

FOUR YEAR UNDERGRADUATE PROGRAM (NEP-2020)
Program: Bachelor in Science (2024 -28)
DISCIPLINE – BIOCHEMISTRY
Session – 2024 -25

DSC -01 to 08		DSE -01 to 12	
Code	Title	Code	Title
BCSC -01T	Introductory Biochemistry and Biomolecules	BCSE -01T	Clinical Biochemistry
BCSC -01P	Introductory Biochemistry and Biomolecules	BCSE -01P	Clinical Biochemistry
BCSC -02T	Bioanalytical Techniques	BCSE -02T	Biology of Infectious Diseases
BCSC -02P	Bioanalytical Techniques	BCSE -02P	Biology of Infectious Diseases
BCSC -03T	Enzymology	BCSE -03T	Biotechnology
BCSC -03P	Enzymology	BCSE -03P	Biotechnology
BCSC -04T	Intermediary Metabolism	BCSE -04T	Plant Biochemistry
BCSC -04P	Intermediary Metabolism	BCSE -04P	Plant Biochemistry
BCSC -05T	Gene replication, expression and regulation	BCSE -05T	Human Physiology
BCSC -05P	Gene replication, expression and regulation	BCSE -05P	Human Physiology
BCSC -06T	Biochemistry and Function of Hormones	BCSE -06T	Cell Biology
BCSC -06P	Biochemistry and Function of Hormones	BCSE -06P	Cell Biology
BCSC -07T	Immunology	BCSE -07T	Microbial Biochemistry
BCSC -07P	Immunology	BCSE -07P	Microbial Biochemistry
BCSC -08T	Nutraceutical Biochemistry and Functional Foods	BCSE -08T	Nutritional and Environmental Biochemistry
BCSC -08P	Nutraceutical Biochemistry and Functional Foods	BCSE -08P	Nutritional and Environmental Biochemistry
		BCSE -09T	Bioinformatics
		BCSE -09P	Bioinformatics
		BCSE -10T	Industrial Biochemistry
		BCSE -10P	Industrial Biochemistry
		BCSE -11T	Entrepreneurship Development
		BCSE -11P	Entrepreneurship Development
		BCSE -12T	Research Methodology
		BCSE -12P	Research Methodology
GE -01 & 02		VAC	
BCGE -01T	Introductory Biochemistry and Biomolecules	BCVAC-01	Ethno medicine in Chhattisgarh
BCGE -01P	Introductory Biochemistry and Biomolecules	SEC	
BCGE -02T	Bioanalytical Techniques	BCSEC-01	Biostatistics
BCGE -02P	Bioanalytical Techniques		

Name and Signature of Convener & Members of CBoS:

M. K. D.
 11/06/2024
 (Dr. Mrigendra Kumar Dwivedi)

H. E.
 Representative
 Comm. H.E.

Programme Educational Objectives:

PEO 1: The graduating student shall become a professional assistant in the area of biochemistry.

PEO 2: The graduating student shall become a researcher in the field of biochemistry.

PEO 3: The graduating student will become an entrepreneur or a consultant or a freelancer in the area of biochemistry.

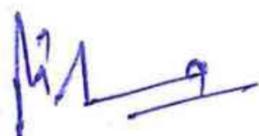
Program Outcome:

On successful completion of this program the graduates shall have:

PO1.	Knowledge: A knowledge of contemporary issues related to biochemistry. Ability to demonstrate the fundamental knowledge of molecules of life, molecular techniques, toxicology in the area of biochemistry.
PO2.	Critical Thinking and Reasoning: Ability to think critically and apply the same to update scientific knowledge.
PO3.	Problem Solving: Ability to identify, formulate and solve professional problems in the area of biochemistry, experimental skill and critical thinking, students will be capable of addressing intricate societal and industrial challenges.
PO4.	Advanced Analytical and Computational Skills: Ability to design experiment and interpret the results. An ability to design a system, or process to meet desired need within realistic constraints
PO5.	Effective Communication: An ability to communicate effectively in scientific reasoning and data analysis in both written and oral forms.
PO6.	Social/ Interdisciplinary Interaction: Ability to function in a multidisciplinary team.
PO7.	Self-directed and Life-long Learning: A recognition of the needed for and an ability to engage in lifelong learning in the area of biochemistry.
PO8.	Effective Citizenship: Leadership and Innovation: An ability to use the techniques, skills and modern professional tools necessary for professional practice and for research.
PO9.	Ethics: An understanding of professional and ethical responsibility in the area of biochemistry.
PO10.	Further Education or Employment and Global Perspective: The broad education necessary to understand the impact of solutions in a global, economic, environmental and societal context.

Program Specific Objectives:

PSO1.	Students shall be able to identify, formulate and solve the problems of biological metabolisms, protein biochemistry and molecular biology.
PSO2.	Students shall be able to conduct the experiments in the field of medicine, toxicology and immunology as well as to analyses and interpret the results.
PSO3.	Students shall be able to use the biochemical techniques, bioinformatics tools, biostatistics, skills and modern pathological tools necessary for professional practice and for research.



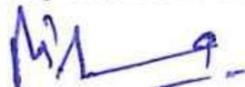
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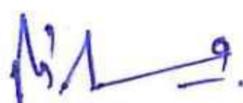
FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Certificate / Diploma / Degree/Honors)</i>		Semester - I	Session: 2024-2025
1	Course Code	BCSC – 01 T	
2	Course Title	Introductory Biochemistry and Biomolecules	
3	Course Type	Discipline Specific Course (Theory)	
4	Pre-requisite (if, any)	As per program	
5	Course Learning Outcomes (CLO)	<p><i>After completion of the course, the students would be able to:</i></p> <ul style="list-style-type: none"> ➤ Understand the history of Biochemistry and key contributions of Indian scientists. ➤ Understand the properties of carbohydrates, proteins, lipids, cholesterol, DNA, RNA and their importance in biological systems. ➤ Understand the methods of determination of amino acid & Proteins. ➤ Understand the structure and function of determination of DNA & RNA. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	General understanding of Biochemical Molecular Logic of Life. Definition. Experiments and discoveries of Acharya Nagarjuna. Famous Indian and foreign Biochemists and their inventions/ Discoveries. Importance of Yog, Pranayam, food and healthy lifestyle for balance of biochemical (kaf, vat, pitta) of our body and role in maintaining good mental and physical health. Biochemical basis of Lifestyle disorders.		09
II	Structure and functions of Carbohydrates and lipids: Definition, classification, biological importance. Monosaccharides: Stereochemistry of monosaccharides, (+) and (-), D and L, epimers, anomers Disaccharides: Establishment of structures of sucrose and lactose and maltose. Polysaccharides: Partial structure, occurrence and importance of starch, glycogen, inulin, cellulose, chitine. heparin, hyaluronic acid. Lipids: Classification and biological role. Fatty acids – Nomenclature of saturated and unsaturated fatty acids. Phosphoglycerides: Structure and function of lecithin, cephalins, phosphatidylinositol, plasmalogens, and cardiolipin Structure and importance of sphingomyelin, gangliosides and cerebroside.		12
III	Structure and functions of Amino acids and Proteins: Structure and classification of amino acids based on polarity. Amino acids D & L notation. Peptides: Peptide bond, structure and biological importance. Proteins: Peptides, Primary Structure of proteins, N- and C- terminal amino acids, Secondary Structure – α Helix. β -sheet, β -bend. Tertiary and quaternary structure, denaturation and renaturation of proteins.		12
IV	Structure and functions of Nucleic acids: Composition of DNA and RNA. Nucleosides and nucleotides. Chargaff's rule. Primary and secondary structure of DNA, Watson and Crick model of DNA. Melting of DNA (T_m).		12
Keywords	Biomolecules, Carbohydrate, Lipids, Fatty acids, Nucleotides, Nucleosides, Nucleic acids,		

Name and Signature of Convener & Members of CBoS:




PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
<ul style="list-style-type: none"> ➤ Nelson, Cox and Lehninger Principles of Biochemistry, 7th Edition ➤ Medical Biochemistry By Styanarayan. 		
Online Resources–		
<ul style="list-style-type: none"> ➤ e-Resources / e-books and e-learning portals ➤ https://www.britannica.com/ ➤ https://en.wikibooks.org/wiki/Biochemistry ➤ https://www.pdfdrive.com/biomolecules-books.html ➤ https://byjus.com/biology/biomolecules/ ➤ https://www.vedantu.com/biology/biomolecules 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		100 Marks
Continuous Internal Assessment (CIA):		30 Marks
End Semester Exam (ESE):		70 Marks
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20 Assignment / Seminar - 10 Total Marks - 30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark ; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit- 4x10=40 Marks	



