

**MANONMANIAM SUNDARANAR UNIVERSITY  
TIRUNELVELI**

UG COURSES – AFFILIATED COLLEGES

**B.Sc., Biochemistry**

(Choice Based Credit System)

(with effect from the academic year 2017-2018 onwards)

**Eligibility for admission to B.Sc., Biochemistry**

**Candidates shall be admitted to the course provided he / she has passed plus two examinations of the state or central board with biology / biochemistry as one of the subject.**

Sem	Pt III/ IV/V /VI	S ub N o.	Subject status	Subject Title	Hrs/ wee k	Cre dits	Marks				
							Maximum			Passing minimum	
							Int.	Ext.	Tot.	Ext	Tot.
III	I	17	Language	Tamil/Other Language	6	4	25	75	100	30	40
	II	18	Language	English	6	4	25	75	100	30	40
	III	19	Core - 1	Enzymology	4	4	25	75	100	30	40
		20	Major Practical- III	Enzymes and Enzyme kinetics	3+	2	50	50	100	30	40
		21	Allied	Chemistry	3	3	25	75	100	30	40
		22	Allied Practical-I		2+	2	50	50	100	30	40
		23	Skilled Based subject	Blood Banking	4	4	25	75	100	30	40
	IV	24	Common	Yoga	2	2					
	V	25	Non-Major Elective	Nutritional biotechnology	2	2	25	75	100	30	40
			<b>Total</b>		<b>30</b>						
IV	I	26	Language	Tamil/Other Language	6	4	25	75	100	30	40
	II	27	Language	English	6	4	25	75	100	30	40
	III	28	Core – 1	Intermediary metabolism	4	4	25	75	100	30	40
		29	Major Practical- IV	Isolation and Characterization of Biomolecules	3+	2	50	50	100	30	40
		30	Allied II	Chemistry	3	3	25	75	100	30	40
		31	Allied Practical- II		2+	2	50	50	100	30	40
		32	Skill Based Subject	DNA finger printing	4	4	25	75	100	30	40
	IV	33	Non-Major Elective	Cancer Biology	2	2	25	75	100	30	40
	V	34	Extension Activity	NCC,NSS, YRC, YWF	-	1	-	-	-	-	-
	VI	35	Common	Computers for digital Era	2	2	-	-	-	-	-
			<b>Total</b>		<b>30</b>						

### III - SEMESTER

#### Course-5 – ENZYMOLOGY

L	T	P	C
4	0	0	4

**Objective: To integrate the practical aspects of enzymology with the kinetic theory and a mechanistic overview of enzyme activity and regulation in cell**

Total Hours : 60

#### **Unit-1**

12

Hours

#### **Introduction to Enzymes**

General characteristics of enzymes, enzyme specificity, Nomenclature, definition with examples of holoenzyme, apoenzyme, coenzymes, cofactors, activators, inhibitors, Unit of enzymes. Definition of IU, Katal, Enzyme turn over number and specific activity. Mechanism of enzyme action, Active site.

#### **Unit-2**

12 Hours

#### **Enzyme kinetics**

Factors affecting enzyme activity- enzyme concentration, substrate concentration, pH and temperature. Derivation of Michaelis Menton equation for uni substrate reactions.  $K_m$  and its significance. Line weaver-Burk plot.

#### **Unit-3**

12 Hours

#### **Enzyme inhibition**

Reversible and irreversible inhibition, competitive inhibition, non-competitive inhibition and un competitive inhibition. Allosteric enzymes.

## **Unit-4**

12 Hours

### **Cofactors in enzyme catalysis**

Role of cofactors in enzyme catalysis NAD/NADP, FMN/FAD, Coenzyme A, Pyridoxal Phosphate, Tetrahydrofolate, Mechanism of action of chymotrypsin, lysozyme. Multienzyme complexes- pyruvate dehydrogenase complex.

## **Unit-5**

Hours

12

### **Enzyme regulation**

General mechanism, Feedback inhibition, Enzyme repression induction- Reversible and irreversible covalent modifications with specific examples. Immobilized enzymes and their industrial applications. Isoenzymes and their medical applications.

