

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA-8
(Affiliated to Krishna University, Machilipatnam)

SYLLABUS

Subject: Biochemistry

Course Title: Nucleic Acids &

Bioanalytical Techniques

No. of Hrs:60

LTP:400

Semester: II

Course Code: 20BCCCBT24

Credits:4

Course objectives

- Impart knowledge about biological significance and structures of Nucleic Acids
- Incorporating theoretical and practical knowledge of principles and working of analytical instrumentation.
- To know the usage of Instrumentation for analyzing/Separation of biochemically active compounds.

Course outcomes

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

CO1: Outline the molecular structure of DNA and RNA.

CO2: Understand the biological importance of nitrogenous base and nucleic acids

CO3: learn the principles of separation and isolation of cells and tissues for studying their functional abnormalities

CO4: acquire Knowledge about different Bioanalytical Instruments and their applications to biochemistry

Unit-I: Nucleic Acids and Porphyrins

(12hrs)

1.1 General Structure of nucleotides, nucleosides, purines, and pyrimidines, Nucleic acids - Structure and types of DNA and RNA. Watson-Crick DNA double helix structure, Biological importance Hydrolysis of nucleic acids. formation of phosphodiester bonds, Introduction to circular DNA, supercoiling, Denaturation of nucleic acids hyperchromic effect, T_m-values, and their significance.

1.2 Structure of porphyrins, protoporphyrin, porphobilinogen Properties, Identification of Porphyrins, Metalloporphyrins—heme, Cyanocobalamin and chlorophylls.

Unit-II: Centrifugation and Electrophoresis techniques (12hrs)

- 2.1 Methods of tissue homogenization: (Potter-Elvehjem, mechanical blender, sonicator, and enzymatic). Centrifugation techniques- principles, and applications- differential, density gradient. Ultra-centrifugation- preparative and analytical.
- 2.2 Electrophoresis- principles and applications of paper, polyacrylamide (native and SDS) and agarose gel electrophoresis, isoelectric focusing, immune-electrophoresis-types, and applications.

Unit-III: Chromatographic techniques (12hrs)

- 3.1 Types of chromatographic techniques, Principle and applications - Paper chromatography- solvents, R_f value, applications; Thin layer chromatography- principle, choice of adsorbent and solvent, R_f value, applications;
- 3.2 Gel filtration, Ion-exchange- Chromatography applications, separation of metal ions, Affinity chromatography.

Unit-IV: Spectroscopy and tracer techniques (10hrs)

- 1.1 Electromagnetic radiation, Beer-Lambert's law. Colorimetry and Spectrophotometry, spectrofluorimetric, flame photometry.
- 1.2 Tracer techniques: Radioisotopes, units of radioactivity, half-life, β , and γ - emitters, use of radioactive isotopes in biology.

Unit-V: Microbial techniques: (10hrs)

- 5.1 Microscopy: Basic principles of light microscopy, phase contrast, electron microscope, and fluorescent microscope and their applications. Preparation of different growth media, isolation and culturing and preservation of microbes.
- 5.2 Gram's staining- Gram-positive and Gram-negative bacteria, Flagellar staining for motility and Endospore staining, Sterilization Techniques-Physical methods, chemical methods, radiation methods, ultrasonic and. Antibiotic resistance.

Skill / Hands-on (2hrs)

- Schematize the structures of Nucleic acids
- Isolations of biologically relevant compounds.
- Different separation techniques for analyzing and separating biologically active compounds
- Basic microbial Techniques -Sterilization techniques, Medium preparation

Co-curricular Activities: (2hrs)

- Structure practicing sessions

- Class Tests
- Quiz
- Assignment

Prescribed Textbooks

1. Textbook of Biophysical Chemistry – Nath & Upadhyaya., Himalaya publications
2. Leininger Principles of Biochemistry SEVENTH EDITION David L. Nelson Madison Michael M. Cox.
3. Outlines of Biochemistry, 5th Edition by E E Conn, PK Stumpf 693. John Wiley and Sons, New York. 1987
4. Biochemistry Prof. U. Satyanarayana, 3rd revised Edition:2006, Arunabha Sen, books and allied (P)Ltd, 8/1Chintamani Das lane, Kolkata 700009.

Reference text Books

1. Biochemistry by L. Steyer (1995) W.H. Freeman Press, San Francisco, USA. 4.
2. Biochemistry, by Voet. D. and Voet, J.G. (2004). 3rd Edition, John Wiley & Sons, Inc. USA.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA-8
(Affiliated to Krishna University, Machilipatnam)

MODEL QUESTION PAPER

Subject: Biochemistry
**Course Title: Nucleic Acids &
Biochemical Techniques**

Time: 3 Hrs.

Date

Semester: II
Course Code:20BCCCBT24

Max. Marks: 100 M

Reg. No.

SECTION-A

Answer **ALL** questions

20 X 1 = 20 M

1. The basic building block of nucleic acid is
 - A. NDP
 - B. NTP
 - C. NMN
 - D. DTP
2. Deoxyribose Nucleic Acids are
 - A. Powerhouse
 - B. Chemical factories
 - C. Genetic material
 - D. Waste material
3. The sedimentation coefficient has units of time, expressed in
 - A. Svedbergs.
 - B. Gravitational Constant
 - C. Gravity
 - D. Density
4. In the electrophoresis process DNA migrates towards the positive anode in the presence of an electric field due to the presence of _____ charge on it.
 - A. Positive
 - B. Negative
 - C. Amphoteric
 - D. Neutral
5. The substance to be separated in a chromatographic procedure is called _____.
 - A. Solute
 - B. Solvent

- C. Solution
- D. Sublimate

6. The primary difference between ribose sugar and deoxyribose sugar is the presence of hydroxyl group on the _____ of ribose.

- A. 2' carbon
- B. 4' carbon
- C. 6' carbon
- D. 5' carbon

7. Molecular weight in DNA and RNA are

- A. Nucleic acids
- B. Proteins
- C. Carbohydrates
- D. Pentoses

8. The term **radioactivity** was actually coined by

- A. Marie Curie
- B. Rosalind
- C. Watson
- D. Becquerel

9. Sodium dodecyl sulfate(SDS) in SDS-PAGE is a _____ detergent.

- A. Anionic
- B. Cationic
- C. Non-anionic
- D. Anionic exchanger

10. In which type of chromatography, the stationary phase held in a narrow tube, and the mobile phase is forced through it under pressure?