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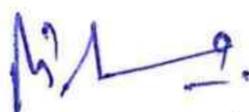
PART- A: Introduction			
Program: Bachelor in Science <i>(Certificate / Diploma / Degree/Honors)</i>		Semester - I	Session: 2024-2025
1	Course Code	BCSC – 01 P	
2	Course Title	Introductory Biochemistry and Biomolecules	
3	Course Type	Discipline Specific Course (Practical)	
4	Pre-requisite (if, any)	As per the Program	
5	Course Learning Outcomes (CLO)	<i>On successful completion of the course, the student shall be able to:</i> <ul style="list-style-type: none"> ➤ Describe the basic lab requirements and their uses. ➤ Analyze the characteristics of the compound on the basis of their pH. ➤ Formulate to prepare normal, molar and stock solution. ➤ Estimate Biomolecules in mixture. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> ➤ Safety measures in laboratories. ➤ Preparation of normal, molar and stock solution. ➤ Preparation of buffers. ➤ Qualitative tests for carbohydrates, lipids, amino acids, proteins and nucleic acids. ➤ Separation of amino acids/ sugars/ bases by Paper / Thin layer chromatography. ➤ Estimation of vitamin C titrimetric method. ➤ Determination of saponification value and iodine number of fats. ➤ Short write-ups on disease privations practices in Indian Knowledge system. 		30
Keywords	Laboratory Safety, Estimation, Sugar, Fat, Proteins		

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PART-C: Learning Resources		
Text Books, Reference Books and Others		
Text Books Recommended –		
<ul style="list-style-type: none"> ➤ Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, ➤ Experimental Biochemistry by Beedu Shashidhar Rao 		
Online Resources–		
<ul style="list-style-type: none"> ➤ e-Resources / e-books and e-learning portals ➤ https://en.wikibooks.org/wiki/Biochemistry ➤ https://www.pdfdrive.com/biomolecules-books.html ➤ https://ncert.nic.in/textbook.php 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		50 Marks
Continuous Internal Assessment (CIA):		15 Marks
End Semester Exam (ESE):		35 Marks
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on lab. work - 20 Marks B. Spotting based on tools & technology (written) – 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

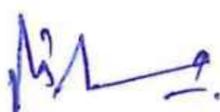
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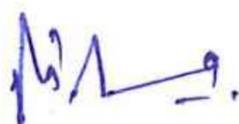
PART- A: Introduction			
Program: Bachelor in Science (Certificate / Diploma / Degree / Honors)		Semester - II	Session: 2024-2025
1	Course Code	BCSC - 02T	
2	Course Title	Bio-analytical Techniques	
3	Course Type	Discipline Specific Course (Theory)	
4	Pre-requisite (if, any)	As per the Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Understand basic concepts of Spectroscopy. ➤ Describe amino acids with application of chromatography. ➤ Understand basic concepts of centrifugation. ➤ Understand working principle, instrumentation and applications of various electrophoretic techniques. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	Spectroscopy - Concepts of spectroscopy, Laws of photometry. Beer-Lambert's law, Principles and applications of colorimetry. Visible and UV spectroscopy. Electrophoretic techniques – Principles of electrophoretic separation. Types of electrophoresis including paper and gel. PAGE and SDS-PAGE. Isoelectric focussing.		12
II	Chromatography – Principles and applications of paper, thin layer, ion exchange, affinity, gel permeation, adsorption and partition chromatography. HPLC and FPLC.		09
III	Centrifugation – Principle of centrifugation, concepts of RCF, different types of instruments and rotors, preparative, differential and density gradient centrifugation, analytical, ultra-centrifugation, determination of molecular weights and other applications.		12
IV	Microscopy – Bright field, Dark field, Phase contrast and Fluorescence microscopy Transmission and scanning microscopy, freeze fracture techniques, specific staining of biological materials Immunological Techniques: Immuno diffusion, immune electrophoresis, radioimmunoassay, ELISA, Immuno fluorescence.		12
Keywords	Spectroscopy, Chromatography, Centrifugation, Electrophoresis, Microscope, ELISA.		

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PART-C: Learning Resources		
Text Books, Reference Books and Others		
Text Books Recommended –		
<ul style="list-style-type: none"> ➤ K Wilson and John Walker Practical Biochemistry: Principles & Techniques ➤ RF Boyer Biochemistry Laboratory: Modern Theory & Techniques ➤ Physical biochemistry by D Friefelder, WH Freeman & Co., USA. ➤ Biophysical Chemistry By Upahyaya & Nath 		
Online Resources–		
<ul style="list-style-type: none"> ➤ e-Resources / e-books and e-learning portals ➤ https://en.wikibooks.org/wiki/Biochemistry ➤ https://www.pdfdrive.com/biomolecules-books.html ➤ https://ncert.nic.in/textbook.php 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		100 Marks
Continuous Internal Assessment (CIA):		30 Marks
End Semester Exam (ESE):		70 Marks
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20 Assignment / Seminar - 10 Total Marks - 30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40 Marks	

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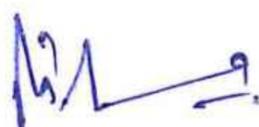
PART- A: Introduction			
Program: Bachelor in Science <i>(Certificate / Diploma / Degree/ Honors)</i>		Semester -II	Session: 2024-2025
1	Course Code	BCSC- 02P	
2	Course Title	Bioanalytical Techniques	
3	Course Type	Discipline Specific Course (Practical)	
4	Pre-requisite (if, any)	As Per the Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Examine different components present in the extract of radish leaves by using chromatography technique. ➤ Analysis independently of various biomolecules in the laboratory. ➤ Demonstrate the effect of inorganic compound and its percent purities in various types of samples. ➤ Analyze characteristics of UV absorption spectra of by different methods in samples in different biomolecules. 	
6	Credit Value	1 Credits	Credit =30 Hours Laboratory or Field learning/Training
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> ➤ Verification of Beer-Lambert's law. ➤ Separation of sugars using paper chromatography. ➤ Separation of amino acids by paper chromatography ➤ Differential centrifugation of cell organelles ➤ SDS-PAGE gel electrophoresis of protein ➤ Separation of plant pigments by Paper chromatography ➤ Estimation of DNA and RNA. 		30
Keywords	Spectroscopy, Estimation, Quantitative, Separation, Techniques		

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PART-C: Learning Resources		
Text Books, Reference Books and Others		
Text Books Recommended –		
<ul style="list-style-type: none"> ➤ K Wilson and John Walker Practical Biochemistry: Principles & Techniques ➤ RF Boyer Biochemistry Laboratory: Modern Theory & Techniques ➤ Physical biochemistry by D Friefelder, WH Freeman & Co., USA. ➤ Biophysical Chemistry By Upahyaya & Nath 		
Online Resources–		
<ul style="list-style-type: none"> ➤ e-Resources / e-books and e-learning portals ➤ https://en.wikibooks.org/wiki/Biochemistry ➤ https://www.pdfdrive.com/biomolecules-books.html ➤ https://ncert.nic.in/textbook.php 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		50 Marks
Continuous Internal Assessment (CIA):		15 Marks
End Semester Exam (ESE):		35 Marks
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on lab. work - 20 Marks B. Spotting based on tools & technology (written) – 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

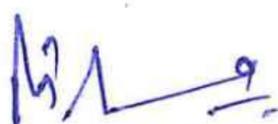
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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science (Diploma / Degree / Honors)		Semester - III	Session: 2024-2025
1	Course Code	BCSC- 03 T	
2	Course Title	Enzymology	
3	Course Type	Discipline Specific Course (Theory)	
4	Pre-requisite (if, any)	As Per the Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Describe the enzyme catalysis and regulatory enzymes. ➤ Explain the mechanism of action of enzymes and role of vitamins as coenzyme precursors. ➤ Express the Michaelis-Menten equation, and double reciprocal plots, and graphical representation of various inhibitors. ➤ Describe the principles and methods of Diagnosis by enzymes. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	<p>Introduction to enzymes: Nature of enzymes - protein and non-protein (ribozyme). Cofactor and prosthetic group, apoenzyme, holoenzyme. IUBMB classification of enzymes. Coenzymes.</p> <p>Features of enzyme catalysis Catalytic power and specificity of enzymes (concept of active site), Fischer's lock and key hypothesis, Koshland's induced fit hypothesis</p>		09
II	<p>Enzyme kinetics: Relationship between initial velocity and substrate concentration, steady state kinetics, equilibrium constant - Mono substrate reactions. Michaelis-Menten equation, Lineweaver-Burk plot, Km and Vmax, K_{cat} and turnover number. Effect of pH, temperature and metal ions on the activity of enzyme.</p>		12
III	<p>Enzyme inhibition: Reversible inhibition (competitive, uncompetitive, non-competitive, mixed and substrate). Mechanism based inhibitors.</p> <p>Mechanism of action of enzymes - General features - proximity and orientation, strain and distortion, acid base and covalent catalysis (chymotrypsin, lysozyme).</p>		12
IV	<p>Regulation of enzyme activity: Control of activities of single enzymes (end product inhibition) and metabolic pathways, feedback inhibition (aspartate transcarbamoylase), reversible covalent modification phosphorylation (glycogen phosphorylase). Proteolytic cleavage- zymogen. Multienzyme complex as regulatory enzymes, pyruvate dehydrogenase. Isoenzymes - properties and physiological significance (lactate dehydrogenase).</p> <p>Application of enzymes in diagnostics: (SGPT, SGOT, creatine kinase, alkaline and acidphosphatases), Enzyme electrodes, biosensors.</p>		12
Keywords	Coenzyme, Ribozyme, Cofactor, Apoenzyme, Michaelis-Menten equation.		