### **References**

1. Principles of Biochemistry- Lehninger 3<sup>rd</sup> edition
2. Enzymes- Trevor Palmer
3. Principles of Biochemistry- B.L.Smith
4. Agarwal's text book of Biochemistry- Goel publishing house
5. Harper's Review of Biochemistry 24<sup>th</sup> edition
6. Text book of Biochemistry- Lubert Stryer 4<sup>th</sup> edition
7. Principles of Biochemistry- Emil L. Smith, Abraham White, Philip Handler- 7<sup>th</sup> edition.

### MAJOR PRACTICAL 3: ENZYMES AND KINETICS

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

1. ASSAY OF AMYLASE –Effect of pH, Temperature,  
Enzyme concentration and Substrate concentration
2. ASSAY OF ACID PHOSPHATASE – Effect of pH, Temperature, Enzyme concentration  
and Substrate concentration
3. ASSAY OF ALKALINE PHOSPHATASE - Effect of pH, Temperature, Enzyme  
concentration  
and Substrate concentration

MSU / 2017-18 / UG-Colleges / Part-III (B.Sc. Chemistry) / Semester – III / Allied – I  
**ALLIED CHEMISTRY - I**

**Objective** To learn about atomic structure and bonding. To learn the principles of reactions of organic compounds. To study about photochemical reactions. To learn about the importance of polymers and polymer science. To study about lubricants and some cosmetics in the modern world.

**Unit I – Inorganic chemistry**

Atomic structure : electronic configuration - Aufbau principle - Pauli's exclusion principle- Hund's rule. Bonding : electrovalent, covalent, hydrogen bonds-orbital overlap - s-s, s-p. Hybridization and VESPR theory - CH<sub>4</sub>, C<sub>2</sub>H<sub>4</sub>, C<sub>2</sub>H<sub>2</sub>- BeCl<sub>2</sub>, BF<sub>3</sub>, NH<sub>3</sub>, H<sub>2</sub>O, PCl<sub>5</sub>, IF<sub>5</sub>, IF<sub>7</sub>.

**Unit II - Organic chemistry – Principles of reactions**

Heterolytic and homolytic cleavage - nucleophiles and electrophiles-reaction intermediates – preparation and properties of carbonium ions, carbanions and free radicals type of reactions - substitution, addition, elimination and polymerisation reactions.

**Unit III- Physical chemistry - Photochemistry**

Definition-comparison between thermal and photochemical reactions-Laws of photochemistry-Beer Lambert's law-Grothus Draper law-Einstein's law-Quantum yield-low and high quantum yield-determination of quantum yield-fluorescence, phosphorescence, thermoluminescence, chemiluminescence and bioluminescence-definition with examples photosensitisation.

**Unit IV- Polymer Chemistry**

Definition- Monomers, Oligomers and Polymers - Classification of polymers- natural, synthetic- linear, cross linked and network- plastics, elastomers, fibres- homopolymers and co-polymers Thermoplastics: polyethylene, polypropylene, polystyrene, polyacrylonitrile, poly vinyl chloride, nylon and polyester - Thermosetting Plastics : phenol formaldehyde and epoxide resin-Elastomers: natural rubber and synthetic rubber - Buna - N, Buna-S and neoprene.

**Unit V- Applied Chemistry**

Lubricants-classification-criteria of good lubricating oils-synthetic lubricating oilspoly glycols and poly alkene oxides-greases or semi solid lubricants-examples-solid lubricants-graphite  
Preparation and uses of shampoo, nail polish, sun screens, tooth powder, tooth paste, boot polish, moth ball and chalk piece.

**Reference Books**

1. B. R. Puri, L. R. Sharma and K. C. Kalia, Principles of Inorganic Chemistry
2. P. L. Soni, Text Book of Inorganic Chemistry
3. K. S. Tewari and N. K. Vishnoi, A Text Book of Organic Chemistry.
4. Arun Bahl and B.S. Bahl, Advanced Organic Chemistry, S. Chand and Sons.
5. M.K. Jain and S. C. Sharma, Modern Organic Chemistry
6. K.K.Rohatgi Mukherjee, Fundamentals of photochemistry , Wiley Eastern Ltd.
7. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, Chand & Co.
8. Malcom P. Stevens, Polymer Chemistry – An Introduction
9. V.R. Gowariker, Polymer Science, Wiley Eastern, 1995.
10. Sawyer.W, Experimental cosmetics, Dover publishers, New york, 2000.