- A. Column chromatography
- B. Planar chromatography
- C. Liquid chromatography
- D. Gas chromatography

11. IR spectrum is a plot of:
- A. % Transmittance versus time
 - B. % Transmittance versus wavenumber
 - C. Peak area versus time
 - D. Peak area versus wavenumber
12. Which of the following spectroscopy techniques is associated with molecular emission?
- A. UV-Visible spectroscopy
 - B. IR spectroscopy
 - C. Fluorescence spectroscopy
 - D. X-ray diffraction
13. A compound containing some amount of radioisotope is _____
- A. tracer
 - B. radioactive compound
 - C. non-radioactive
 - D. linear active compound
14. Nuclei bombarded with protons, neutron or alpha particles are changed to
- A. Isotopes
 - B. Radioisotopes
 - C. An element having an atomic number less than 82
 - D. None of above
15. The half-life of a radioisotope is the time taken for _____
- A. complete decay
 - B. half the half decay
 - C. half of the complete decay
 - D. start of the decay process
16. What do you mean by sterilization?
- A. Purification of products
 - B. Recovery of products
 - C. Elimination of contamination
 - D. Formulation of media

17. The highest feasible temperature for batch sterilization is _____ in autoclave is.
- A. 124°C
 - B. 120°C
 - C. 122°C
 - D. 121°C
18. Laminar Air Flow (LAF) prevents the contamination of _____ samples.
- A. Chemical
 - B. Biological
 - C. Dry powder
 - D. Medium
19. Which of the following refers to a disinfecting chemical dissolved in alcohol?
- A. Iodophor
 - B. Tincture
 - C. Phenol
 - D. Peroxygen
20. Which of the following peroxygenase is widely used as a household disinfectant, is inexpensive, and breaks down into water and oxygen gas?
- A. hydrogen peroxide
 - B. peracetic acid
 - C. benzoyl peroxide
 - D. ozone

SECTION-B

Answer any **FOUR** questions

4 X 8 =32M

21. What are nucleic acids? Mention the different elements present Draw structures of nucleic acids.
22. Illustrate the formation of phosphodiester bonds with their structures.
23. Write a short note on the Density gradient centrifugation technique.
24. Explain the process of Gel Filtration Chromatography/ and write the principle.
25. Describe the physical and chemical methods of sterilization.
26. Enlist the uses of radioactive isotopes in biology.

SECTION-C

Answer any **FOUR** questions

4 X12=48M

27. How different Chromatography Techniques are used for the separation of Biological compounds.
28. What is a microscope Write a brief note on different types of microscopes.
29. Give the principle and working of the spectrophotometer?
30. Show with the help of a diagram and discuss base-pairing present in the Watson and Crick double-helical structure of DNA.
31. Explain the different types of Electrophoresis techniques?
32. Define the Beer lamberts Law. Write the concept of Molecular extinction Coefficient.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA
(Affiliated to Krishna University, Machilipatnam)

Blueprint

Subject: Biochemistry
Course Title: Nucleic Acids &
Bioanalytical Techniques
Maximum Marks: 100

Semester: II
Course Code: 20BCCCBT24
Maximum Time: 3Hrs.

SECTION – A

Answer **ALL** questions

20 x 1 = 20 M

Q. No.	UNIT	Marks Weightage	RBT LEVEL
1	I	1	RBT1 – 10 RBT2 – 10
2	I	1	
3	I	1	
4	I	1	
5	II	1	
6	II	1	
7	II	1	
8	II	1	
9	III	1	
10	III	1	
11	III	1	
12	III	1	
13	IV	1	
14	IV	1	
15	IV	1	
16	IV	1	
17	V	1	
18	V	1	
19	V	1	
20	V	1	

SECTION – B

Answer any **FOUR** questions

4 x 8 = 32 M

Q. No.	UNIT	Marks Weightage	RBT LEVEL
21	I	8	RBT1 – 3; RBT2 – 3
22	II	8	
23	III	8	
24	IV	8	

25	V	8	
26	I / II / III / IV / V	8	

SECTION – C

Answer any **FOUR** questions

4 x 12 = 48

M

Q. No.	UNIT	Marks Weightage	RBT LEVEL
27	I	12	RBT1 – 3; RBT2 – 3
28	II	12	
29	III	12	
30	IV	12	
31	V	12	
32	I / II / III / IV / V	12	

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA-8
(Affiliated to Krishna University, Machilipatnam)

PRACTICAL SYLLABUS

Subject: Biochemistry

Course Title: Isolations &

Biochemical Techniques-Practical

No. of Hrs:30

LTP:002

Semester: II

Course Code: 20BCP2BT21

Credits:1

Course objectives

- learn the various analytical techniques
- applications in the separation
- isolation of cells and tissues for studying their functional abnormalities
- Quantitation of DNA & RNA

Course outcomes

After completion of the practical, students will be able to

CO1: separate molecules chromatography techniques

CO2: Isolate Biological relevant components from different food sources.

1. Isolation of RNA and DNA from tissue/culture.
2. Estimation of RNA by Orcinol Method.
3. Separation of plant pigments by TLC
4. Isolation of egg albumin from egg white.
5. Isolation of cholesterol from egg yolk.
6. Isolation of starch from potatoes.
7. Isolation of casein from milk.
8. Separation of amino acids by paper chromatography.

Prescribed Textbook

1. Experimental Biochemistry: A Student Companion by Beige Shashidhar Rao, Vijay Deshpande.
2. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology. Andreas Hoffman and Samuel Cookie.
3. An introduction to practical biochemistry. David T. Plummer, Tata Mac Grew-Hill.

