellulose, hemicelluloses, lignin, water soluble components and proteins. Carbon assimilation and immobilization. Microbes associated with organic matter decomposition. Factors affecting organic matter decomposition.

**Unit III**

Solid waste management- methods of solid waste management- open dumping, land filling, incineration, pyrolysis Biogas production-mechanism of methane gas formation. Factors affecting methane formation Utilization of Biogas.

**Unit-IV**

Vermicomposting-Earthworm and its characteristics-internal anatomy-digestive, excretory, respiratory and reproductive systems. Preparatory methods of vermiculture. Economic and ecological importance of vermicompost and vermi wash.

**Unit-V**

Mushroom culture- classification-Tests for identification-Characteristics of common edible mushrooms-Nutritive value of mushrooms. Culture techniques-preparation of spawn- Preparation compost- spawn running and harvesting. Preservation and storage. Recipes of mushroom.

**Text Book**

1. Dubey, RC. (2009). A Text book of microbiology, S. Chand & Co. Ltd, New Delhi.

**Reference**

1. NIIR Board, 2004, The Complete Technology Book on Biofertilizers and Organic Farming, National Institute of Industrial Research.
2. Mohoney, R. Lab Techniques in Zoology, (UK: Butterworth, 1966)
3. Vasantaraj David, S. and Kumaraswamy, T. Elements of Economic Entomology, (Chennai: Popular Book Depo, 1998).

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester III	Code 18SBS3101	Title of the Paper SOLID WASTE MANAGEMENT														Hours 6	Credits 5
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs			
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8				
CO1	5	4	5	4	3	3	4	5	3	4	4	4	4	4.0			
CO2	5	3	5	3	4	3	4	4	2	3	3	4	5	3.7			
CO3	4	3	3	5	3	3	4	3	4	4	3	3	4	3.5			
CO4	5	4	3	3	2	2	5	3	3	5	4	3	3	3.5			
CO5	4	3	5	3	3	3	3	3	3	3	3	4	3	3.3			
CO6	5	3	5	4	3	4	3	2	4	3	3	3	4	3.5			
CO7	4	3	5	2	2	5	3	5	3	4	5	4	2	3.7			
CO8	4	5	3	5	3	5	2	4	2	5	3	3	4	3.7			
Overall Mean Score for COs														3.5			

Result: The Score for this Course is 3.5 (High Relationship)

Note:

Mapping Scale	1-20% 1	21-40% 2	41-60% 3	61-80% 4	81-100% 5
Relation Quality	0.0-1.0 Very poor	1.1-2.0 Poor	2.1-3.0 Moderate	3.1-4.0 High	4.1-5.0 Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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Semester III  
18PBS3101B

Hours/Week: 6  
Credits : 5

### Interdisciplinary Core: IMMUNOLOGY

#### Course Outcomes:

1. Know the anatomy of the immune reactions.
2. Study in detail the components of immune system.
3. Learn the different types of antigens.
4. Learn the structural details of antibodies.
5. Learn the generation mechanisms of antibodies.
6. Learn the initiation and regulation of immune response.
7. Learn the biochemical basis of immune disorders.
8. Know the analytical methods involved in immunology.

#### Unit – I:

Introduction to Immunology: Infection- types, factors influencing infection pathogenicity. Sources and carriers of infectious agents. Immune system- definition and properties. Cells of the immune system. Lymphoid organs- primary and secondary; structure and functions. Natural defenses of the body (Innate immunity)- skin, mucous membrane, lysozyme and phagocytes. Reticuloendothelial system and its components.

#### Unit – II:

Antigens and Antibodies: definition, properties- antigenicity and immunogenicity, antigenic determinants and haptens. Types of antigens - flagellar, somatic, capsular, soluble, heterophile, tumour and autoantigens. Antigen - antibody interactions - molecular mechanism of binding. Affinity, avidity, valency, cross reactivity and multivalent binding. Complement system; components- alternate and classical pathways, initiators and MAC. Inflammation acute and chronic; mechanism and significance.

#### Unit – III:

Immunoglobulins: Basic structure, classes and distribution of antibodies. Antibody diversity- genetic and other factors. Theories of antibody formation. Acquired immunity- Humoral: Biosynthesis of antibodies; B and T lymphocyte cooperation. Primary and secondary immune response. Cell Immunity- components of T lymphocytes, T cell receptor diversity and CD molecules. Role of antigen presenting cells. Regulation of immune response. Cytokines, types and role in immunity. Mitogens and immunosuppressants. Immunological tolerance- at birth and in adults; induction and termination.

#### Unit – IV:

Immune system in health & disease: Transplantation immunology- graft rejection and HLA antigens. Role of MHC and T cells. Prevention of graft rejection. Hypersensitivity- Immediate and delayed types; mechanism of reaction. Vaccines and toxoids: types, production and uses. Active and passive immunization, immunization schedule. Tumor immunology: tumor antigens, immunosurveillance and NK cells. Auto immunity-mechanism of breakdown, pathogenesis and specific diseases.