## SKILL BASED COURSES IN BIOCHEMISTRY – SEMESTER III

### BLOOD BANKING

L	T	P	C
4	0	0	4

**Objective:** To launch extensive awareness programmes for blood banking services including donar motivation, so as to ensure adequate availability of safe blood.

Total Hours : 60

Unit-1  
Hours 12

#### Blood

Composition of blood, Basic principle involved in Immunohaematology prior to blood transfusion, Collection of blood – requirements, preparation, Veinpuncture. Hemolysis and prevention. Separation of serum.

Unit-2  
Hours 12

#### Collection of blood

Blood collection for transfusion, Changes in blood on keeping, Anticoagulants in blood bank, Prevention of blood – precautions, Blood containers – Blood bags – Safety in blood bags.

Unit-3  
Hours 12

#### Blood groups

Human blood group system – A, B, AB, O, Sub groups – A1 and A2 – Percentage of different groups, (D) factor system. Principles and Methods of blood grouping and Rh typing- tube and slide methods. Group interaction.

Unit- 4  
Hours 14

#### Blood transfusion

Types and identification of various blood transfusion, Universal donar/recipient. Donar selection, Compatibility test – importance, types and methods – major and minor. Interpretation of

compatibility test between all available donor and patient and reporting methods. Release of blood transfusion, Precautions to be followed.

Unit- 5  
Hours

14

Screening procedures for blood transfusion

Screening procedures for blood transfusion – HbsAg, HCV, HIV (ELISA, Western blot tests), VDRL, TPHA, Identification of Malarial and filarial parasites and LD bodies (Principles and methods).

### **References**

1. Clinical diagnosis and Management by laboratory methods by Henry Bernard, J., Sanford, T and Davidson, 2002. W.B. Saunders, New York.
2. Clinical Laboratory Methods and Diagnosis by Gradwohl, 2000. (ed) Ales C. Sonnenwirth and Leonard Jarret, M.D. B.I. publications, New Delhi.
3. Clinical Laboratory Medicine by Richard. R , 1989 Medical public., Chicago
4. Haematology by Williams and J. William, 1990 Mc Graw Hill, New York.
5. Medical Laboratory Technology Vol. I, II & III – Kanai .L. Mukherjee.

## NON MAJOR ELECTIVE COURSES IN BIOCHEMISTRY – SEMESTER III

(2017 onwards)

### NUTRITIONAL BIOTECHNOLOGY

L T P C2 0 0 2

Objective:

The course is intended to introduce the student to the basics of physiological aspects and to familiarize the students with the basics of human nutrition.

Unit I Nutrition –definition, Recommended Dietary Allowances (RDA) and balanced diet-factors affecting RDA, principles of deriving RDA. Carbohydrates –classification, functions, digestion and absorption maintenance of blood sugar level, sources.(10L)

Unit II Dietary fibre, role of fibres, recommended dietary allowances and sources, Lipids –classification, chemical composition, functions, sources, digestion and absorption recommended dietary allowances, deficiency diseases(5L)

Unit III Proteins, classification, functions, chemical composition, digestion and absorption, sources, recommended dietary allowances, deficiency diseases, factors affecting protein utilization.(5L)

Unit IV Vitamins-structure and biochemical roles, deficiency disorders of vitamin A, D, E,K, B1, B2, B6, Folic acid, Panthothenic acid, Niacin and Vitamin C.(5L)

Unit V Minerals-biochemical functions of Na, K, Ca, P, I, Fe and Se -Disorders related to hyper activity and deficiencies of these elements. Diseases related to nutritional deficiencies-Carbohydrates, Lipid, Proteins, Vitamins and Minerals.(5L)

Outcome: This course is introduced the basics of physiological aspects and basics of human nutrition to the students.