Name and Signature of Convener & Members of CBoS:




PART-C: Learning Resources**Text Books, Reference Books and Others****Text Books Recommended –**

- 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 / ISBN:10:1-4292-3414-8.
- Biochemistry (2011) 4th ed., Donald, V. and Judith G.V., John Wiley & Sons Asia Pvt.Ltd. (New Jersey), ISBN:978-1180-25024.
- Fundamentals of Enzymology (1999) 3rd ed., Nicholas C.P. and Lewis S., OxfordUniversity Press Inc. (New York), ISBN:0 19 850229 X.

Online Resources–**e-Resources / e-books and e-learning portals**

- <https://www.jbc.org/Enzymology>
- <https://www.sciencedirect.com/topics/medicine-and-dentistry/enzymology>
- <https://www.biologyonline.com/dictionary/coenzyme>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3770912/>
- <https://www.eposters.net/redirect/?ID=16026&UID=0&Type=poster>
- https://link.springer.com/chapter/10.1007/978-0-387-35141-4_34

PART -D: Assessment and Evaluation**Suggested Continuous Evaluation Methods:****Maximum Marks: 100 Marks****Continuous Internal Assessment (CIA): 30 Marks****End Semester Exam (ESE): 70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10	
Total Marks - 30		
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40 Marks	




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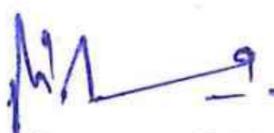
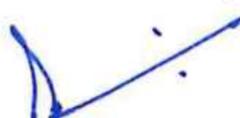
FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science (Diploma / Degree/ Honors)		Semester -III	Session: 2024-2025
1	Course Code	BCSC- 03 P	
2	Course Title	Enzymology	
3	Course Type	Discipline Specific Course (Practical)	
4	Pre-requisite (if, any)	As Per the Program	
5	Course Learning Outcomes (CLO)	On successful completion of the course, the student shall be able to: <ul style="list-style-type: none"> ➤ Explain purification of proteins by various methods. ➤ Estimate enzyme activity by different methods. ➤ Explain progress curve of enzyme. ➤ Practice the effect of physical parameters on enzyme activity. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> ➤ Partial purification of acid/ alkaline phosphatase. ➤ Assay of enzyme activity and specific activity, e.g. acid/ alkaline phosphatase. ➤ Effect of pH on enzyme activity and determination of optimum pH. ➤ Determination of Km and Vmax using Lineweaver-Burk graph. ➤ Isolation and purification of urease. ➤ Inhibition of alkaline/acid phosphatase activity by EDTA ➤ Effect of substrate concentration on alkaline phosphatase activity and determine of its Km value. ➤ Effect of temperature of enzyme activity and determination of activation energy. ➤ Effect of enzyme concentration on enzyme activity. 		30
Keywords	Assay, Enzyme, Specific activity, Temperature,		

Name and Signature of Convener & Members of CBoS:

PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
<ul style="list-style-type: none"> ➤ 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 / ISBN:10:1-4292- 3414-8. ➤ Biochemistry (2011) 4th ed., Donald, V. and Judith G.V., John Wiley & Sons Asia Pvt. Ltd. (New Jersey), ISBN:978-1180-25024. ➤ Fundamentals of Enzymology (1999) 3rd ed., Nicholas C.P. and Lewis S., Oxford University Press Inc. (New York), ISBN:0 19 850229 X. 		
Online Resources–		
<ul style="list-style-type: none"> ➤ e-Resources / e-books and e-learning portals ➤ https://en.wikibooks.org/wiki/Biochemistry ➤ https://www.pdfdrive.com/biomolecules-books.html ➤ https://ncert.nic.in/textbook.php 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		50 Marks
Continuous Internal Assessment (CIA):		15 Marks
End Semester Exam (ESE):		35 Marks
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on lab. work - 20 Marks B. Spotting based on tools & technology (written) – 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBoS:

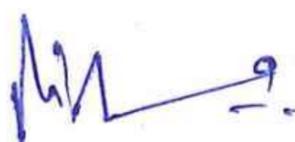
FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science (Diploma / Degree / Honors)		Semester - III	Session: 2024-2025
1	Course Code	BCSE- 01 T	
2	Course Title	Clinical Biochemistry	
3	Course Type	Discipline Specific Elective (Theory)	
4	Pre-requisite (if, any)	As per the Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Learn about the normal constituents of urine, blood and their significance in maintaining good health. ➤ Understand the mechanisms of causation of diseases of liver, kidney and of Cancer. ➤ Describe with the variations in the levels of triglycerides and lipoproteins and their relationship with various diseases. ➤ Explain with the role of enzymes in diagnosis of various diseases. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	Urine: Normal composition of urine – volume, pH, colour, specific gravity. Constituents-urea, uric acid, creatinine, pigment. Abnormal constituents – glucose, albumin, ketone bodies, variations in urea, creatinine, pigments and their clinical significance in brief. Abnormalities in Nitrogen Metabolism – Uremia, hyperuricemia, porphyria and factors affecting nitrogen balance.		09
II	Blood: Normal constituents of blood and their variation in pathological conditions - urea, uric acid, creatinine, glucose, bilirubin, total protein, albumin/globulin ratio. Lipid profile cholesterol, triglycerides, lipoproteins - HDL and LDL. Blood Clotting – Disturbances in blood clotting mechanisms – haemorrhagic disorders – haemophilia, von Willebrand's disease, purpura, Rendu-Osler-Werber disease, thrombotic thrombocytopenic purpura, disseminated intravascular coagulation, acquired prothrombin complex disorders, circulating anticoagulants.		12
III	Diagnostic Enzymes – Enzymes in health and diseases. Biochemical diagnosis of diseases by enzyme assays – SGOT, SGPT, alkaline phosphatase, CPK, cholinesterase, LDH Disorders of liver and kidney – Jaundice, fatty liver, normal and abnormal functions of liver and kidney. Inulin and urea clearance. Electrolytes and acid-base balance – Regulation of electrolyte content of body fluids and maintenance of pH, reabsorption of electrolytes.		12
IV	Biochemistry of Cancer , Cellular differentiation in cancer, carcinogens and cancer therapy Inborn errors of metabolism: Sickle cell anaemia, phenyl ketonuria, Neimann – Pick disease and Gaucher's disease.		12
Keywords	Blood, Urine, Cancer, Enzymes, Diseases		

Name and Signature of Convener & Members of CBoS:

PART-C: Learning Resources		
Text Books, Reference Books and Others		
Text Books Recommended –		
<ul style="list-style-type: none"> ➤ Concise Medical Physiology – Choudhary – New Central Book Agency – Calcutta. ➤ TextBook of Medical Physiology – Guyton – Prism Books Pvt. Ltd. – Bangalore. ➤ Harper’s Biochemistry – Murray, Granner, Mayes, and Rodwell – Prentice Hall International Inc. ➤ Textbook of medical physiology: A. C. Gyton, and J. E HallSaunders Elsevier Publications, A division of Reed Elsevier India Pvt .Ltd.New Delhi ISBN 81-8147-084-2 ➤ T.M. Delvin (editor), Text book of biochemistry with clinical correlation, (1982), John Wiley & Sons Inc. USA. 		
Online Resources–		
e-Resources / e-books and e-learning portals		
<ul style="list-style-type: none"> ➤ https://www.sciencedirect.com/topics/medicine-and-dentistry/enzymology ➤ https://www.jbc.org/Enzymology ➤ https://www.biologyonline.com/dictionary/coenzyme ➤ https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3770912/ ➤ https://www.eposters.net/redirect/?ID=16026&UID=0&Type=poster ➤ https://link.springer.com/chapter/10.1007/978-0-387-35141-4_34 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		100 Marks
Continuous Internal Assessment (CIA):		30 Marks
End Semester Exam (ESE):		70 Marks
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20 Assignment / Seminar - 10 Total Marks - 30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40 Marks	

Name and Signature of Convener & Members of CBoS:




FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science (Diploma / Degree / Honors)		Semester - III	Session: 2024-2025
1	Course Code	BCSE-01 P	
2	Course Title	Clinical Biochemistry	
3	Course Type	Discipline Specific Elective (Practical)	
4	Pre-requisite (if, any)	As Per the Program	
5	Course Learning Outcomes (CLO)	On successful completion of the course, the student shall be able to: ➤ Understand Qualitative and quantitative analysis of constituents of biological fluids such as urine, blood and their estimation using standard methods.	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> ➤ Qualitative and quantitative analysis of urine : proteins, Bence-Jones proteins, Cl-, Ca²⁺ ➤ Qualitative analysis of abnormal constituents in urine - glucose, albumin, bile pigments, bile salts and ketone bodies. ➤ Separation of Blood Plasma and Serum ➤ Determination of A/G ratio in serum ➤ Isolation and estimation of serum cholesterol ➤ Serum enzyme assays: alkaline phosphatase, SGOT, SGPT ➤ Estimation of bilirubin (conjugated and unconjugated) in serum. ➤ Estimation of total lipids in serum by vanillin method. ➤ Estimation of cholesterol in serum. ➤ Estimation of blood urea nitrogen from plasma. ➤ Estimation of SGPT and SGOT in serum. ➤ Preparation of starch from potato and its hydrolysis by salivary amylase. <ul style="list-style-type: none"> a. Determination of achromatic point in salivary amylase. b. Effect of sodium chloride on amylases 		30
Keywords	Blood, Plasma, Liver function test, Serum enzymes		

Name and Signature of Convener & Members of CBoS:

PART-C: Learning Resources**Text Books, Reference Books and Others****Text Books Recommended –**

- 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 / ISBN:10:1-4292- 3414-8.
- Biochemistry (2011) 4th ed., Donald, V. and Judith G.V., John Wiley & Sons Asia Pvt. Ltd. (New Jersey), ISBN:978-1180-25024.
- Fundamentals of Enzymology (1999) 3rd ed., Nicholas C.P. and Lewis S., Oxford University Press Inc. (New York), ISBN:0 19 850229 X.