#### Unit – V:

Immunological techniques: Polyclonal antibodies- principle and production of antisera. Monoclonal antibodies - hybridoma technique, applications, merits and demerits. Recombinant antibodies. Principle and applications of RIA, ELISA. Precipitation reaction - Immunodiffusion, immuno-electrophoresis, precipitin ring test. Agglutination tests - heamagglutination, febrile and latex agglutination. Widal, VDRL, pregnancy and rheumatoid factor tests.

#### Text books for study

1. Charles A. Janeway and Paul, J. R. 1994. Immunobiology. (4th Edition), Travels Blackwell Scientific Publishers, New York.
2. Kuby Richard, A. Goldsby., Thomas J. Kint and Barbara. A. Osborne. 2000. Immunology. (4th Edition), W.H. Freeman and Company, New York.

#### References

1. Fahim Halim Khan, 2009, The Elements of Immunology, Pearson education, New Delhi.
2. Frank C. Hay and Olwyn M. R. Westwood, 2006, Practical Immunology, Blackwell Publishing, India.
3. Ivan M. Roitt and Peter J. Delves. 2005. Roitt's Essential Immunology. (10th Edition). Blackwell Scientific Publishers, New York.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester III	Code 18PBS3101B	Title of the Paper Interdisciplinary Core: IMMUNOLOGY														Hours 4	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs			
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8				
CO1	4	2	3	4	2	3	4	4	2	3	3	5	4	3.53			
CO2	5	1	2	3	4	4	3	2	3	3	4	1	5	3.30			
CO3	3	2	5	1	4	5	2	3	4	4	2	3	5	3.46			
CO4	2	3	4	1	4	4	3	2	4	3	2	4	4	3.30			
CO5	4	3	2	4	3	4	2	4	3	3	3	4	4	3.38			
CO6	4	3	2	3	4	3	2	3	4	3	2	4	3	3.07			
CO7	4	3	4	2	3	4	3	2	3	4	3	2	5	3.23			
CO8	4	5	4	3	2	3	4	4	3	5	4	3	4	3.69			
Overall Mean Score for COs															3.37		

Note:

Mapping Scale	1-20%	21-40%	41-60%	61-80%	81-100%
Relation Quality	0.0-1.0 Very poor	1.1-2.0 Poor	2.1-3.0 Moderate	3.1-4.0 High	4.1-5.0 Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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**Core Elective-3A:**

**LIFE SCIENCES FOR COMPETITIVE EXAMINATIONS-II**

**Course Outcomes:**

1. Gain knowledge on basic theories of evolution.
2. Know the stages in the evolution process.
3. Learn the methods of speciation.
4. Study the topics of the CSIR UGC – Net and SET syllabus that are not included in the core courses.
5. Be familiar with ecosystem and its contents.
6. Learn the energy transfer within the different ecosystems.
7. Learn the causes of environmental pollution.
8. Understand the significance of environmental health.

**Unit – I:**

Emergence of evolutionary thoughts: Lamarck; Darwin–concepts of variation, adaptation, struggle, fitness and natural selection; Mendelism; spontaneity of mutations. Origin of cells and unicellular evolution: Origin of basic biological molecules; abiotic synthesis of organic monomers and polymers; Concept of Oparin and Haldane; Experiment of Miller; The first cell; Evolution of prokaryotes; Origin of eukaryotic cells; Evolution of unicellular eukaryotes; anaerobic metabolism, and aerobic metabolism.

**Unit – II:**

Paleontology and evolutionary history: The evolutionary time scale; eras, periods and epoch; major events in the evolutionary time scale; origins of unicellular and multi cellular organisms; major groups of plants and animals; Stages in primate evolution including Homo. Molecular evolution: concepts of neutral evolution, molecular divergence and molecular clocks; molecular tools in phylogeny, classification and identification.

**Unit – III:**

Mechanisms of speciation and behavior: Speciation; allopatricity and sympatricity; convergent evolution; Sexual selection; co-evolution. Approaches and methods in study of behavior; Proximate and ultimate causation; altruism and evolution; neural basis of learning, memory, cognition, sleep and arousal; biological clocks; social communication; social dominance; use of space and territoriality; mating systems, parental investment and reproductive success; parental care; aggressive behavior;

habitat selection and optimality in foraging; migration, orientation and navigation; domestication and behavioral changes.

**Unit – IV:**

The Environment; biotic and abiotic interactions. Concept of habitat and niche; population ecology; concept of metapopulation. Species interactions: Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis. Community ecology: nature, structure and attributes; levels of species diversity and its measurement; edges and ecotones. Ecological succession: Types, mechanisms, changes involved in succession & concept of climax.

**Unit – V:**

Ecosystem ecology: Ecosystem structure, function; energy flow and mineral cycling (C,N,P); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine). Biogeography: major terrestrial biomes; theory of island biogeography; biogeographical zones of India. Conservation biology: principles and management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves).