References

1.Nutrition science –B.SriLakshmi,New age international (P) limited

2.Nutritional Biochemistry –M.S. Swaminathan

3.Nutritional Biochemistry, 2nd edition, Tom Brody, Academic Press  
4.Nutrition –An integrated approach, 3rd edition, Ruth L. Pike and Myrtle L. Brown



SEMESTER- IV

Course-6 METABOLISM

L	T	P	C
4	0	0	4

**Objective: To recognize outstanding scientists for their efforts relating to metabolism research.**

Total Hours : 60

**Unit-1**

12

Hours

**General introduction to metabolism**

Carbohydrates metabolism – glycolysis, oxidation of pyruvate to acetyl coA. TCA cycle, Bioenergetics, Cori's cycle, metabolism of hexoses- galactose, fructose, mannose, pentose phosphate pathway, Glyoxalate pathway, Glycogen metabolism, Glucuronate pathway, gluconeogenesis.

**Unit-2**

12

Hours

**Lipid metabolism.**

Oxidation of fatty acid-  $\alpha$ ,  $\beta$  and  $\omega$  oxidation,  $\beta$ -Oxidation, role of carnitine in  $\beta$ -oxidation. Biosynthesis of fatty acid- saturated fatty acid- synthesis of palmitic acid, Unsaturated fatty acid – synthesis of linolenic acid, linoleic acid and palmitoleic acid, biosynthesis of triacylglycerol, biosynthesis of phospholipids, biosynthesis of cholesterol.

**Unit-3**

12Hours

**Bioenergetics**

Laws of thermodynamics and concepts of free energy, enthalpy and entropy. High energy phosphate compounds and significance of ATP. Electron transport chain and its significance, inhibitors of ETC, oxidative phosphorylation- chemiosmotic theory, site of oxidative phosphorylation, P/O ratio, inhibitors and uncouplers of oxidative phosphorylation.

## **Unit-4**

12

Hours

### **Aminoacid metabolism**

Transamination, deamination and decarboxylation of aminoacids. Metabolism of non-essential aminoacids – tyrosine, phenylalanine, Urea cycle. Integration of carbohydrate, lipid and protein metabolism, ketogenesis.

## **Unit-5**

12Hours

### **Nucleotide metabolism**

purine and pyrimidine biosynthesis and degradation.

### **References**

1. Principle of Biochemistry- Lehninger 3<sup>rd</sup> edition
2. Biochemistry- David Rawn
3. Principles of Biochemistry- B.L.Smith
4. Agarwal's text bok of Biochemistry- Goel publishing House
5. Harper's Review of Biochemistry- 24<sup>th</sup> edition
6. Text book of Biochemistry- Lubert Stryer 4<sup>th</sup> edition
7. Principles of Bichemistry- Emil L. Smith, Abraham White, Philip Handler- 7<sup>th</sup> edition.

## **MAJOR PRACTICAL-4: ISOLATION AND CHARACTERIZATION OF BIOMOLECULES**

1. Isolation and Estimation of DNA ( Animal tissue)
2. Isolation and estimation of RNA from yeast
3. Estimation of iron from Plant sources
4. Estimation of Protein from Soya bean
5. Estimation of Carbohydrates from Wheat
6. Estimation of calcium from milk
7. Estimation of Vitamin C from Citrus Fruits
8. Estimation of fructose from fruit.
9. Separation of aminoacids by paper chromatography
10. Separation of plant pigments by column chromatography

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

### **References**

1. Laboratory Manual in Biochemistry- T.N. Pattambiraman -3<sup>rd</sup> edition
2. Laboratory Manual in Biochemistry – J. Jayaraman, New Age International Publishers
3. Biochemical methods – S. Sathasivam and , A. Manicham, New Age International Publishers
4. An Introduction to Practical Biochemistry – David . T Plummer – 3<sup>rd</sup> edition

**MSU / 2017-18 / UG-Colleges / Part-III (B.Sc. Chemistry) /Semester –IV / Allied - II**  
**ALLIED CHEMISTRY - II**

L T P C  
2 2 0 3

**Objective**

To learn the chemistry of basic aromatic compounds. To understand the nuclear particles and few nuclear reactions To know about carbohydrates, amino acids, proteins and nucleic acid. To study about fuels, fertilizers, cement and glass. To know about some common diseases and the drugs used.

**UNIT 1 ORGANIC CHEMISTRY (11 Hrs)** Aromatic compounds General characteristics of aromatic compounds - aromaticity – Huckel’s rule with examples- non – benzenoid aromatic compounds (definition and examples only)

Preparation, properties and structure of benzene, naphthalene and anthracene.