Reference Textbook

1. Techniques in Molecular biology Ed. Walker & Gastra, Croom Helm, 1983.
2. An introduction to spectroscopy for Biochemistry. Ed. Brown S.N., Academic press.
3. Analytical Biochemistry, Holmes, and Hazel peck, Longman, 1983.
4. A textbook of quantitative inorganic analysis including elementary instrumental analysis, Vogel ELBS.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA
(Affiliated to Krishna University, Machilipatnam)

Scheme of Valuation of Practical examination

Subject: Biochemistry

Course Title: Biochemical Techniques-Practical

Maximum Marks: 50

Semester: II

Course Code: 20BCP2BT21

Time: 3Hrs.

- | | |
|--------------------------------------|-------------|
| 1. Major Isolation | 7 + 5 = 12M |
| Isolation of Casein from Milk | |
| 2. Minor Separation Technique | 4 + 4 = 8M |
| Paper Chromatography of Amino acids. | |
| 3. Principles/Identification | 2 X 5 = 10M |
| 4. Viva | 10M |
| 5. Record | 10M |

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
(Affiliated to Krishna University, Machilipatnam)

SYLLABUS

Subject: Biochemistry

Semester: III

**Course Title: Enzymology &
Intermediary Metabolism**

Course Code:20BCCCIM34

No. of Hrs:60

LTP:400

Credits:4

Course objectives

- To understand the concepts of enzymes and enzyme-substrate reactions.
- To acquire basic knowledge about the energy transformations of living organisms.
- To impart knowledge of bioenergetic reactions
- To provide information on metabolic processes undergone by the biomolecules
- To emphasize the importance of the metabolism of biological systems.

Course outcomes:

At the end of the course, the student can

CO1: Gain knowledge about the physiological importance of enzymes

CO2: Classify the metabolic reactions

CO4: Explain the fate of various cell metabolites.

CO5: Analyse different energy transformation laws

CO6: Understand the pathophysiology of metabolic diseases

Unit-I: Enzymology

(12 hrs.)

1.1 Introduction to Biocatalysts, differences between chemical and biological catalysis.

Nomenclature and classification of enzymes. Definition of holo-enzyme, apo-enzyme, coenzyme, cofactor. The active site, Enzyme specificity. Principles of the energy of activation, transition state. Interaction between enzyme and substrate-lock and key, induced fit models. Fundamentals of enzyme assay, enzyme units.

1.2 Michaelis -Menten equation for the uni-substrate reaction (derivation not necessary), Significance of K_m and V_{max} Enzyme inhibition –competitive and non-competitive. Outlines of the mechanism of enzyme action, factors affecting enzyme activity. Commercial application of enzymes.

Unit- II: Bioenergetics and Biological oxidation (10 hrs.)

2.1 Bioenergetics: Thermodynamic principles – Chemical equilibria; free energy, enthalpy (H), entropy (S). Free energy change in biological transformations in living systems; High energy compounds. Energy, change.

2.2 Oxidation-reduction reactions. Organization of electron carriers and enzymes in mitochondria. Classes of electron-transferring enzymes, inhibitors of electron transport. Oxidative phosphorylation. Uncouplers and inhibitors of oxidative phosphorylation.

Unit-III: Carbohydrate Metabolism. (10 hrs.)

3.1 Concept of anabolism and catabolism. Glycolytic pathway, energy yield. The fate of pyruvate-formation of lactate and ethanol, Citric acid cycle, regulation, energy yield. Glycogenolysis and glycogenesis. Pentose phosphate pathway.

3.2 Gluconeogenesis. Photosynthesis- Light and Dark reactions, Calvin cycle, C₄ Pathway. Anaplerotic reactions. Disorders of carbohydrate metabolism- Diabetes Mellitus.

Unit-IV: Lipid and Nucleotide Metabolism (12hrs.)

4.1 Catabolism of fatty acids (β - oxidation) with even and an odd number of carbon atoms, degradation of triacylglycerol, and lecithin Biosynthesis of triacylglycerol lecithin.

Biosynthesis of cholesterol, Disorders of lipid metabolism.

4.2 General reactions of amino acid metabolism- transamination, decarboxylation and deamination, Urea cycle and regulation, Biosynthesis of creatine. Inborn errors of aromatic and branched-chain amino acid metabolism.

Unit-V: Metabolism of Nucleotides (12 hrs.)

5.1 Biosynthesis and regulation of purine and pyrimidine nucleotides De novo and the salvage pathway.

5.2 Catabolism of purines and pyrimidines, Degradation, Disorders of nucleotide metabolism- Gout, Lesch-Nyhan syndrome, Heme Biosynthesis, and porphyria.

Skill / Hands-on (2hrs.)

- Schematize the metabolic reactions
- Identification of biologically relevant metabolites
- Calculation of Energy transformations
- Connecting different metabolisms to TCA cycle

Co-curricular Activities: (2hrs.)

- Metabolites Structure practicing sessions

- Assignments on metabolic disorders
- Drawing chart for whole Intermediary Metabolism

Prescribed Textbooks

1. The biochemistry of Nucleic acids; Adams et al., Chapman and Hall, 1986.
2. Biochemistry 3rd Edition 2006 by Satyanarayana, Chakrapani 3rd revised
3. Outlines of Biochemistry, 5th Edition by E E Conn, PK Stumpf 693. John Wiley and Sons, New York. 1987
4. Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN:13:978-1-4641-0962-1
5. Biochemistry (2012) 7th ed., Berg, J.M., Tymoczko, J.L. and Stryer L., W.H. Freeman and Company (New York), ISBN:10:1-4292-2936-5, ISBN:13:978-1-4292-2936

Reference text Books

1. Textbook of Biochemistry with Clinical Correlations (2011) 7th ed., Devlin, T.M., John Wiley & Sons, Inc. (New Jersey), ISBN:978-0-470-28173-4.
2. Biochemistry, A problem Approach, 2nd Edn. Wood, W.B. Addison Wesley 1981.
3. Principles of Biochemistry White-A, Handler, Pand Smith E.L. Mc Graw Hill.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA
(Affiliated to Krishna University, Machilipatnam)

MODEL QUESTION PAPER SEMESTER END EXAMINATIONS

Subject: Biochemistry
Course Title: Enzymology &
Intermediary Metabolism

Maximum Marks: 100

Date

Semester: III
Course Code: 20BCCCIM34

Maximum Time: 3Hrs.