**Text books for study**

1. Verma P. S & V. K. Agarwal, 2003, Cytology, Genetics, Evolution and Ecology, S. Chand & Co. Ltd., New Delhi.
2. Sharma P.D., 1999, Ecology and Environment, Rastogi Publishers, Meerut.

**References**

1. Odum. E.P, 1970, Fundamentals of Ecology, 3rd edition, W.B. Saunders Ltd., U.K.
2. Karl J. Nikias, 1981, Paleobotany, Paleoecology & Evolution, Praeger Pub., USA.
3. Pranav Kumar and Usha Mina. Pathfinder Academy: CSIR-JRF-NET Life Sciences Six Book Combo Set: CSIR-JRF-NET Life Sciences. Edition: 2016. Pathfinder Publication.
4. Rupendra Singh, Dr Madhu Gupta and Anubha Shukla. CSIR NET/ JRF Life Sciences MCQ Practice book. Catalyst Center of excellence Pvt. Ltd; Seventh Edition (2017).

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester III	Code 18PBI3203A	Title of the Paper Core Elective-3A: LIFE SCIENCES FOR COMPETITIVE EXAMINATIONS-II													Hours 4	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)			Programme Specific Outcomes (PSOs)										Mean Score of COs		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8			
CO1	4	5	3	2	4	4	3	3	5	4	1	2	2	3.23		
CO2	3	4	2	4	3	5	2	3	4	2	5	3	4	3.07		
CO3	4	2	3	4	5	2	4	3	5	4	2	4	4	3.38		
CO4	3	5	4	2	3	5	4	2	4	3	2	4	5	3.53		
CO5	4	5	3	5	4	2	2	4	4	3	2	5	3	3.15		
CO6	3	4	3	2	4	3	2	4	3	2	4	2	4	3.07		
CO7	4	3	2	3	2	3	4	2	3	4	3	2	3	2.92		
CO8	3	4	5	2	2	3	4	5	3	4	2	2	3	3.23		
Overall Mean Score for COs														3.30		

Result: The Score for this Course is 3.3 (High Relationship)

Note:

Mapping Scale	1-20%	21-40%	41-60%	61-80%	81-100%
Relation	1	2	3	4	5
Quality	0.0-1.0 Very poor	1.1-2.0 Poor	2.1-3.0 Moderate	3.1-4.0 High	4.1-5.0 Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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Semester III  
18PBI3203B

Hours/Week: 4  
Credits : 4

**Core Elective-3B:  
PHARMACEUTICAL BIOCHEMISTRY**

**Course Outcomes:**

1. Make a detailed study of drugs, particularly their actions on living systems.
2. Learn the pharmacokinetics and pharmacodynamics of drugs.
3. Learn the formulations available for various tracts.
4. Learn the drugs available for GI tract and sleep disorders.
5. Know their chemotherapeutic value.
6. Familiarize with the adverse effects of drug action.
7. Study the process and development of drugs.
8. Learn the procedures of molecular docking.

**Unit – I:**

Drugs – definition, source and nature, types of classification and nomenclature, dose response curve and LD50. Role of drugs, Drug – protein interactions, routes of drug administration.

**Unit – II:**

Drug targets – Enzymes, receptors, carrier proteins. Structural proteins, nucleic acids, lipids and carbohydrates. Forces in drug – receptor interaction, Receptor theories.

**Unit – III:**

Pharmacokinetics and Pharmacodynamics: Drug absorption, distribution, metabolism, Phase I and Phase II reactions. Excretion and dosing. Pharmacokinetic oriented drug design – Drug solubility and drug stability. Biological testing and bioassays – testing drugs *in vitro* and *in vivo*. Drug discovery. Lead compounds – natural sources and synthetic sources.

**Unit – IV:**

Drugs acting on various systems: CNS- Sedatives- Hypnotics, GI tract- drugs for peptic ulcer, diarrhoea and constipation. Miscellaneous drugs - antiseptics, disinfectants, chelating agents. Adverse drug reactions and drug induced side effects, biological effects of drug abuse and drug dependence, drug tolerance and intolerance.

**Unit – V:**

Drug development: Target – oriented drug design, computer aided drug design, Quantitative structure, activity relationship – binding interaction,

functional groups and pharmacophore. High throughput screening and Molecular docking.

### Textbooks for Study

1. K. D. Tripathi, Essentials of Medical Pharmacology, (7th Edition), Jaypee Publishers, 2010.
2. Jayashree Ghosh, A Textbook of Pharmaceutical Chemistry (3rd edition). S.Chand & Company Ltd., New Delhi, 2010.