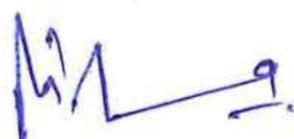
Online Resources–

- **e-Resources / e-books and e-learning portals**
<https://www.thermofisher.com/in/en/home/references/protocols/cell-and-tissue-analysis/elisa-protocol/elisa-sample-preparation-protocols/plasma-and-serum-preparation.html>
- <https://labmonk.com/determination-of-sgot-and-sgpt>
- <https://www.labcorp.com/help/patient-test-info/total-protein-and-albumin-globulin-ag-ratio>
- <https://link.springer.com/article/10.1007/s101570200005>
- <https://jcp.bmi.com/content/jclinpath/6/3/173.full.pdf>

PART -D: Assessment and Evaluation**Suggested Continuous Evaluation Methods:****Maximum Marks: 50 Marks****Continuous Internal Assessment (CIA): 15 Marks****End Semester Exam (ESE): 35 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on lab. work - 20 Marks B. Spotting based on tools & technology (written) – 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBoS:




FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

Department of Biochemistry

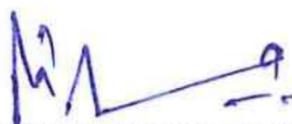
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Diploma / Degree / Honors)</i>		Semester - IV	Session: 2024-2025
1	Course Code	BCSC-04 T	
2	Course Title	Intermediary Metabolism	
3	Course Type	Discipline Specific Theory	
4	Pre-requisite (if, any)	As Per the Course	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Acquire the knowledge of energy production in living systems by the degradation of fatty acids. ➤ Explain the various pathways of fatty acid synthesis in living systems. ➤ Explain the mechanism of the machinery system involved in carbohydrate metabolism. ➤ Describe breakdown and synthesis of Amino acids and nucleotides in humans and recognize its relevance with respect to nutrition and human diseases. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	Carbohydrate Metabolism : Reactions and energetics of glycolysis. Alcoholic and lactic acid fermentations. Reactions and energetic of TCA Cycle. Gluconeogenesis, glycogenesis and glycogenolysis. Reaction and Physiological significance of pentose phosphate pathway. Regulation of Glycolysis and TCA cycle.		12
II	Electron Transport Chain and Oxidative Phosphorylation : Structure of mitochondria, sequence of electron carriers, sites of ATP production, inhibitors of electron transport chain. Hypothesis of mitochondrial Oxidative phosphorylation. Transport of reducing potentials into mitochondria.		09
III	Lipid Metabolism : Introduction, hydrolysis of triacylglycerols, transport of fatty acids into Mitochondria, β oxidation saturated fatty acids, ATP yield from fatty acid Oxidation. Biosynthesis of saturated and unsaturated fatty acids. Metabolism of Ketone bodies, oxidation of unsaturated and odd chain fatty acids. Biosynthesis of triglycerides and important phospholipids, glycolipids.		12
IV	Amino acid Metabolism: General reactions of amino acid metabolism: transamination, oxidative Deamination and decarboxylation. Urea cycle. Degradation and biosynthesis of Amino acids. Glycogenic and ketogenic amino acids. Nucleotide Metabolism: Sources of the atoms in the purine and pyrimidine molecules. Biosynthesis and Degradation of purines and pyrimidines .		12
Keywords		Glycolysis, Oxidative Phosphorylation, Oxidation, Urea cycle, Nucleotides, Porphyrins.	

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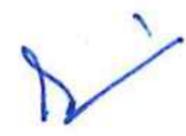
PART-C: Learning Resources								
Text Books, Reference Books and Others								
Text Books Recommended –								
<ul style="list-style-type: none"> ➤ Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN:13:978-1-4641-0962-1 / ISBN:10:1-4641-0962-1. ➤ Textbook of Biochemistry with Clinical Correlations (2011) 7th ed., Devlin, T.M., JohnWiley& Sons, Inc. (New Jersey), ISBN:978-0-470-28173-4. ➤ Biochemistry (2012) 7th ed., Berg, J.M., Tymoczko, J.L. and Stryer L., W.H. Freemanand Company (New York), ISBN:10:1-4292-2936-5, ISBN:13:978-1-4292-2936-4. 								
Online Resources–								
e-Resources / e-books and e-learning portals								
<ul style="list-style-type: none"> ➤ https://www.britannica.com/science/metabolism ➤ https://www.sciencedirect.com/science/article/pii/S0009912013001677 ➤ https://pubmed.ncbi.nlm.nih.gov/23720291/ ➤ https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3243375/ 								
PART -D: Assessment and Evaluation								
Suggested Continuous Evaluation Methods:								
Maximum Marks:		100 Marks						
Continuous Internal Assessment (CIA):		30 Marks						
End Semester Exam (ESE):		70 Marks						
Continuous Internal Assessment (CIA): (By Course Teacher)	<table border="1"> <tr> <td>Internal Test / Quiz-(2):</td> <td>20 +20</td> </tr> <tr> <td>Assignment / Seminar -</td> <td>10</td> </tr> <tr> <td>Total Marks -</td> <td>30</td> </tr> </table>	Internal Test / Quiz-(2):	20 +20	Assignment / Seminar -	10	Total Marks -	30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
Internal Test / Quiz-(2):	20 +20							
Assignment / Seminar -	10							
Total Marks -	30							
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40 Marks							

Name and Signature of Convener & Members of CBoS:




FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

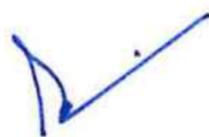
PART- A: Introduction			
Program: Bachelor in Science (Diploma / Degree/ Honors)		Semester - IV	Session: 2024-2025
1	Course Code	BCSC- 04 P	
2	Course Title	Intermediary Metabolism	
3	Course Type	Discipline Specific Course (Practical)	
4	Pre-requisite (if, any)	As Per the Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Describe the importance of lipids as storage molecules and as structural component of biomembranes. ➤ Explain the importance of high energy compounds , synthesis of ATP under aerobic and anaerobic conditions. ➤ Explain the role of TCA cycle in central carbon metabolism, importance of anaplerotic reactions and redox balance. ➤ Explain perturbations in the carbon metabolism can lead to various disorders such as diabetes and cancer. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> ➤ To understand the concepts of preparation of buffers. ➤ To estimate biomolecules such as glucose, proteins, cholesterol in clinical samples. ➤ To isolate of lipids from egg. ➤ Estimation of salivary amylase ➤ Separation of Blood Plasma and Serum ➤ Estimation of proteins from serum by biuret and Lowry methods. ➤ Estimation of bilirubin (conjugated and unconjugated) in serum. ➤ Estimation of cholesterol in serum. ➤ Estimation of blood urea nitrogen from plasma. ➤ Preparation of starch from potato and its hydrolysis by salivary amylase. ➤ Determination of achromatic point in salivary amylase. ➤ Effect of sodium chloride on amylases. 		30
Keywords	Serum, Plasma, lipids, enzymes estimation, quantitative		

Name and Signature of Convener & Members of CBoS:

PART-C: Learning Resources		
Text Books, Reference Books and Others		
Text Books Recommended –		
<ul style="list-style-type: none"> ➤ 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 / ISBN:10:1-4641-0962-1. ➤ Textbook of Biochemistry with Clinical Correlations (2011) 7th ed., Devlin, T.M., John Wiley & Sons, Inc. (New Jersey), ISBN:978-0-470-28173-4. ➤ 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:13:978-1-4292-2936-4. 		
Online Resources–		
<ul style="list-style-type: none"> ➤ e-Resources / e-books and e-learning portals ➤ https://link.springer.com/article/10.1007/s00217-008-0998-4 ➤ https://www.cdc.gov/nchs/data/nhanes/nhanes_03_04/113_c_met_lipids.pdf 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		50 Marks
Continuous Internal Assessment (CIA):		15 Marks
End Semester Exam (ESE):		35 Marks
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on lab. work - 20 Marks B. Spotting based on tools & technology (written) – 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