Reg No.

SECTION-A

Answer **ALL** questions

20 X 1 = 20 M

1. A _____ is a biocatalyst that increases the rate of the reaction without being changed.
 - A. Aluminum oxide
 - B. Silicon dioxide
 - C. Enzyme
 - D. Hydrogen peroxide

2. Name the enzyme which is non-proteinaceous.
 - A. Ribozyme
 - B. Peptidase
 - C. Xylanase
 - D. Cellulase

3. Enzyme increases the rate of reaction by lowering the _____ Energy.
 - A. activation
 - B. Emitted
 - C. Absorbed
 - D. Residual

4. What is the nature of an enzyme?
 - A. Vitamin
 - B. Lipid
 - C. Carbohydrate

D. Protein

5. Breakdown of Glycogen is called
- A. Glycogenolysis
 - B. Lipolysis
 - C. Alkalosis
 - D. Glycolysis
7. For photosynthesis green plants require:
- A. Chlorophyll only
 - B. Light
 - C. Carbon dioxide and water
 - D. All of the above
8. Diabetes Mellitus is an impairment of _____metabolism.
- A. Carbohydrate
 - B. Lipid
 - C. Fats
 - D. Nucleic acids
9. β - oxidation) is _____of fats with odd number of carbon atoms.
- A. Catabolism
 - B. Anabolism
 - C. lipogenesis
 - E. change from even
10. Degradation of Triacylglycerol yields
- A. Fatty acids +Glucose
 - B. Fatty acids+ Glycerol
 - C. Fatty acids+ Fats
 - D. 2 Fatty acids
11. Fatty acids are elongated in
- A. Microsomes
 - B. Mitochondria
 - C. Cytoplasm
 - D. Desmosomes

12. Lecithin brings about even dispersion of
- A. Fats and Oils
 - B. Fats and sugars
 - C. Different Fats
 - D. Different Oils
13. Which of the following is not the precursor for the denovo purine biosynthesis?
- A. Aspartic Acid
 - B. Glycine
 - C. Glutamine
 - D. Arginine
14. Which of the following cofactor is used during the conversion of uracil to thymine?
- A. S-Adenosyl Methionine
 - B. Tetrahydrofolate
 - C. Tetrahydrobiopterin
 - D. Biotin
15. Which of the following is the degradation product of pyrimidines?
- A. beta-alanine
 - B. Uric acid
 - C. Allantoin
 - D. Glycine
16. Identify activator of the enzyme "Glutamine: Phosphoribosylpyrophosphate amidotransferase" a committed step of de novo biosynthesis of purines?
- A. Adenosine Monophosphate
 - B. Guanosine Monophosphate
 - C. Inosine Monophosphate
 - D. Phosphoribosyl Pyrophosphate
17. Transamination reaction in amino acid synthesis is catalyzed by enzyme_____
- A. Nitric oxide synthase
 - B. Decarboxylase
 - C. Aminotransferase

D. Glutamate decarboxylase

18. Krebs-Henseleit cycle. Is also known as

- A. urea cycle
- B. Uric acid cycle
- C. Bile Cycle
- D. TCA cycle

19. Name the amino acid which does not take part in transamination during amino acid catabolism.

- A. Proline
- B. Threonine
- C Lysine
- D Serine

20. Which of these is a hereditary disease caused due to an error in amino acid metabolism?

- A. Homocystinuria
- B. Albinism
- C. Phenylketonuria
- D. Branched-chain ketoaciduria

SECTION-B

Answer any **FOUR** questions

4 X 8 =32M

- 21. Outline the mechanism of enzyme inhibition.
- 22. Give an account of anaplerotic reactions.
- 23. Explain the process of beta-oxidation of fat
- 24. Give an account of the biosynthesis of Haem porphyrin.
- 25 Describe the processes of decarboxylation and deamination.
- 26. Enumerate steps with the glycolytic pathway with structures.

SECTION-C

Answer any **FOUR** questions

4 X 12=48M

- 27. Write the classification of the enzymes.
- 28. Discuss light and dark reactions of photosynthesis.
- 29. Organize different stages of the synthesis of cholesterol biosynthesis
- 30. Show the process of Haem biosynthesis with structures.
- 31. Summarize the ultimate fates of the carbon skeletons of the amino acids.
- 32. What is the other name for the citric acid cycle. Describe the cycle with structure.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA
(Affiliated to Krishna University, Machilipatnam)

Blueprint

Subject: Biochemistry
Course Title: Enzymology & Intermediary
Maximum Marks: 100

Semester: III
Course Code: 20BCCCIM34
Maximum Time: 3Hrs.

SECTION – A

Answer **ALL** questions

20 x 1 = 20 M

Q. No.	UNIT	Marks Weightage	RBT LEVEL
1	I	1	RBT1 – 10 RBT2 – 10
2	I	1	
3	I	1	
4	I	1	
5	II	1	
6	II	1	
7	II	1	
8	II	1	
9	III	1	
10	III	1	
11	III	1	
12	III	1	
13	IV	1	
14	IV	1	
15	IV	1	
16	IV	1	
17	V	1	
18	V	1	
19	V	1	
20	V	1	

SECTION – B

Answer any **FOUR** questions

4 x 8 = 32 M

Q. No.	UNIT	Marks Weightage	RBT LEVEL
21	I	8	RBT1 – 3; RBT2 – 3
22	II	8	
23	III	8	
24	IV	8	
25	V	8	
26	I / II / III / IV / V	8	

SECTION – C

Answer any **FOUR** questions

4 x 12 = 48 M

Q. No.	UNIT	Marks Weightage	RBT LEVEL
27	I	12	RBT1 – 3; RBT2 – 3
28	II	12	
29	III	12	
30	IV	12	
31	V	12	
32	I / II / III / IV / V	12	

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
(Affiliated to Krishna University, Machilipatnam)

PRACTICAL SYLLABUS

Subject: Biochemistry

Semester: III

Course Title: Enzymology-Practical

Course Code:20BCP3EN31

No. of hours: 30

LTP 002

Credits: 1

Course objectives

- Learn the various Enzymes assays
- Quantitation of biologically important parameters.