### References

1. Robert K. Murray, Daryl K. Granner, Peter A. Mayer and Victor W. Rodwell, Harper's Biochemistry. (25th edition), Mc Graw Hill, New York, 2006.
2. Bertram Katzung, Basic and Clinical Pharmacology, (12th edition), Lange Publishers, 2012.
3. Gareth Thomas, Fundamentals of Medicinal Chemistry, Wiley Blackwell Publishers, 2003.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester III	Code 18PB13203B	Core Elective-3B: PHARMACEUTICAL BIOCHEMISTRY					Title of the Paper								Hours 4	Credits 4			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)													Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8						
CO1	4	3	2	3	4	3	4	2	3	4	5	3	2	3.23					
CO2	3	2	3	4	3	4	3	2	1	5	3	2	4						
CO3	3	2	3	4	3	5	3	2	4	3	5	4	3		3.15				
CO4	4	3	4	2	2	4	3	2	3	4	2	3	3						
CO5	2	3	4	2	3	5	2	1	4	2	3	2	3	3.23					
CO6	3	3	4	3	2	3	3	4	2	3	2	3	4		2.76				
CO7	4	3	3	3	4	2	2	3	4	4	4	3	3	3.00					
CO8	3	4	2	3	4	3	4	3	4	2	3	2	3		3.23				
Overall Mean Score for COs																3.08			

Note:

Mapping Scale	1-20%	21-40%	41-60%	61-80%	81-100%
Relation Quality	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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**Semester III**  
**18PBI3301**

**Hours/Week: 4**  
**Credits : 4**

**IDC (WS):**  
**HERBAL TECHNOLOGY**

**Course Outcomes:**

1. Learn the medicinal value of plants.
2. Study the medicinally used traditional herbs.
3. Explore the role of herbs in Siddha medicine.
4. Understand various methods involved in recognition and collection of medicinal plants.
5. Understand various methods involved in preservation of medicinal plants.
6. Understand the methods of conservation of rare plants.
7. Study the phytochemical reactions of secondary metabolites.
8. Outline the plants used in traditional medicine.

**Unit I**

Introduction- Herbal medicines: history and scope - definition of medical terms - role of medicinal plants in Siddha systems of medicine; cultivation - harvesting - processing - storage - marketing and utilization of medicinal plants.

**Unit II**

Pharmacognosy Pharmacognosy - systematic position medicinal uses of the following herbs in curing various ailments; Tulsi, Ginger, Fenugreek, Indian Goose berry and Ashoka.

**Unit III**

Phytochemistry- active principles and methods of their testing - identification and utilization of the medicinal herbs; *Catharanthus roseus* (cardiotonic), *Withania somnifera* (drugs acting on nervous system), *Clerodendron phlomoides* (anti-rheumatic) and *Centella asiatica* (memory booster).

**Unit IV**

Analytical pharmacognosy - Drug adulteration - types, methods of drug evaluation – Biological testing of herbal drugs - Phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds).

**Unit V**

Conservation of herbs- Medicinal plant banks micro propagation of important species (*Withania somnifera*, neem and tulsi)- Herbal foods-future of pharmacognosy.

**Text Books**

1. Glossary of Indian medicinal plants, R.N.Chopra, S.L.Nayar and I.C.Chopra, 1956. C.S.I.R, New Delhi.
2. The indigenous drugs of India, Kanny, Lal, Dey and Raj Bahadur, 1984. International Book Distributors.

**Reference Books**

1. Herbal plants and Drugs Agnes Arber, 1999. Mangal Deep Publications.
2. Ayurvedic drugs and their plant source. V.V. Sivarajan and Balachandran Indra 1994. Oxford IBH publishing Co.
3. Ayurveda and Aromatherapy. Miller, Light and Miller, Bryan, 1998. Banarsidass, Delhi.
4. Principles of Ayurveda, Anne Green, 2000. Thomsons, London.



Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester III	Code 18PBI3301	Title of the Paper IDC (WS): HERBAL TECHNOLOGY										Hours 4	Credits 4	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	2	3	3	4	2	2	4	3	3	4	3	4	3	3.07
CO2	3	2	4	3	2	2	4	3	2	4	3	4	3	3.00
CO3	3	2	3	4	2	3	3	2	3	2	3	2	3	3.07
CO4	4	3	2	3	2	3	2	2	4	3	4	3	4	3.15
CO5	4	3	5	3	3	4	4	2	3	4	2	4	4	3.46
CO6	3	4	3	2	3	4	3	2	3	2	4	4	3	3.07
CO7	4	3	4	3	5	4	3	4	3	2	3	2	3	3.30
CO8	3	2	3	2	1	2	3	2	3	4	3	4	5	2.84
Overall Mean Score for COs														3.18

Result: The Score for this Course is 3.18 (High Relationship)

Note:

Mapping Scale	1-20%	21-40%	41-60%	61-80%	81-100%
Relation	1	2	3	4	5
Quality	0.0-1.0 Very poor	1.1-2.0 Poor	2.1-3.0 Moderate	3.1-4.0 High	4.1-5.0 Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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Semester III  
18PBI3302Hours/Week: 4  
Credits : 4

## IDC (BS): FIRSTAID MANAGEMENT

## Course Outcomes:

1. Perform a basic assessment of an emergency situation.
2. Undertake immediate relief and rescue during emergency.
3. Learn the methods of arresting heamorrhage.
4. Learn the first aid methods to deal with bone fracture.
5. Learn the instrumentations available for emergency relief and rescue.
6. Demonstrate an awareness of signs, symptoms and treatment for common medical emergencies.
7. Gains psychological intelligence during critical situations.
8. Dispense the psychological counseling to persons at risk.