**UNIT 2 PHYSICAL CHEMISTRY (13 Hrs)**

Nuclear chemistry

Nuclear stability – n/p ratio – packing fraction – mass defect – binding energy - isotopes, isobars, isotones with examples. Separation of isotopes by diffusion method – group displacement law - radioactive series - Nuclear fission, fusion - Application of radio isotopes (radio diagnosis and therapy, C-14 dating).

**UNIT 3 BIO CHEMISTRY (11 Hrs)**

Carbohydrates –definition and classification – artificial synthetic sweeteners. Amino acids - classification – amphoteric nature – isoelectric point. Proteins - classification according to composition, solubility and shape - colour reactions - biological action . Nucleic acids – purines, pyrimidines, nucleocides, nucleotides – DNA – structure of DNA – RNA - different types of RNA

**UNIT 4 INDUSTRIAL CHEMISTRY (13 Hrs)**

Fuel gases – Water gas, Producer gas, L.P.G, Gobar gas and Natural gas. Fertilizers – N.P.K and mixed fertilizers. Soaps and detergents – an elementary idea of soaps and detergents. Cleansing action of soaps and detergents. Cement and glass: Portland cementmanufacture only. Manufacture of glass- types and uses borosilicates -photochromic and safety glass.

**UNIT-5: PHARMACEUTICAL CHEMISTRY (12 Hrs)**

Common diseases – infective diseases – insect borne –air borne – water borne – hereditary diseases. Definition and examples of analgesics, antipyretics, sulpha drugs, antimalarials and, antibiotics. Diabetes – causes – hyper and hypoglycemic drugs. Indian medicinal plants – tulsi, neem, keezhanelli- their importance

Text Books

1. Puri, Sharma & Kalia, Principles of Inorganic Chemistry, Milestone Publishers and Distributors, 2008.
2. P.L. Soni, Text book of Inorganic Chemistry, Sultan Chand and Sons, 2007.

Reference Books

1. Bahl and Arun Bahl, Organic Chemistry, S. Chand and Sons, New Delhi , 2005.
2. Morrison & Boyd, Organic Chemistry, VIth ed, Prentice Hall of India Pvt. Ltd., New Delhi, 1998.
3. P. L. Soni, Text book of Organic Chemistry, S. Chand and Company Ltd., New Delhi .
4. J. L. Jain, Sunjay Jain and Nitin Jain, Fundamentals of Biochemistry, S. Chand and Company Ltd.,New Delhi, 2005.
5. S. Lakshmi, Pharmaceutical Chemistry, S. Chand and Sons, New Delhi , 1995.

## SKILL BASED COURSES FOR B.Sc. BIOCHEMISTRY - SEMESTER IV

### DNA FINGER PRINTING

L	T	P	C
4	0	0	4

**Objective: To promote the use of DNA technology in various areas relating to social welfare including crime and civil matters, plant and animal stock improvement, certification of cell lines, detection, prevention and treatment of diseases.**

Total Hours : 60

Unit- 1

12

Hours

Molecular basis of life

An introduction. Experimental Proof of DNA and RNA as genetic material.

Structure and functions of DNA and RNA. Watson and Crick model of DNA and other forms for DNA (A and Z ). Functions of DNA and RNA including ribozymes.

Unit- 2

12

Hours

Introduction of Genetic engineering.

Tools for genetic engineering, DNA manipulative enzymes – Restriction enzymes and DNA Ligases. Gene cloning vector – Plasmids, Bacteriophage and cosmids. Isolation of plasmid DNA (E.coli), Restriction digestion of DNA's.

Gene Libraries – Genomic DNA and cDNA cloning techniques, expression of cloned DNA in E.coli. separation of DNA by Agarose Gel Electrophoresis and SDA-PAGE, Polmerase chain reaction (PCR)

Blotting techniques – Southern, Western and Northen blot. Nucleic acid sequencing - Sanger's method.

Unit- 3

12

Hours

DNA finger printing

History, Evolution of term finger printing- Global and Indian scenario. Principle of DNA finger printing. Technological developments in DNA finger printing.