Course outcomes

After completion of the practical, students will be able to

CO1: perform assays for different enzymes

CO2: Efficiently quantitate different biologically important parameters.

1. Assay of amylase.
2. Assay of urease.
3. Assay of catalase
4. Effect of pH, the temperature on enzyme activity.
5. Effect substrate concentration on enzyme activity.
6. Estimation of Haemoglobin by Cyanmethemoglobin method.
7. Estimation of Urea by Diacetyl Monoxime (DAM) Method
8. Estimation of Blood Glucose by Dinitro salicylic acid method.

Prescribed Textbook

1. Experimental Biochemistry: A Student Companion by Beige Sashidhar Rao, Vijay Deshpande.
2. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology. Andreas Hoffman and Samuel Cloekie.
3. An introduction to practical biochemistry. David T. Plummer, Tata Mac Grew-Hill.

Reference Textbook

1. Techniques in Molecular biology Ed. Walker & Gastra, Croom Helm, 1983.
2. An introduction to spectroscopy for Biochemistry. Ed. Brown S.N., Academic press.
3. Analytical Biochemistry, Holmes, and Hazel peck, Longman, 1983.
4. A textbook of quantitative inorganic analysis including elementary instrumental analysis, Vogel ELBS.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA
(Affiliated to Krishna University, Machilipatnam)

Subject: Biochemistry

Semester: III

Course Title: Enzymology Enzymology-Practical

Course Code: 20BCP3EN31

Maximum Marks: 50

Maximum Time: 3Hrs.

Scheme of Valuation of Semester End Practical examination

1	Major	7 + 5 = 12M
	Estimation of Urea by Serum Urea by Diacetyl Monoxime (DAM) Method	
2	Minor	4 + 4 = 8M
	Assays /Analyze	
	Assay the activity of Catalase enzyme,	
3.	Principles/Identification	2 X 5= 10M
3	Viva	10M
4	Record	10M

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA
(Affiliated to Krishna University, Machilipatnam)

SYLLABUS

Subject: Biochemistry	Semester: IVA
Course Title: Physiology, Nutrition & Clinical Biochemistry	CourseCode:20BCCCCB44
No. of Hrs:60	LTP:400
	Credits:4

Unit-I: Digestion and Blood (12hrs.)

- 1.1 Digestion and absorption of carbohydrates, lipids, and proteins. Role of enzymes and gastrointestinal hormones in digestion.
- 1.2 Composition of the blood, Blood groups, coagulation of blood, and disorders of blood coagulation (hemophilia). Hemoglobin and transport of gases in the blood (oxygen and CO₂). Types of anemias, hemoglobinopathies-sickle cell anaemia.

Unit-II: Excretory system and Musculoskeletal system (10hrs.)

- 2.1 Muscles- types of muscles and mechanism of muscle contraction. skeletal system- Organization of the skeleton, Structure of bone tissue, Division, and Classification
- 2.2 Introduction to excretory system Organization of kidney, Structure, and functions of the nephron, Urine formation, Role of kidneys in maintaining acid-base and electrolyte balance in the body.

Unit III: Nervous system and Endocrinology. (12hrs.)

- 3.1 Introduction to the nervous system, the general organization of a nervous system, Neurons- structure, types, properties and functions; Neurotransmitters, Reflex-types, and Cerebrospinal fluid. Composition and functions
- 3.2 Endocrinology- organization of the endocrine system. Classification of hormones. Outlines of chemistry, physiological role, and disorders of hormones of thyroid, parathyroid, pituitary, and hypothalamus. Introduction of gastrointestinal hormones. Mechanism of hormonal action,

Unit- IV: Nutritional Biochemistry (12hrs.)

- 4.1 Balanced diet. Calorific values of foods and their determination by bomb calorimeter. BMR and factors affecting it. The specific dynamic action of foods. Energy requirements Sources of complete and incomplete proteins. The biological value of proteins. Malnutrition- Kwashiorkor, Marasmus, and PEM.

4.2 Vitamins- sources, structure, biochemical roles, deficiency disorders of water- and fat-soluble vitamins. Introduction to nutraceuticals and functional foods. Bulk and trace elements-Ca, Mg, Fe, I, Cu, Mo, Zn, Se, and F.

Unit- V: Clinical Biochemistry (12hrs.)

5.1 Plasma proteins in health and disease. Serum lipids and lipoproteins. Liver function tests- conjugated and total bilirubin in serum, albumin: globulin ratio, Serum enzymes in liver diseases-SGOT, SGPT, GGT, CPK, Acid, and alkaline phosphatases.

5.2 Normal and abnormal constituents of urine. Renal function tests-Blood urea, creatinine, GFR, creatinine clearance. GTT and gastric and pancreatic function tests.

Skill / Hands-on (2hrs.)

- Schematize the metabolic reactions
- Identification of biologically relevant metabolites
- Calculation of Energy transformations
- Connecting different metabolisms to TCA cycle

Co-curricular Activities: (2hrs.)

- Schematic models of different Physiological Systems
- Assignments
- Schematic representations through Charts

Prescribed Books

1. Biochemistry 3rd Edition 2006 by Satyanarayana, Chakrapani 3rd revised
2. Essentials of Food and Nutrition, Vol. I & II, M.S. Swaminathan.
3. Text Book of Biochemistry with clinical correlations. Thomas M. Devlin (John Wiley).
4. Harper's Review of Biochemistry, Murray et al (Longman).
5. Biochemical aspects of human disease – R.S. Elkeles and A.S. Tavit. (Blackwell Scientific Publications).
5. Human Physiology by Chatterjee And Chatterjee

Reference Books

1. Guyton and Hall Textbook of Medical Physiology.
2. Clinical Biochemistry – S.Ramakrishnan and Rajiswami.
3. Chemical Biochemistry (Metabolic and clinical aspects) by W.J.Marshall & S.K.Bangert.
4. Textbook of clinical Biochemistry by Tietz et al.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA
(Affiliated to Krishna University, Machilipatnam)

MODEL QUESTION PAPER FOR SEMESTER END EXAMINATION

Subject: Biochemistry
**Course Title: Physiology, Nutrition &
Clinical Biochemistry**
Maximum Marks: 100
Date

Semester: IV-1

CourseCode:20BCCCCB44

Time: 3Hrs.