**Unit – I: Principles of First Aid Management:** Basic knowledge about human body organs and their functions. Principles of First Aid. Causality assessment. Priorities of first aid, unconsciousness and recovery positions. Resuscitation, control of major bleedings, choking, and treatment of shocks. Emergency aid in schools and others.

**Unit – II: Causality assessment:** Patient management and care, labeling of causalities. Approach to a causality. Handling and transport of injured persons. Disaster management and multiple causalities.

**Unit – III: Bleeding and injuries:** Internal and external bleeding, injuries to muscles, joints and bones, stroke. miscellaneous injuries, splinting skill tests, head, neck, back, chest, abdomen injuries. poisoning - bites - stings. drug abuse. frostbite and cold exposure. Burns and Scalds. Heat stroke, heat cramps and heat exhaustion.

**Unit – IV: Emergency Care:** Accident reporting, first aid to victims of road accidents. Patient assessment and management, breathing emergencies, defibrillation. Sudden illness - heart attack, stroke, fainting, convulsion epilepsy, prevention of heart attack and apoplexy.

**Unit – V: First aid rooms and equipments:** First aid kits, cleaning of wounds, dressing and bandages. antiseptics – types and action. Injury assessment in factories and in rural areas. Psychological first aid.

## Text books for study

1. First Aid Manual- St. John Ambulance Guide.
2. Standard First Aid and Personal Safety, 8th ed. – American Red Cross

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester III	Code 18PB13302	Title of the Paper IDC (BS): FIRST AID MANAGEMENT												Hours 4	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	4	3	3	5	4	3	4	3	4	5	4	4	5	3.92	
CO2	3	4	3	3	4	5	2	4	1	4	5	4	3	3.46	
CO3	3	4	2	4	3	4	3	5	4	3	5	2	4	3.53	
CO4	3	4	4	5	4	2	4	4	3	4	4	3	4	3.69	
CO5	3	2	4	4	3	4	5	4	5	2	3	5	3	3.61	
CO6	3	2	3	4	2	3	3	2	3	4	3	4	5	3.15	
CO7	3	3	4	3	4	2	2	3	4	2	3	4	4	3.15	
CO8	4	3	4	3	4	2	4	3	4	3	4	5	4	3.61	
Overall Mean Score for COs														3.45	

**Result: The Score for this Course is 3.45 (High Relationship)**

*Note:*

Mapping Scale	1-20%	21-40%	41-60%	61-80%	81-100%
Relation	1	2	3	4	5
Quality	0.0-1.0 Very poor	1.1-2.0 Poor	2.1-3.0 Moderate	3.1-4.0 High	4.1-5.0 Very High

*Values Scaling:*

Mean Score of COs =	Total of Values	Mean Overall Score for COs =	Total of Mean Scores
	Total No. of POs & PSOs		Total No. of COs

**Semester IV  
18PB14113**

**Hours/Week: 6  
Credits : 5**

## CLINICAL BIOCHEMISTRY

### Course Outcomes:

1. Gain thorough knowledge about the biochemical basis of various diseases and disorders.
2. Analyze the mechanisms of blood clotting and the related disorders.
3. Analyze the symptoms of various diseases.
4. Learn the protein deficiency disorders.
5. Study the disorders of nucleic acid metabolism.
6. Study various diagnostic procedures for diseases and disorders.
7. Know the available treatment modalities.
8. Learn a wide range of protocols in clinical biochemistry analysis

### Unit – I:

Blood and body fluids: Collection and preservation, Disturbances in Blood clotting – haemophilia A and haemophilia B. Haemoglobin in anaemias-sickle cell, thalassemia, abnormal haemoglobins. Porphyrins and porphyrinurias. Anticoagulants. Hemolytic diseases of the new born. Adverse reactions of blood transfusions. Blood banking Cellular injury: causes, pathogenesis and morphology of cell injury. Intercellular alterations in lipids, proteins and carbohydrates, cellular adaptation, atrophy and hypertrophy. Basic mechanism involved in the process of inflammation and repair: alteration in vascular permeability and blood flow. Brief outline of the process of repair.

### Unit – II:

Disturbances of carbohydrate and Lipid metabolism: Blood sugars – Its maintenance, hyper and hypoglycemia. Regulation of blood glucose concentration, diabetes mellitus – complications, secondary degenerative diseases. Laboratory diagnosis of early and latent diabetes. Glucose tolerance test. Dietary regimes in diabetes mellitus. Hypoglycemic agents. Galactosemia, fructosuria and lactose intolerance. Hypo and hyper cholesteraemia, Hypo and hyper lipoproteinemia, hypocholesteremic agents, hypertension. Lipid storage diseases- fatty liver & obesity.