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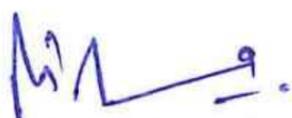
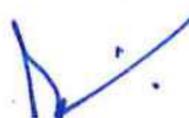
FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science (Diploma / Degree/Honors)		Semester - IV	Session: 2024-2025
1	Course Code	BCSE-02 T	
2	Course Title	Biology of Infectious Diseases	
3	Course Type	Discipline Specific Elective (Theory)	
4	Pre-requisite (if, any)	As Per Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Understand various classes of microbial infectious agents, their mode of action, biology of the diseases, transmission of diseases, the concepts of treatment, and drug resistance for various antimicrobial agents. ➤ Demonstrate molecular basis of diagnosis and treatment of diseases as well as strategies for development of vaccines against these diseases. ➤ Explain the details of important infectious diseases such as tuberculosis, AIDS, malaria, filariasis, etc. ➤ Understand the significance of hygiene, sanitation, vaccination in prevention of infectious diseases. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	Infectious diseases: Classification, Nosocomial infections; Past and present emerging and re-emerging infectious diseases and pathogens. Source, reservoir and transmission of pathogens. Safety measures when working with pathogens, biosafety levels, infection and evasion. Fungal diseases: Etiology, characteristics and diagnosis of Candidiasis, Sporotrichosis, Aspergillosis and Ring worm.		09
II	Bacterial diseases: classification of bacterial pathogens, virulence factors and host pathogen interaction. Bacterial toxins, enterotoxins and their mode of action, diarrhea, cholera; Tuberculosis, infection and pathogenicity, diagnostics, therapeutics and vaccines, drug resistance. Other bacterial diseases such as - Typhoid, Tetanus, Anthrax and Pneumonia; their virulence factors and host pathogen interactions.		14
III	Viral diseases: Structure and classification of viruses, viral virulence factors, host pathogen interactions; AIDS: history, causative agent, pathogenesis, diagnostics, drugs; Other viral diseases such as Hepatitis, Influenza, Rabies, Dengue and Polio; Chicken Pox, Herpes Virus.		12
IV	Parasitic diseases: Classes of parasites and diseases caused by them, Malaria: causative agents, vectors, etiology, diagnostics, drugs, vaccine development. Role of drugs, vaccines and sanitation in prevention and treatment of infectious diseases.		10
Keywords	Infection, Disease, Prevention, Precaution		

Name and Signature of Convener & Members of CBoS:

PART-C: Learning Resources								
Text Books, Reference Books and Others								
Text Books Recommended –								
<ul style="list-style-type: none"> ➤ Jawetz, Melnick and Adelbergs Medical Microbiology 27th ed., McGraw Hill Education ➤ Klien's Microbiology (2008) 7th ed., Prescott, Harley, Wiley, J.M., Sherwood, L.M., Woolverton, C.J. McGraw Hill International Edition (New York) ➤ Sherris Medical Microbiology: An introduction to infectious diseases (2010) 4. Kenneth J. Ryan, C., George Ray, Publisher: McGraw-Hill.E-learning Resources 								
Online Resources–								
e-Resources / e-books and e-learning portals								
<ul style="list-style-type: none"> ➤ https://www.britannica.com/science/metabolism ➤ https://www.sciencedirect.com/science/article/pii/S0009912013001677 ➤ https://pubmed.ncbi.nlm.nih.gov/23720291/ ➤ https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3243375/ 								
PART -D: Assessment and Evaluation								
Suggested Continuous Evaluation Methods:								
Maximum Marks:		100 Marks						
Continuous Internal Assessment (CIA):		30 Marks						
End Semester Exam (ESE):		70 Marks						
Continuous Internal Assessment (CIA): (By Course Teacher)	<table border="1"> <tr> <td>Internal Test / Quiz-(2):</td> <td>20 +20</td> </tr> <tr> <td>Assignment / Seminar -</td> <td>10</td> </tr> <tr> <td>Total Marks -</td> <td>30</td> </tr> </table>	Internal Test / Quiz-(2):	20 +20	Assignment / Seminar -	10	Total Marks -	30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
Internal Test / Quiz-(2):	20 +20							
Assignment / Seminar -	10							
Total Marks -	30							
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40 Marks							

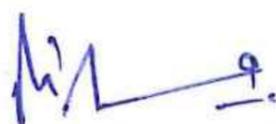
Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science (Diploma / Degree/ Honors)		Semester - IV	Session: 2024-2025
1	Course Code	BCSE- 02 P	
2	Course Title	Biology of Infectious Diseases	
3	Course Type	Discipline Specific Elective- Practical	
4	Pre-requisite (if, any)	As Per the Program	
5	Course Learning Outcomes (CLO)	<ul style="list-style-type: none"> ➤ Students will acquire the knowledge to isolate bacteria from water/sewage samples, to stain bacteria, fungi, acid fast bacilli and to perform important diagnostic tests for infectious diseases such as WIDAL test. ➤ Students will be exposed to permanent slides of pathogens in order to get hands-on training to know nature of various pathogens causing diseases. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> ➤ Grams staining for bacteria ➤ Isolation and culture of bacteria from water/sewage samples. ➤ Demonstration of various media for bacterial culture ➤ Isolation and enumeration of bacteriophages (PFU) from water/sewage samples ➤ WIDAL test ➤ Acid fast staining ➤ Permanent slides of pathogens: Mycobacterium tuberculosis, Leishmania, Plasmodium falciparum ➤ Fungal staining 		30
Keywords	Diagnostic tests, Infection identification, Methods		

Name and Signature of Convener & Members of CBoS:




PART-C: Learning Resources**Text Books, Reference Books and Others****Text Books Recommended –**

- Klien's Microbiology (2008) 7th ed., Prescott, Harley, Wiley, J.M., Sherwood, L.M., Woolverton, C.J. McGraw Hill International Edition (New York)
- Jawetz, Melnick&Adelbergs Medical Microbiology 27th ed., McGraw Hill Education

Online Resources–**e-Resources / e-books and e-learning portals**

- <https://link.springer.com/article/10.1007/s00217-008-0998-4>
- https://www.cdc.gov/nchs/data/nhanes/nhanes_03_04/113_c_met.pdf

PART -D: Assessment and Evaluation**Suggested Continuous Evaluation Methods:**

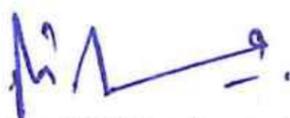
Maximum Marks: 50 Marks

Continuous Internal Assessment (CIA): 15 Marks

End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
	Assignment/Seminar +Attendance - 05 Total Marks - 15	
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment	Managed by Course teacher as per lab. status
	Performed the Task based on lab. work - 20 Marks	
	Spotting based on tools & technology (written) – 10 Marks	
	Viva-voce (based on principle/technology) - 05 Marks	

Name and Signature of Convener & Members of CBoS:




FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science (Degree/Honors)		Semester - V	Session: 2024-2025
1	Course Code	BCSC-05 T	
2	Course Title	Gene Replication, Expression and Regulation	
3	Course Type	Discipline Specific Course (Theory)	
4	Pre-requisite (if, any)	As Per the Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Distinguish the process of replication in prokaryotes & eukaryotes. ➤ Distinguish the process of transcription in prokaryotes & eukaryotes. ➤ Distinguish the process of translation in prokaryotes & eukaryotes. ➤ Discuss the transcriptional regulation in prokaryotes & eukaryotes. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	<p>Basic Concepts of Genetic Information: Salient features of Eukaryotic, prokaryotic and viral genomes; highly repetitive, moderately repetitive and unique DNA sequences. T_m and buoyant density and their relationship with G-C content in DNA. Chirality of DNA, tertiary Structure of DNA. Structure and properties of RNA: secondary and tertiary structures. Nucleic acid hybridization: Cot value and satellite DNA.</p>		12
II	<p>DNA replication: Features of replication, enzymes and proteins in DNA replication, E coli DNA polymerases, stages of replication initiation, elongation and termination. Replication In Eukaryotes: end replication problem, telomerase, various modes of replication. Comparison of replication in prokaryotes and eukaryotes. Inhibitors of DNA replication.</p>		11
III	<p>Transcription in prokaryotes: RNA polymerases, transcription cycle in bacteria, sigma factor, bacterial promoters, identification of DNA binding sites by DNA footprinting, various stages of RNA synthesis, initiation, elongation and termination, rho-dependent and rho-independent termination. Inhibitors of transcription and applications as antimicrobial drugs. Transcription in eukaryotes: Comparison between prokaryotic and eukaryotic transcription. The three classes of eukaryotic RNA polymerases, transcription by RNA polymerase II, RNA polymerase II core promoters, general transcription factors, transcription by RNA polymerase I and III. Inhibitors of eukaryotic transcription and their applications RNA Processing: Types of RNA processing- polyadenylation and capping, the spliceosome machinery, splicing pathways, group I and group II introns, alternative splicing, exon shuffling and RNA editing.</p>		11

Name and Signature of Convener & Members of CBoS:



IV	<p>Translation: Genetic code and its characteristics, triplet nature, degenerate, deciphering the genetic code, Wobble hypothesis. Suppressor tRNAs. Exceptions to the nearly universal genetic code. Messenger RNA, transfer RNA, charging of tRNA. The structure of ribosome. Three stages of translation-initiation, elongation and termination. Translation in eukaryotes. Regulation of translation. Comparison of prokaryotic and eukaryotic protein synthesis. Inhibitors of translation and their clinical importance.</p> <p>Regulation of gene expression in prokaryotes: Principles of gene regulation, negative and positive regulation, concept of operons, regulatory proteins, activators, repressors, DNA binding domains, regulation of lac operon and trp operon.</p>	11
Keywords	Chirality, DNA Replication, Transcription, Translation, Gene Expression, Operon.	