Reg No.

SECTION-A

Answer **ALL** questions

20 X 1 = 20 M

1. _____ is a process of is the breakdown of large insoluble food molecules into small water-soluble food molecules so that they can be absorbed
 - A. Ingestion
 - B. Digestion
 - C. Ejection
 - D. Absorption

2. Name the enzyme which breaks down proteins
 - A. Pepsin
 - B. Peptidase
 - C. Proteinase
 - D. Amylase

3. Blood is fluid _____ tissue
 - A. Connective
 - B. Muscle
 - C. Nervous
 - D.

4. Blood is composed of Formed elements and _____
 - A. Plasma
 - B. Lymph
 - C. Water
 - D. Chemicals

5. Actin and myosin are both proteins that are found in all types of _____ tissue
- A. Muscle
 - B. Nervous
 - C. Vascular
 - D. Connective
6. Cardiac muscles are _____ cells.
- A. Multinucleate
 - B. Uninucleate
 - C. Binucleate
 - D. Anucleate
7. _____ is considered as the basic functional unit of the human kidney
- A. Exon
 - B. Nephron
 - C. Cilia
 - D. Neuron
8. The _____ is a network of tiny blood vessels located at the beginning of a nephron.
- A. Renal calyces
 - B. Renal pyramid
 - C. Bowman's capsule
 - D. Glomerulus
9. Cerebral palsy affects neurons in which part of the body?
- A. Brain
 - B. Muscles
 - C. Bones
 - D. Spine
10. Full form of HCG
- A. Human gonadotropin
 - B. Human chorionic gonadotropin
 - C. Chorionic gonadotropin
 - D. Gonadotrpin Hormone

11. Which of the following secretions is exocrine?

- A. Pineal Gland.
- B. Pituitary Gland.
- C. Thyroid.
- D. Salivary

13. Calorific value of protein is

- A. 8
- B. 9
- C. 4
- D. 6

14. Deficiency disorders are deficiencies of?

- A. Vitamins
- B. Minerals
- C. Carbohydrates
- D. Fats

15. The _____ is an instrument used to measure the heat of reaction at a fixed volume and the measured heat which is called the change of internal energy (ΔE)

- A. Bomb calorimeter
- B. Calorimeter
- C. Thermometer
- D. Heater

16. Write the full form of PEM

- A. Protein Energy Malnutrition
- B. Protein Malnutrition
- C. Energy Malnutrition
- D. Malnutrition

17. SGPT & SGOT are the enzymes are done for investigation of _____ function.

- A. Liver
- B. Kidneys
- C. Renal
- D. Gastric

18. The normal range for Specific gravity of Normal Urine is

- A. 1.005 to 1.030
- B. 1.055 to 1.035

- C. 1.000 to 1.030
- D. 1. 500 to 1. 800

19. Elevated alkaline phosphatase is indicator of _____.
- A. Chemosis
 - B. Acidosis
 - C. Alkalosis
 - D. biliary obstruction due to stones
20. The is a network of small blood vessels (capillaries) known as a tuft, located at the beginning of a nephron in the kidney.
- A. glomerulus
 - B. Neurons
 - C. Sarcomere
 - D. Capillaries

SECTION-B

Answer any **FOUR** questions

4 X 8 =32M

- 21. Outline the mechanism of Hormone action.
- 22. Write a note on reflex types.
- 23. What is the calorific value of food. Write the calorific value of carbohydrates, fats, and proteins
- 24. Give an account of acid-base balance maintenance by kidney
- 25. Write the composition of blood.
- 26. Enlist different trace elements and discuss their role.

SECTION-C

Answer any **FOUR** questions

4 X 12=48M

- 27. Describe the processes of muscle contraction and relaxation.
- 28. Classify water-soluble and fat-soluble vitamins. Draw their structures.
- 29. Describe the structure and function of the kidney.
- 30. Enlist the different Liver Function Tests
- 31. Summarize the different malnutrition conditions resulting from protein deficiency.
- 32. Describe the process of blood coagulation.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA
(Affiliated to Krishna University, Machilipatnam)

Blueprint

Subject: Biochemistry
Course Title: Physiology, Nutrition & Clinical Biochemistry

Semester: IVA

Course Code: 20BCCCCB44

Maximum Marks: 100

Maximum Time: 3Hrs.

SECTION – A

Answer **ALL** questions

20 x 1 = 20 M

Q. No.	UNIT	Marks Weightage	RBT LEVEL
1	I	1	RBT1 – 10 RBT2 – 10
2	I	1	
3	I	1	
4	I	1	
5	II	1	
6	II	1	
7	II	1	
8	II	1	
9	III	1	
10	III	1	
11	III	1	
12	III	1	
13	IV	1	
14	IV	1	
15	IV	1	
16	IV	1	
17	V	1	
18	V	1	
19	V	1	
20	V	1	

SECTION – B

Answer any **FOUR** questions

4 x 8 = 32 M

Q. No.	UNIT	Marks Weightage	RBT LEVEL
21	I	8	RBT1 – 3; RBT2 – 3
22	II	8	
23	III	8	
24	IV	8	
25	V	8	

26	I / II / III / IV / V	8	
----	-----------------------	---	--

SECTION – C

Answer any **FOUR** questions

4 x 12 = 48 M

Q. No.	UNIT	Marks Weightage	RBT LEVEL
27	I	12	RBT1 – 3; RBT2 – 3
28	II	12	
29	III	12	
30	IV	12	
31	V	12	
32	I / II / III / IV / V	12	

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
(Affiliated to Krishna University, Machilipatnam)

PRACTICAL SYLLABUS

Subject: Biochemistry

Semester: IVA

Course Title: Clinical Biochemistry-Practical

Course Code:20BCP4CB41

No. of hours: 30

LTP 002

Credits: 1

Course objectives

- To Learn LFT, RFT, and determination of biological components
- perform biochemical tests,

CO3: Course outcomes

After completion of the practical, students will be able to

CO1: Correlate the normal values to those present in diseased conditions,

CO2: Estimate different Biochemical parameters from a serum sample.