Tools for DNA Finger printing: Minisatellite based, Micro satellite based, SNP based techniques for DNA finger printing, Single locus to Multilocus, Singleplex to Multiplex.

Low through put to High throughput

### Application of DNA

Application of DNA in finger printing History, Agriculture, Veterinary, Medicines, Forensics, Ecology, Conservation.

### Unit- 5 15 Hours

#### Critical issues in DNA fingerprinting

Genetics issues, Technical issues, Statistical issues. Case studies: Historic cases, erratic cases. Application oriented case studies. Critical issues related case studies.

#### References

1. Glick, B.T and Pasternak J.J (1998) Molecular biotechnology, Principles and application of recombinant DNA, Washington D. C. ASM press.
2. Howe, C. (1995) Gene cloning and manipulation, Cambridge University Press, USA
3. Lewin, B., Gene VI New York, Oxford University Press
4. Rigby, P.W.J. (1987) Genetic Engineering Academic Press Inc., Florida, USA
5. Sambrook et al (2000), Molecular cloning volumes I, II & III, Cold spring Harbor Laborator Press, New York, USA
6. Walker J.M and Gingold E. B (1983) Molecular Biology and Biotechnology ( Indian Edition), Royal Society of Chemistry, U.K
7. Karp G. (2002) Cell & Molecular Biology, 3<sup>rd</sup> edition, John Wiley and Sons inc
8. Christopher H. (1995), Gene cloning and manipulating, Cambridge University Press
9. Nicholl D.S.T (1994) An Introduction of Genetic engineering, Cambridge University Press
10. Old R.W and Primrose S.B. (1986) principles of Gene manipulation, An introduction to Genetic Engineering ( 3<sup>rd</sup> edition) Black Well Scientific Publications
11. Watson J.D. Hopins, N.H. Roberts, J.W. Stectz J.A and Weiner A.M (1988). Molecular biology of society for Microbiology.
12. DNA fingerprinting: state of the science by Sergio D.J . Pena, Birkhauser 1993.
13. Genomic diversity: applications in human population genetics by Surinder Singh Papiha, Ranjan Deka, Ranajit Chakraborty: Springer, 1999.

**NON MAJOR ELECTIVE COURSES IN BIOCHEMISTRY – Semester IV**  
**CANCER BIOLOGY**

L T P C 2 0 0 2

**Objective:** This course for non biology or non biotechnology students, who are interested to know about the Biology of Cancer.

**Unit I** Fundamentals of Cancer biology-regulation of cell cycle, mutations that cause changes in signal molecules, effects on receptor, signal switches, tumour suppressor genes, modulation of cell cycle in cancer, different forms of cancers, diet and cancer. Cancer screening and early detection, Detection using biochemical assays, tumour markers, molecular tools for early diagnosis of cancer.(7L)

**Unit II** Principles of carcinogenesis –Chemical carcinogenesis, metabolism of carcinogenesis, principles of physical carcinogenesis, X –ray radiation -mechanisms of radiation carcinogenesis.(5L)

**Unit III** Principles of Molecular Cell Biology of Cancer –Signal targets and cancer, activation of kinases, Oncogenes, Identification of oncogenes, retroviruses and oncogenes, Oncogenes/proto oncogene activity. Growth factors related to transformation, telomerases.(7L)

**Unit IV** Principles of cancer metastasis -Clinical significances of invasion, heterogeneity of metastatic phenotype, metastatic cascade, basement membrane disruption, three step theory of invasion, proteinases and tumour cell invasion.(6L)

**Unit V** New Molecules for Cancer Therapy –Different forms of therapy, chemotherapy, radiation therapy, detection of cancers, advances in cancer detection. Use of signal targets towards therapy of cancer, Gene therapy.(5L)

**Outcome:** This course creates knowledge in tumour, oncogenes, signals and diagnosis and treatment of Cancer.

**References**

1. Maly B.W.J, "Virology a Practical Approach", IRLI Press, Oxford, 1987.
2. Dunmock N.J and Primrose S.B., "Introduction to Molecular Virology", Blacwell Scientific Publications, oxford, 1988.
3. "An Introduction To Cellular and Molecular Biology of Cancer", Oxford Medocal Publications, 1991.