### Unit – III:

Protein deficiency diseases: Plasma proteins, - their significance and variation in health and diseases. Agammaglobulinemia, Multiple myeloma, Proteinuria, Wilson's disease, Cystinuria, Hartnup disease, Maple syrup urine disease, Alkaptonuria, Albinism, Tyrosinosis, Phenylketonuria. Disorders of sulphur

containing amino acid and urea cycle. Nucleic acid disorders: Orotic aciduria, and Xanthinuria, Gout, Lesch-nyhan syndrome.

#### Unit – IV:

Diseases of the liver: Macro and micro anatomy of liver, Hepatitis and its types, jaundice and its types. Cirrhosis, alcoholic liver diseases. Cholestatic liver diseases. Hepatic tumors and biliary tract diseases - clinical manifestation of liver diseases. Liver functions tests. Disorders of bilirubin metabolism. Enzyme released from diseased liver tissue. Pancreatic function test; Gastric function test. Biochemical parameters of CSF in health and disease.

#### Unit – V:

Renal Diseases: Renal stress and its analysis. Renal function tests - biochemical changes in acute and chronic renal failure. Normal and abnormal urinary constituents. Enzyme parameters in pathological conditions. Cardiac pathology - Major manifestations of heart disease - Ischaemic heart diseases, angina pectoris, myocardial infarction. Cardiac markers in infarction - LDH, creatine kinase. Serological tests in infectious diseases and viral infections. Amniotic fluid and maternal serum, ailment in pregnancies.

#### Text books for study

1. Devlin, 1997, Textbook of Biochemistry (with clinical correlation), John Wiley, UK.
2. M. N. Chatterjee and Rana Shinde 1995. Text book of Medical Biochemistry 2nd Edition, Jaypee Brothers Medical publishers Private Limited, New Delhi.

#### References

1. Henry, R. J., Cannon, D. C, and Winkelman, J. W., 1974. "Clinical Chemistry: Principles and Techniques" 2nd ed. Harper and Row, Hagerstown, Maryland.
2. Cantrow and Trumper, 1962, Clinical Biochemistry, 6th edition, VY.B. Saunders Company, Philadelphia.
3. Luxton. R, 2008, Clinical Biochemistry, 2<sup>nd</sup> edition, Scion Publishing Ltd., Bloxham, United Kingdom.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester IV	Code 18PB14113	Title of the Paper CLINICAL BIOCHEMISTRY												Hours 6	Credits 5
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	4	4	3	4	5	4	4	3	4	3	4	3	4	3.76	
CO2	5	4	5	2	4	4	3	2	4	3	2	4	4	3.53	
CO3	3	4	2	4	5	4	3	2	4	2	5	4	2	3.38	
CO4	4	3	2	4	4	3	4	2	1	4	3	2	4	3.07	
CO5	4	3	3	3	4	4	1	3	4	2	4	3	5	3.30	
CO6	3	5	2	3	4	2	3	4	5	2	3	4	3	3.24	
CO7	3	4	3	2	4	3	3	4	5	4	2	3	4	3.28	
CO8	3	4	2	4	3	5	4	3	5	4	3	2	3	3.28	
Overall Mean Score for COs															3.36

Result: The Score for this Course is 3.36 (High Relationship)

Note:

Mapping Scale	1-20%	21-40%	41-60%	61-80%	81-100%
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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### ADVANCED ENDOCRINOLOGY

#### Course Outcomes:

1. Study the different glands of endocrine systems.
2. Learn the molecular features of hormones and their synthesis.
3. Study the hormonal regulations of various physiological functions and signaling mechanisms.
4. Study the signal transduction mediated by cell surface receptors.
5. Study the hormonal regulation of reproduction.
6. Familiarize with the endocrine diseases.
7. Understand the mechanism and role of nuclear receptors.
8. Outlines the endocrinology of cancer.

#### Unit – I:

Introduction - Hormones - definition; classical and nonclassical endocrinology. Pituitary hormones and their control by the hypothalamus. Thyroid metabolic hormones. Adrenocortical hormones. Feedback mechanisms (HPA&HPG). Inactivation and degradation of hormones. Hypothalamus - neurohypophyseal hormones. Hormone resistant syndrome and multiendocrine neoplasia – different types. Melatonins and serotonin – light and dark cycles. RIA and ELISA in Bioassay of hormones. Genetic control of hormone formation.

#### Unit – II:

Hormones acting through cell surface receptors - Hormones acting through cell surface receptors. Hormone – receptor interaction; multiple hormone subunits, Scatchard analysis; peptide hormone receptors: types of receptors- beta – adrenergic receptor and insulin receptor- structure and mechanism of action. Signal transducers and second messengers- protein kinases, cAMP, IP3, DAG, Calcium and Calmodulin. Eicosanoids and mechanism of action.

#### Unit – III:

Molecular endocrinology of insulin resistance - Endocrinology of adipose tissues - leptin, ghrelin, adiponectin, resistin. Fetal endocrine programming of adult disorders (FEPAD): Adverse effects of glucocorticoids in programming events. Endocrinology of insulin like growth factors (IGF's) and its binding proteins (IGFBP). Modulation of placental hormones and growth factors in FEPAD.