1. Determination of vitamin C by 2, 6 -dichlorophenol indophenol method.
2. Estimation of iron by Wong's method.
3. Urine Analysis of albumin, sugars, and ketone bodies
4. Estimation of Serum Albumin-Globulin ratio
5. Estimation of serum bilirubin
6. Estimation of SGOT(AST), SGPT(ALT). GGT
7. Estimation of Serum/Urinary Creatinine
8. Determination of Serum Inorganic Phosphorus (Fiske and SubbaRow method)

Prescribed Textbooks

1. Varley's Practical Clinical Biochemistry – Ed. Alan W. Gowenlock (Heinemann Medical Books, London, 1988).
2. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology. Andreas Hoffman and Samuel Cloekie.
3. An introduction to practical biochemistry. David T. Plummer, Tata Mac Grew-Hill.

Reference Textbooks

1. Clinical diagnosis and management by Lab methods (John Bernard Henry, W.B. Salunders Company, 1984).

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA
(Affiliated to Krishna University, Machilipatnam)

Scheme of Valuation of Semester End Practical examination

Subject: Biochemistry

Course Title: Clinical Biochemistry-Practical

Maximum Marks: 50

Semester: IVA

Course Code: 20BCP4CB41

Maximum Time: 3Hrs.

1	Major Estimation of Iron by Method	7 + 5 = 12M
2	Minor Determination /Analyse Determination of vitamin C by 2, 6 -dichlorophenol indophenol method	4 + 4 = 8M
3.	Principles/Identification	2 X 5= 10M
3	Viva	10M
4	Record	10M

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
(Affiliated to Krishna University, Machilipatnam)

SYLLABUS

Subject: Biochemistry	Semester: IV B	
Course Title: Microbiology, Immunology and Molecular biology	Course Code 20BCCCMB44	
No. of hours:60	LTP:400	Credits:4

Unit-I: Microbiology **(12 hrs.)**

- 1.1 Introduction to microbiology, and microbial diversity. Classification of microorganisms- prokaryotic and eukaryotic microorganisms.
- 1.2 Bacterial structure, growth curve. Introduction to viruses-plant and animal viruses, structure, life cycle

Unit-II: Nitrogen Fixation **(12 hrs.)**

- 2.1 The Nitrogen cycle, Non-biological and biological nitrogen fixation, photosynthesis-pigments, Photosystems: I & II, mechanism Nitrogenase system.
- 2.2 Utilization of nitrate ion, Ammonia incorporation into organic compounds. Synthesis of glutamine and regulatory mechanism of glutamine synthase.

Unit-III: Applied Biochemistry **(12 hrs.)**

- 3.1 Fermentation Technology: Batch, continuous culture techniques, principle, types of fermenters. Pasteur effect. Industrial production of chemicals- alcohol, acids (citric acid), solvents (acetone), antibiotics (penicillin)
- 3.2 Enzyme Technology: Immobilization of enzymes and cells, industrial applications, enzymes in Bioremediation.

Unit- IV: Immunology **(12 hrs.)**

- 4.1 Organs and cells of the immune system. Innate and acquired immunity, Cell-mediated and humoral immunity (T-cells and B-cells). Classification of immunoglobulins, the structure of IgG. Epitopes / antigenic determinants. Concept of haptens. Adjuvants.
- 4.2 Monoclonal antibodies. Antigen-antibody reactions- agglutination, immunoprecipitation, immunodiffusion. Blood group antigens. Immunodiagnostics- ELISA. Vaccines and their classification. Traditional vaccines live and are attenuated. Modern vaccines- recombinant and peptide vaccines. Outlines of hypersensitivity reactions.

Unit- V: Molecular biology**(12 hrs)**

5.1 DNA replication and repair -leading and lagging strands, Okazaki fragments, inhibitors of DNA replication. Genetic code,

5.2 Protein synthesis-transcription, translation, inhibitors of protein synthesis. Outlines of cloning technology, vectors, restriction enzymes, PCR, applications of cloning in agriculture, industry, and medical fields.

Skill / Hands-on**(2hrs.)**

- Memorize Genetic code of all 20 amino acids
- Identification of genetic basis of a particular blood group
- Immobilization techniques of cell and Enzymes
- Charts showing Connecting the lysogenic and lytic cycles of viral replication

Co-curricular Activities:**(2hrs.)**

- Schematic models of DNA replication, protein synthesis process
- Assignments
- Schematic representations through Charts

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA
(Affiliated to Krishna University, Machilipatnam)

MODEL PAPER FOR SEMESTER END EXAMINATION

Subject: Biochemistry
Course Title: Microbiology, Immunology
and Molecular Biology
Maximum Marks: 100
Date

Semester: IV B
CourseCode:20BCCCMB44
Time: 3Hrs.
Reg No.

SECTION-A

Answer **ALL** questions

20 X 1 = 20 M

6. _____ is a process of entrapment of an enzyme without changing its catalytic activity
- 7. Immobilization
 - 8. Immortalization
 - 9. Immolation
 - 10. Immigration
11. Name the enzyme which adds primer in DNA replication
- E. Primrose
 - F. Primase
 - G. Nucleotidase
 - H. Nucleosidase
12. An enzyme that cuts DNA. At specific site is called _____ enzyme .
- E. Restriction
 - F. Emission
 - G. Adsorption
 - H. Residual
13. What is a nature Genetic code?
- E. Virtual
 - F. LeetCode
 - G. Unambiguous