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Molecular Cell Biology (2013) 7th ed., Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Bretscher, A., Ploegh, H., Amon, A. and Scott, M.P., W.H. Freeman & Company (New York), ISBN:13:978-1-4641-0981-2.
- Principles of Biochemistry (2008) 3rd ed., Voet, D.J., Voet, J.G. and Pratt, C.W., John Wiley & Sons, Inc. (New York), ISBN:13: 978-0470-23396-2
- Molecular Biology of the Gene (2008) 6th ed., Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R., Cold Spring Harbor Laboratory Press, Cold Spring Harbor (New York), ISBN:0-321-50781 / ISBN:978-0-321-50781-5.

Online Resources– e-Resources / e-books and e-learning portals

- <https://www.genome.gov/genetics-glossary/DNA-Replication>
- <https://www.nature.com/scitable/topicpage/gene-expression-14121669/>
- <https://www.genome.gov/genetics-glossary/Mutation>
- <https://www.frontiersin.org/articles/10.3389/fmicb.2020.624830/full>

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

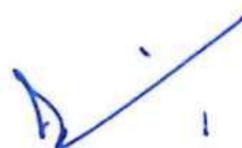
Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10	
Total Marks - 30		
End Semester Exam (ESE):	Two section – A & B	
	Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks	
	Section B: Descriptive answer type qts., 1 out of 2 from each unit-4x10=40 Marks	

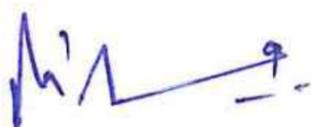
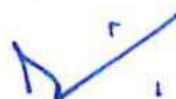
Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Degree/ Honors)</i>		Semester - V	Session: 2024-2025
1	Course Code	BCSC-0 5P	
2	Course Title	Gene Replication, Expression and Regulation	
3	Course Type	Discipline Specific Course (Practical)	
4	Pre-requisite (if, any)	As Per the Program	
5	Course Learning Outcomes (CLO)	On successful completion of the course, the student shall be able to: <ul style="list-style-type: none"> ➤ Demonstrate assay for nucleic acid by various methods. ➤ Demonstrate isolation process of DNA from different samples. ➤ Apply electrophoresis technique for different isolated compounds. ➤ Illustrate SDS-PAGE techniques. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> ➤ Estimation of DNA by diphenylamine method. ➤ Effect of temperature on the viscosity of DNA using Oswald's viscometer. ➤ Extraction of RNA and its estimation by Orcinol method. ➤ Isolation and estimation of RNA from yeast. ➤ Agarose Gel Electrophoresis and separation of DNA ➤ Isolation of DNA from bacteria/eukaryotic cells and check its purity 		30
Keywords	<i>Isolation, DNA Estimation</i>		

Name and Signature of Convener & Members of CBoS:

PART-C: Learning Resources**Text Books, Reference Books and Others****Text Books Recommended –**

- Molecular Cell Biology (2013) 7th ed., Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Bretscher, A., Ploegh, H., Amon, A. and Scott, M.P., W.H. Freeman & Company (New York), ISBN:13:978-1-4641-0981-2.
- Principles of Biochemistry (2008) 3rd ed., Voet, D.J., Voet, J.G. and Pratt, C.W., John Wiley & Sons, Inc. (New York), ISBN:13: 978-0470-23396-2
- Molecular Biology of the Gene (2008) 6th ed., Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R., Cold Spring Harbor Laboratory Press, Cold Spring Harbor (New York), ISBN:0-321-50781 / ISBN:978-0-321-50781-5.

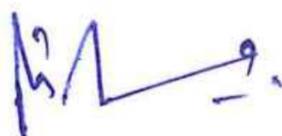
Online Resources–

- **e-Resources / e-books and e-learning portals**
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2874567/>
- <https://pubmed.ncbi.nlm.nih.gov/22546956/>

PART -D: Assessment and Evaluation**Suggested Continuous Evaluation Methods:****Maximum Marks: 50 Marks****Continuous Internal Assessment (CIA): 15 Marks****End Semester Exam (ESE): 35 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
	Assignment/Seminar + Attendance - 05 Total Marks - 15	
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment	Managed by Course teacher as per lab. status
	A. Performed the Task based on lab. work - 20 Marks	
	B. Spotting based on tools & technology (written) – 10 Marks	
	C. Viva-voce (based on principle/technology) - 05 Marks	

Name and Signature of Convener & Members of CBoS:

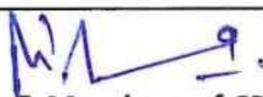



FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

Department of Biochemistry Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Degree/Honors)</i>		Semester - V	Session: 2024-2025
1	Course Code	BCSE- 03 T	
2	Course Title	Biotechnology	
3	Course Type	Discipline Specific Elective (Theory)	
4	Pre-requisite (if, any)	As Per the Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ The students will acquire basic knowledge of recombinant DNA technology, DNA manipulation in prokaryotes and eukaryotes, engineering of DNA molecules using restriction and modification enzymes. ➤ They will get acquainted with the use of cloning and expression vectors, creation of genomic and cDNA libraries and their applications. ➤ Students will also understand the methods for production of proteins using recombinant DNA technology and their application in industrial systems. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	Principles of gene cloning: Restriction and modification systems, restriction endonucleases and other enzymes used in manipulating DNA molecules. Ligation of DNA molecules, DNA ligase, sticky ends, blunt ends, linkers and adapters, homopolymer tailing, Synthetic oligonucleotides. Plasmids and bacteriophages as vectors for gene cloning. Cloning vectors based on E. coli plasmids, pBR322, pUC8, pGEM3Z. Viruses as vectors, cloning vectors based on M13 and λ bacteriophage.		12
II	Uptake of DNA by cells, Selection and identification for transformed cells, Transfection. Chemical and physical methods of DNA introduction into cells. Direct selection, marker rescue. cDNA and Genomic libraries, Southern and Northern hybridization.		11
III	Plant genetic engineering: gene isolation, gene transfer systems, Ti plasmid, plant virus vectors, electroporation, microinjection, microprojectile technology, Transgenic plants and animals. Production of recombinant proteins by eukaryotic cells. Fusion tags such as, polyhistidine, glutathione, maltose binding proteins and their role in purification of recombinant proteins.		11
IV	Application of Biotechnology: Pharmaceutical products of DNA technology; Human protein replacements, Human therapies, Vaccines. Transgenics and animal cloning: Creating transgenic animals and plants. Animal cloning.		11
Keywords	Recombinant DNA, Transfection, Recombinant Protein, Transgenics		

Name and Signature of Convener & Members of CBoS:




PART-C: Learning Resources**Text Books, Reference Books and Others****Text Books Recommended –**

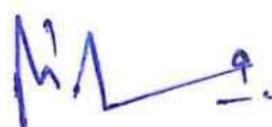
- Principles of Gene Manipulation and Genomics (2006) 7th ed., Primrose, S.B., and Twyman, R. M., Blackwell publishing (Oxford, UK)
- Gene Cloning and DNA Analysis (2010) 6th ed., Brown, T.A., Wiley-Blackwell publishing (Oxford, UK)
- Molecular Biotechnology: Principles and Applications of Recombinant DNA (2010) 4th ed., Glick B.R., Pasternak, J.J. and Patten, C.L., ASM Press (Washington DC)
- Molecular Cloning: A laboratory manual (2014), 4nded., Michael R Green and J. Sambrook Cold spring Harbor laboratory press (3vol.)