#### Unit – IV:

Reproductive Endocrinology - Genetic, endocrine and biochemical aspects of testis and ovarian differentiation and development. Neuroendocrine perspectives of mammalian reproduction. Endocrine, paracrine and autocrine regulation of spermatogenesis, oogenesis, ovulation and steroidogenesis (Testosterone, 17 $\beta$ -estradiol, Progesterone). Control of synthesis and release of steroid hormones. Structure, function and regulation of male and female accessory sex organs. Transport of steroid hormones in blood. Conception and contraception. Apoptosis – steroid hormone action at cell level. Hormonal physiology of parturition and lactation.

#### Unit – V:

Nuclear receptors (NR)- General features, Ligands that act via nuclear receptor and its sub classes (Orphan receptor and variant receptors). Domain structure of NR - hormone binding domain, antigenic domain and DNA binding domain. Hormone response elements. Detailed study of thyroxine, estrogen, androgen, vitamin D, glucocorticoids, Peroxisome proliferator activated receptor and Liver X Receptor. PPAR in insulin resistance. Receptor activation – upregulation and down regulation. Selective estrogen receptor modulator. Endocrine responsive cancer - breast, endometrial and prostate cancers.

#### Textbooks for Study

1. Devlin, 1997, Textbook of Biochemistry (with clinical correlation), John Wiley, USA.
2. Wilson and Foster, 1992, Textbook of Endocrinology, (8th edn), W. B. Saunders, USA.

#### References

1. Robert, K. Murray *et al*, 2003, Harper's Biochemistry (25th Edition), McGraw Hill Publishers (Asia), India.,
2. Arthur C. Guyton and Hall, 2006, Text Book of Medical Physiology, Elsevier India Pvt. Ltd., New Delhi.
3. Mac. E. Hadley and Jon. E. Levin, 2009, Endocrinology 6th ed., Darling Kindersly Pvt. Ltd., India.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester IV	Code 18PBI4114	Title of the Paper ADVANCED ENDOCRINOLOGY												Hours 6	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	4	5	4	3	4	3	4	3	4	2	1	4	3	3.38	
CO2	3	4	3	5	4	4	2	1	4	3	2	1	4	3.07	
CO3	4	3	2	3	4	4	3	2	3	4	2	4	4	3.23	
CO4	4	3	4	2	3	4	3	3	2	4	2	1	4	3.07	
CO5	3	4	2	4	3	4	3	2	4	4	2	1	3	3.07	
CO6	3	4	3	2	3	4	2	3	4	3	2	4	4	3.15	
CO7	5	3	4	2	3	4	2	3	4	2	3	4	3	3.23	
CO8	3	4	2	4	3	4	2	3	4	5	3	4	2	3.30	
Overall Mean Score for COs														3.19	

Result: The Score for this Course is 3.19 (High Relationship)

Note:

Mapping Scale	1-20%	21-40%	41-60%	61-80%	81-100%
Relation	1	2	3	4	5
Quality	0.0-1.0 Very poor	1.1-2.0 Poor	2.1-3.0 Moderate	3.1-4.0 High	4.1-5.0 Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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Semester IV  
18PBI4115

Hours/Week: 5  
Credits : 5

#### Laboratory Course-4 CLINICAL BIOCHEMISTRY-I

##### Course Outcomes:

1. Introduce the concept of Phlebotomy in clinical biochemistry.
2. Analysis of blood sugar for diabetic patients.
3. Analysis of lipid profile.
4. Assay of serum proteins and their metabolic end products.
5. Assay the clinical marker enzymes in various diseases.
6. Assay the vitamins in blood samples.
7. Evaluate the clinical situation based on the level of the parameters.
8. Suggest prognosis.

##### I. Biochemical analysis of blood

1. Estimation of blood glucose (2 methods)
2. Estimation of serum proteins
3. Estimation of plasma fibrinogen
4. Estimation of A: G ratio in serum
5. Estimation of blood urea (2 methods)
6. Estimation of serum uric acid
7. Estimation of serum creatinine.
8. Estimation of serum triglycerides.
9. Estimation of serum cholesterol.
10. Estimation of serum phospholipids.
11. Estimation of serum calcium.
12. Estimation of serum bilirubin.