H. Error-prone

14. A short fragment of DNA involved in the replication of _____ strand.

E. Glutamine

F. Lagging

G. Alanine

H. Leading

6. **For photosynthesis green plants require**

A. Chlorophyll

B. Magnesium

C. Carbon monoxide

D. Nitrogen

7. Photosystems I & II absorb light at

A. 700 nm and 680nm

B. 600nm and 780nm

C. 600nm and 700nm

D. 700nm and 600nm

8. Light reaction of Photosynthesis is also called

A. Hill's Reaction

B. Down-Hill' Reaction

C. Kerb's Reaction

D. Pentose phosphate reaction

11. Glucose is produced as a product of _____ reaction.

A. Photosynthesis

B. Respiration

C. Oxidation

D. Reduction

12. Yeasts breakdown _____ produce alcohol and carbon dioxide as their by-products. of

A. Glucose

B. Mannose

C. Galactose

D. Different Oils

13. Which of the following is not involved in the biosynthesis of glutamine?
- E. Aspartate
 - F. α -glutarate
 - G. Oxaloacetate
 - H. Arginine
14. Which of the following is used for raw material for citric acid?
- A. Starch
 - B. Trehalose
 - C. Cellulose
 - D. Mannose
15. Which of the following is the function of nitrogenase?
- A. Fixes atmospheric nitrogen (N_2) into ammonia.
 - E. Uric acid to Allantoin
 - F. Fixes ammonia. (N_2) into atmospheric nitrogen
 - G. Fixes atmospheric nitrogen (N_2) into ammonia.
16. Which of the following fermentation involves continuous addition of medium
- E. Continuous
 - F. Fed-batch
 - G. Batch
 - H. Bubble
17. Haptens are non-specific substances that intensify _____
- A. Immune response
 - B. Infection
 - C. Antibody
 - D. Clotting process
18. A sudden change from anaerobic to aerobic process is known as
- E. Aerobic twist
 - F. Anaerobic twist
 - G. Pasteur effect
 - H. Oxygen effect
19. All antibodies are immunoglobulins but all immunoglobulins are not _____.

- A. Antibodies
- B. Antigens
- C. Haptens
- D. Adjuvants

20. Which of these antibiotics is involved in Cell wall synthesis inhibition.

- A. Pencillins
- B. Gentamycin
- C. Chloramphenicol,
- D. Keto acids

SECTION-B

Answer any **FOUR** questions

4 X 8 =32M

- 21. Outline the mechanism of protein synthesis with structures.
- 22. Write the classification of the microorganisms based on the preferred range of temperature
- 23. Explain the process of monoclonal antibody production.
- 24. Give an account of different types of inhibitors of DNA replication
- 25. Describe the processes of Nitrogen fixation.
- 26. Enumerate steps of citric acid production

SECTION-C

Answer any **FOUR** questions

4 X12=48M

- 27. Explain the process of Leading and Lagging strand synthesis
- 28. Write briefly about photosystem I and II.
- 29. Describe different types of Immobilization techniques.
- 30. Enlist the different types of antigen-antibody reactions
- 31. Summarize the different phases of bacterial growth.
- 32. What is the nitrogen cycle? Describe the cycle with structures.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA
(Affiliated to Krishna University, Machilipatnam)

Blueprint

Subject: Biochemistry
Course Title: Microbiology, Immunology
and Molecular Biology
Maximum Marks: 100

Semester: IV B
Course Code: 20BCCCMB44
Maximum Time: 3Hrs.

SECTION – A

Answer **ALL** questions

20 x 1 = 20 M

Q. No.	UNIT	Marks Weightage	RBT LEVEL
1	I	1	RBT1 – 10 RBT2 – 10
2	I	1	
3	I	1	
4	I	1	
5	II	1	
6	II	1	
7	II	1	
8	II	1	
9	III	1	
10	III	1	
11	III	1	
12	III	1	
13	IV	1	
14	IV	1	
15	IV	1	
16	IV	1	
17	V	1	
18	V	1	
19	V	1	
20	V	1	

SECTION – B

Answer any **FOUR** questions

4 x 8 = 32 M

Q. No.	UNIT	Marks Weightage	RBT LEVEL
21	I	8	RBT1 – 3; RBT2 – 3
22	II	8	
23	III	8	
24	IV	8	
25	V	8	
26	I / II / III / IV / V	8	

SECTION – C

Answer any **FOUR** questions

4 x 12 = 48 M

Q. No.	UNIT	Marks Weightage	RBT LEVEL
27	I	12	RBT1 – 3; RBT2 – 3
28	II	12	
29	III	12	
30	IV	12	
31	V	12	
32	I / II / III / IV / V	12	

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
(Affiliated to Krishna University, Machilipatnam)

Subject: Biochemistry

Title: Applied Biochemistry-Practical

No. of hours: 30

Semester: IV B

Course Code 20BCP5AB41

Credits: 1

Course objectives

- To Learn basic applied biochemical Techniques
- To Enhance Knowledge on Immunochemical Techniques
- To Impart knowledge on the sensitivity of organisms to various antibiotics

Course outcomes

After completion of the practical, students will be able to

CO1: Correlate the normal values to those present in diseased conditions,

CO2: perform biochemical tests,

1. Preparation and Sterilization of microbial media by autoclave.
2. Demonstration of amylase production.
3. Antibiotic sensitivity by paper disc method.
4. Single radial Immunodiffusion Assay-Mancini method
5. Immobilization of enzyme and testing its activity
6. Analysis of Blood group antigens ABO blood group system
7. Demonstration of PCR reaction in a thermal cyclor.
8. Spotters.

Prescribed Textbooks

4. Varley's Practical Clinical Biochemistry – Ed. Alan W. Gowenlock (Heinemann Medical Books, London, 1988).
5. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology. Andreas Hoffman and Samuel Cloekie.
6. An introduction to practical biochemistry. David T. Plummer, Tata Mac Grew-Hill.

Reference Textbooks

2. Clinical diagnosis and management by Lab methods (John Bernard Henry, W.B. Salunders Company, 1984).

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA
(Affiliated to Krishna University, Machilipatnam)

Scheme of Valuation of Semester End Practical examination

Subject: Biochemistry

Course Title: Applied Biochemistry-Practical

Maximum Marks: 50

Semester: IV B

Course Code: 20BCP5AB41

Maximum Time: 3Hrs.

1	Major Immobilization of enzyme and testing its activity	7 + 5 = 12M
2	Minor Determination /Analyse Analysis of Blood Groups	4 + 4 = 8M
3.	Principles/Identification	2 X 5= 10M
3	Viva	10M
4	Record	10M