##### II. Enzyme assays

1. Determination of serum alkaline phosphatase
2. Determination of serum acid phosphatase
3. Estimation of Vitamin C
4. Estimation of Vitamin A and
5. Estimation of Vitamin E

## References

1. Praful.B.Godkar, 2014, Text book of Medical laboratory technology; III Edition, Volume I and II , Bhalani Publishing house.
2. Alan H .Gowenlock, Varley's Practical Clinical Biochemistry, 6th Edition; CBS publishers.
3. Kanai L. Mukerjee, Volume 1, 2 and 3. Medical Laboratory Technology, 2<sup>nd</sup> Edition, Tata McGraw Hill Education Private Limited, New Delhi.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester IV	Code 18PBI4115	Title of the Paper Laboratory Course-4: CLINICAL BIOCHEMISTRY-I												Hours 5	Credits 5
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
	CO1	4	3	4	3	4	3	2	4	2	4	3	4	5	3.46
	CO2	5	4	3	2	4	3	4	2	3	4	3	4	4	3.46
	CO3	4	3	4	5	4	3	4	2	4	3	4	4	4	3.69
	CO4	4	5	4	3	4	3	2	4	2	4	3	4	4	3.53
	CO5	5	4	3	4	5	3	4	2	3	4	2	4	5	3.69
	CO6	4	3	2	4	3	4	3	2	4	3	5	3	2	3.23
	CO7	4	2	3	4	3	4	2	3	4	5	2	4	3	3.30
	CO8	3	4	2	4	3	4	3	2	5	3	4	2	2	3.15
Overall Mean Score for COs														3.44	

Result: The Score for this Course is 3.44 (High Relationship)

Note:

Mapping Scale	1-20%	21-40%	41-60%	61-80%	81-100%
	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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Semester IV  
18PBI4116

Hours/Week: 5  
Credits : 5

**Laboratory Course-5**  
**CLINICAL BIOCHEMISTRY-II**

**Course Outcomes:**

1. Collection and preservation of blood and urine samples for diagnosis.
2. Learn the methodology of blood typing.
3. Gain knowledge on the counting of total RBC ,WBC and Platelets.
4. Analyze various biochemical blood parameters in clinical diagnosis using semiautoanalyser.
5. Study the normal, abnormal, urinary crystals and deposits.
6. Study the various modes of administration of xenobiotics to the experimental animals.
7. Skill the process of dissection.
8. Be aware of CPCSEA and its guidelines

**I. Hematological studies**

1. Collection of Blood
2. Estimation of hemoglobin content.
3. Total RBC count.
4. Total WBC count.
5. Determination of Packed Cell Volume.
6. Differential WBC count (DC).
7. Absolute Eosinophil count (AEC).
8. Total platelet count.
9. Determination of clotting time
10. Determination of Prothrombin time
11. Determination of ESR.
12. Grouping of blood and Rh typing.
13. Pathological examination of blood film.

**II. Urology**

1. Identification of normal (Collection, Preservation, Color, Odour, Specific gravity, pH and Volume)
2. Screening of abnormal constituents and
3. Urinary crystals and deposits

**III. Miscellaneous**

1. Estimation of clinical parameters (sugar, Hb, Cholesterol , Proteins and creatinine) using semiautomated analyzer.

2. Routes of administration of drugs/xenobiotics
3. Dissection of animals and aseptic removal of individual organs

**References**

1. Praful.B.Godkar, 2014, Text book of Medical laboratory technology; III Edition, Volume I and II , Bhalani Publishing house.
2. Alan H .Gowenlock, Varley's Practical Clinical Biochemistry, 6th Edition; CBS publishers.
3. Handbook on Laboratory Animal Handling – Rats and Mice (Care, Maintenance, Handling, Breeding and Ethics). Dr. Karthik Mohan, Prof. A. Benno Susai Vijayakumar and Prof. T. Antony Diwakar Chandran, Department of Biochemistry, St. Joseph's College (Autonomous), Tiruchirappalli, Tamil Nadu.
4. Sudha Gangal, 2010. Principles and Practice of Animal Tissue Culture. (2nd Edition). University Press (India) Pvt. Ltd.
5. Freshney, R.I. 2005. Culture of Animal Cells: A manual of basic technique. (5th Edition). John Wiley and Sons, New Jersey.
6. Vogel, 1989, Text Book of Practical Organic Chemistry, Longman Scientific and Technical Publishers, New York.

### Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester IV	Code 18PB14116	Title of the Paper Laboratory Course-5: CLINICAL BIOCHEMISTRY-II										Hours 5	Credits 5		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	4	3	3	5	4	3	4	3	4	5	4	4	5	3.92	
CO2	3	4	3	3	4	5	2	4	1	4	5	4	3	3.46	
CO3	3	4	2	4	3	4	3	5	4	3	5	2	4	3.53	
CO4	3	4	4	5	4	2	4	4	3	4	4	3	4	3.69	
CO5	3	2	4	4	3	4	5	4	5	2	3	5	3	3.61	
CO6	4	5	4	4	3	4	5	4	2	3	4	3	3	3.69	
CO7	4	3	5	4	3	4	5	3	4	2	5	4	3	3.76	
CO8	4	3	5	4	3	2	5	4	3	5	4	3	4	3.76	
Overall Mean Score for COs															3.66

**Result: The Score for this Course is 3.66 (High Relationship)**

**Note:**

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

**Values Scaling:**

$$\text{Mean Score of COs} = \frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$$

## Notes

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting or typing. There are no margins, text, or other markings on the page.



## Notes

[illegible]