Online Resources–

- **e-Resources / e-books and e-learning portals**
- <https://www.klimud.org/public/atlas/idrar/web/www.irvingcrowley.com/cls/fund.htm>
- <https://www.mayoclinic.org/tests-procedures/prothrombin-time/about/pac-20384661>
- <https://www.ncbi.nlm.nih.gov/books/NBK482339/>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6709845/>

PART -D: Assessment and Evaluation**Suggested Continuous Evaluation Methods:****Maximum Marks: 100 Marks****Continuous Internal Assessment (CIA): 30 Marks****End Semester Exam (ESE): 70 Marks**

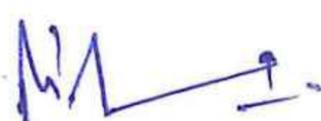
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10	
	Total Marks - 30	
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40 Marks	




Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Degree / Honors)</i>		Semester - V	Session: 2024-2025
1	Course Code	BCSE- 05 P	
2	Course Title	Biotechnology	
3	Course Type	Discipline Specific Elective (Practical)	
4	Pre-requisite (if, any)	As Per The Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Learn the experimental techniques of recombinant DNA technology and their biotechnological applications, such as separation of DNA fragments by Agarose gel electrophoresis, isolation of plasmid DNA from <i>E. coli</i>, transformation of <i>E. coli</i> cells, digestion of plasmid DNA, amplification of a DNA fragment by PCR, etc. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> ➤ Agarose gel electrophoresis for separation of DNA fragments. ➤ Isolation of plasmid DNA from <i>E. coli</i>. ➤ Transformation of <i>E. coli</i> cells with plasmid DNA. ➤ Digestion of plasmid DNA with restriction enzymes. ➤ Amplification of a DNA fragment by PCR. ➤ Complementation of β-galactosidase for Blue and White selection. 		30
Keywords	SDS, DNA isolation, Restriction digestion, PCR		




Name and Signature of Convener & Members of CBoS:

PART-C: Learning Resources**Text Books, Reference Books and Others****Text Books Recommended –**

- Principles of Gene Manipulation and Genomics (2006) 7th ed., Primrose, S.B., and Twyman, R. M., Blackwell publishing (Oxford, UK)
- Gene Cloning and DNA Analysis (2010) 6th ed., Brown, T.A., Wiley-Blackwell publishing (Oxford, UK)
- Molecular Biotechnology: Principles and Applications of Recombinant DNA (2010) 4th ed., Glick B.R., Pasternak, J.J. and Patten, C.L., ASM Press (Washington DC)
- Molecular Cloning: A laboratory manual (2014), 4nded., Michael R Green and J. Sambrook Cold spring Harbor laboratory press (3vol.)

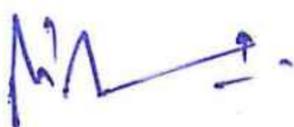
Online Resources–

- **e-Resources / e-books and e-learning portals**
- <https://www.klimud.org/public/atlas/idrar/web/www.irvingcrowley.com/cls/fund.htm>
- <https://www.mayoclinic.org/tests-procedures/prothrombin-time/about/pac-20384661>
- <https://www.ncbi.nlm.nih.gov/books/NBK482339/>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6709845/>

PART -D: Assessment and Evaluation**Suggested Continuous Evaluation Methods:****Maximum Marks: 50 Marks****Continuous Internal Assessment (CIA): 15 Marks****End Semester Exam (ESE): 35 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on lab. work - 20 Marks B. Spotting based on tools & technology (written) – 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBoS:




FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

Department of Biochemistry

Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Degree/Honors)</i>		Semester - VI	Session: 2024-2025
1	Course Code	BCSC- 06T	
2	Course Title	Biochemistry and Function of Hormones	
3	Course Type	Discipline Specific Course (Theory)	
4	Pre-requisite (if, any)	As Per The Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Understand the different modes of communication between cells including signal reception, transduction, amplification and response. ➤ Understand the role of endocrine system in maintaining ionic and glucose homeostasis and the communications that regulate growth appetite, metabolism and reproduction in humans. ➤ Decipher molecular and biochemical mechanisms of all hormones and will be in a position to interpret hormonal levels in individuals with health and disease conditions. Besides, ➤ Understand the role of various plant hormones in growth and development of plants. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	<p>Hormones: Chemical classification of hormones, Functions of hormones and their regulation. Chemical signaling - endocrine, paracrine, autocrine, intracrine and neuroendocrine mechanisms. General introduction to Endocrinology. Hormone receptors - extracellular and intracellular. Receptor - hormone binding.</p> <p>Hypothalamic-Hypophysial system, Pituitary: anatomy, histology, vasculature and secretions. Physiological and biochemical actions of hypothalamic hormones and anterior pituitary hormones; Feed- back regulation. Posterior pituitary hormones – structure, physiology and biochemical actions of AVP and Oxytocin.</p>		12
II	<p>Thyroid gland - Histology; Biosynthesis of thyroid hormone and its regulation: Role of TRH and TSH in T4 synthesis and response. Physiological and biochemical action of Thyroxine. Pathophysiology of thyroxine secretion: Hyper and hypothyroidism, Goiter, Graves' disease, Cretinism, Myxoedema.</p> <p>Regulation of calcium homeostasis: PTH, Vitamin D and calcitonin. Mechanism of Ca²⁺ regulation. Regulation of Growth: growth hormone and somatomedin, Endocrine disorders - gigantism, acromegaly, dwarfism, pygmies. Physiology and biochemical actions of Growth factors- EGF, PDGF and Erythropoietin.</p>		11
III	<p>Hormones of adrenal gland: Physiology and action of Aldosterone; the Renin Angiotensin System. Physiology and Biochemical actions of Cortisol. Adrenal medullary Hormones: Epinephrine and Norepinephrine. General adaptation syndrome: acute and chronic stress response. Pathophysiology – Addison's disease, Conn's</p>		11

Name and Signature of Convener & Members of CBoS:




	syndrome.	
IV	Cells involved in the release of gastrointestinal hormones; The gastrin family of hormones and CCK: the secretin family of hormones; Incretins; Ghrelin; Summary of hormone metabolite control of GI function. Hormones of the Pancreas: Structure, synthesis, physiology and biochemical actions of insulin and glucagon. Adipocyte hormones: Adiponectin and leptin; Appetite and satiety control. Male and female sex hormones. Hormones during ovarian and uterine phases of menstrual cycle; Placental hormones; role of hormones during parturition and lactation.	11
Keywords	Cell Organelles, Cell Biology, Circulatory System, Respiratory System, Digestive System, Endocrine system, Excretory System.	

PART-C: Learning Resources**Text Books, Reference Books and Others****Text Books Recommended –**

- Lehninger: Principles of Biochemistry (2017) 7th ed., Nelson, D.L. and Cox, M.M. W.H. Freeman & Company (New York)
- Vander's Human Physiology (2019) 15th ed., Widmaier, E.P., Raff, H. and Strang, K.T. McGraw Hill International Publications (USA)
- Endocrinology (2007) 6th ed., Hadley, M.C. and Levine, J.E. Pearson Education (New Delhi), Inc.
- The Cell: A Molecular Approach (2009) 5th Ed. Cooper, G.M. and Hausman, R.E. ASM Press & Sunderland, (Washington DC), Sinauer Associates. (MA).

Online Resources– e-Resources / e-books and e-learning portals

- <https://www.nature.com/scitable/topic/cell-biology-13906536/>
- <https://www.sciencedirect.com/topics/medicine-and-dentistry/endocrinology>
- <https://www.webmd.com/lung/how-we-breathe> <https://www.britannica.com/science/circulatory-system>
- <https://www.niddk.nih.gov/health-information/digestive-diseases/digestive-system-how-it-works>

PART -D: Assessment and Evaluation**Suggested Continuous Evaluation Methods:****Maximum Marks: 100 Marks****Continuous Internal Assessment (CIA): 30 Marks****End Semester Exam (ESE): 70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20 Assignment / Seminar - 10 Total Marks - 30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit-4x10=40 Marks	

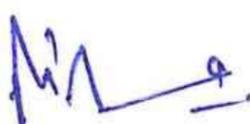
Name and Signature of Convener & Members of CBoS:




FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

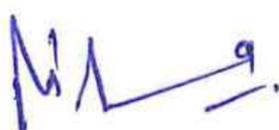
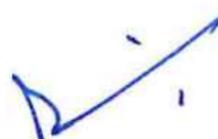
PART- A: Introduction			
Program: Bachelor in Science <i>(Degree/ Honors)</i>		Semester - VI	Session: 2024-2025
1	Course Code	BCSC -6P	
2	Course Title	Biochemistry and Function of Hormones	
3	Course Type	Discipline Specific Course (Practical)	
4	Pre-requisite (if, any)	As Per The Program	
5	Course Learning Outcomes (CLO)	<i>On successful completion of the course, the student shall be able to:</i> <ul style="list-style-type: none"> ➤ Students will acquire practical training to undertake clinical tests like Glucose Tolerance test, estimation of serum Ca²⁺, serumT₄, serumelectrolytes and HCG based pregnancy test. ➤ Interpret hormonal level with clinical conditions of the individuals. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> ➤ Estimation of serum Ca²⁺. ➤ Estimation of serum T₄ ➤ HCG based pregnancy test. ➤ Estimation of serum electrolytes. ➤ Case studies 		30
Keywords	Glucose Tolerance test, estimation of serum Ca ²⁺ , serumT ₄ , serumelectrolytes , HCG based pregnancy test		

Name and Signature of Convener & Members of CBoS:




PART-C: Learning Resources		
Text Books, Reference Books and Others		
Text Books Recommended –		
<ul style="list-style-type: none"> ➤ Lehninger: Principles of Biochemistry (2017) 7th ed., Nelson, D.L. and Cox, M.M. W.H. Freeman & Company (New York) ➤ Vander's Human Physiology (2019) 15th ed., Widmaier, E.P., Raff, H. and Strang, K.T. McGraw Hill ➤ International Publications (USA) ➤ Endocrinology (2007) 6th ed., Hadley, M.C. and Levine, J.E. Pearson Education (New Delhi), Inc. ➤ The Cell: A Molecular Approach (2009) 5th Ed. Cooper, G.M. and Hausman, R.E. ASM Press & Sunderland, (Washington DC), Sinauer Associates. (MA). 		
Online Resources–		
e-Resources / e-books and e-learning portals		
<ul style="list-style-type: none"> ➤ https://www.nature.com/scitable/topic/cell-biology-13906536/ ➤ https://www.sciencedirect.com/topics/medicine-and-dentistry/endocrinology ➤ https://www.webmd.com/lung/how-we-breathe ➤ https://www.britannica.com/science/circulatory-system ➤ https://www.niddk.nih.gov/health-information/digestive-diseases/digestive-system-how-it-works 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		50 Marks
Continuous Internal Assessment (CIA):		15 Marks
End Semester Exam (ESE):		35 Marks
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar + Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment Performed the Task based on lab. work - 20 Marks Spotting based on tools & technology (written) – 10 Marks Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

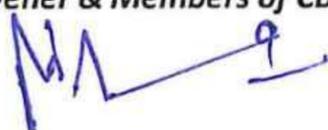
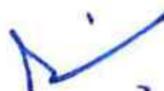
Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Degree/Honors)</i>		Semester - VI	Session: 2024-2025
1	Course Code	BCSE-04 T	
2	Course Title	Plant Biochemistry	
3	Course Type	Discipline Specific Elective (Theory)	
4	Pre-requisite (if, any)	As Per The Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Learning outcomes for this course include detailed understanding of metabolic processes specific for plants such as nitrate assimilation, photosynthesis, respiration, nitrogen fixation. ➤ Understand the role of different metabolic pathways in plant growth and development. ➤ Understand insight to various stressful conditions of the environment that affect plant growth and productivity ➤ Understand the defense mechanisms in plants due to which plants survive under stresses. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	<p>Nitrogen metabolism: assimilation of nitrate, structural features of nitrate reductase and nitrite reductase, incorporation of ammonia into organic compounds, regulation of nitrate assimilation. Biological nitrogen fixation by free living and in symbiotic association; structure and function of the enzyme nitrogenase.</p> <p>Electron transport system in plants: Chemiosmotic theory, ATP synthase and mechanism of ATP synthesis.</p>		12
II	<p>Photosynthesis – Photosynthetic apparatus, pigments of photosynthesis, role of carotenoids, photosystems I and II, their location; Hill reaction, photosynthetic electron transport and generation of NADPH & ATP, cyclic and non-cyclic photophosphorylations, complexes associated with thylakoid membranes; light harvesting complexes, path of carbon in photosynthesis – C₃ and C₄ pathway of carbon reduction and its regulation, Photorespiration.</p>		11
III	<p>Special features of secondary plant metabolism, terpenes (classification, biosynthesis), lignin, tannins, pigments, phytochrome, waxes, alkaloids, biosynthesis of nicotine, functions of alkaloids, cell wall components.</p> <p>Toxins of plant origin – mycotoxins, phytohemagglutinins, lathrogens, nitriles, protease inhibitors, protein toxins.</p>		11
IV	<p>Stress metabolism in plants – Environmental stresses, salinity, water stress, heat, chilling, anaerobiosis, pathogenesis, heavy metals, radiations and their impact on plant growth and metabolism, criteria of stress tolerance.</p> <p>Antioxidative defense system in plants – reactive oxygen species and their generation, enzymic and non-enzymic components of antioxidative defense mechanism.</p>		11
Keywords	Electron transport, Nitrogen assimilation, secondary metabolites, Reactive oxygen species.		

Name and Signature of Convener & Members of CBoS:

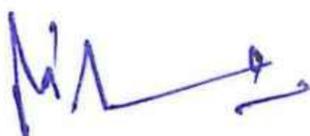
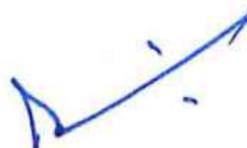
PART-C: Learning Resources**Text Books, Reference Books and Others****Text Books Recommended –**

- Buchann (2015), Biochemistry and Molecular Biology of Plants, 2nded. Publisher: I KInternational. ISBN-10: 8188237116, ISBN- 978047 0714218
- Taiz and Zeiger, Plant Physiology, 5thedition, Sinauer Associates Inc.ISBN-13:978- 0878938667, ISBN-10:0878938664
- Caroline Bowsher, Martin steer, Alyson Tobin (2008), Plant Biochemistry, Garland science ISBN978-0-8153-4121-5.
- P.M Dey and J.B. Harborne (Editors) (1997), Plant Biochemistry, Publisher:Academic Press ISBN-10:0122146743, ISBN- 13:978-0122146749

PART -D: Assessment and Evaluation**Suggested Continuous Evaluation Methods:****Maximum Marks: 100 Marks****Continuous Internal Assessment (CIA): 30 Marks****End Semester Exam (ESE): 70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10 Total Marks - 30	
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40 Marks	

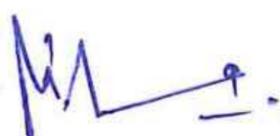
Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

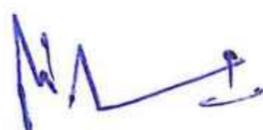
PART- A: Introduction			
Program: Bachelor in Science <i>(Degree/Honors)</i>		Semester - VI	Session: 2024-2025
1	Course Code	BCSE-04P	
2	Course Title	Plant Biochemistry	
3	Course Type	Discipline Specific Elective (Practical)	
4	Pre-requisite (if, any)	As Per the Program	
5	Course Learning Outcomes (CLO)	<i>On successful completion of the course, the student shall be able to:</i> <ul style="list-style-type: none"> ➤ Determine the contents of photosynthetic pigments, ascorbic acid, phenols, tannins, hydrogen peroxide in plant samples. ➤ Understand the spectral patterns of photosynthetic pigments. ➤ Perform extraction and assay enzymes like urease from Jack bean. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> ➤ Estimation of chlorophylls and carotenoids from grass/spinach leaves ➤ Estimation of ascorbic acid, phenols, tannins in fruits and vegetables ➤ Determination of radical scavenging activity of plant extracts ➤ Estimation of hydrogen peroxide in tissue extracts ➤ Extraction and assay of urease from Jackbean. ➤ Separation of photosynthetic pigments by TLC and determination of absorption Spectra. 		30
Keywords	Photosynthetic pigments, ascorbic acid, phenols, tannins,		

Name and Signature of Convener & Members of CBoS:




PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
<ul style="list-style-type: none"> ➤ Buchann (2015), Biochemistry and Molecular Biology of Plants, 2nded. Publisher: I KInternational. ISBN-10: 8188237116, ISBN- 978047 0714218 ➤ Taiz and Zeiger, Plant Physiology, 5th edition, Sinauer Associates Inc. ISBN-13: 978- 0878938667, ISBN-10:0878938664 ➤ Caroline Bowsher, Martin steer, Alyson Tobin (2008), Plant Biochemistry, Garland science ISBN978-0-8153-4121-5. ➤ P.M Dey and J.B. Harborne (Editors) (1997), Plant Biochemistry, Publisher: Academic Press ISBN-10:0122146743, ISBN-13:978-0122146749 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		50 Marks
Continuous Internal Assessment (CIA):		15 Marks
End Semester Exam (ESE):		35 Marks
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on lab. work - 20 Marks B. Spotting based on tools & technology (written) – 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBoS:




FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

Department of Biochemistry

Course Curriculum

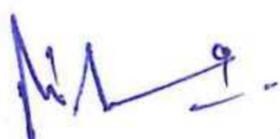
PART- A: Introduction			
Program: Bachelor in Science (Degree / Honors)		Semester - VII	Session: 2024-2025
1	Course Code	BCSC-07 T	
2	Course Title	Immunology	
3	Course Type	Discipline Specific Course (Theory)	
4	Pre-requisite (if, any)	As per the Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Differentiate between innate and adaptive immunity and also between humoral and cell mediated immunity. ➤ Explain the primary and secondary response and the irrelevance to immunizations. ➤ Identify the role of antigen presenting cells, lymphocytes, and phagocytic cells in immune responses. ➤ Apply immunochemical techniques used in pathological laboratories. ➤ Discriminate the nature of antigens and antibodies. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	Cell and Organs of Immune System: Innate immune mechanism and characteristics of adaptive immune response. Cells of immune system: Hematopoiesis and differentiation, mononuclear cells and granulocytes. Antigen presenting cells. Primary and Secondary lymphoid organs and tissues. Ontogeny and phylogeny of lymphocytes. Lymphocyte traffic.		12
II	Antigens: nature of antigens, factor affecting immunogenicity, Haptens and super antigens. Antigenic determinants. Recognition of antigens by T and B cell. Antigen processing. Role of MHC molecules in antigen presentation and co-stimulatory signals. Antigen and antibody interaction. Antigen receptor molecules: B-cell receptor complex, Immunoglobulin- structure types and functions. T-cell receptor complex. Clonal selection theory- concept of antigen specific receptor. Organization and expression of immunoglobulin genes. Generation of antibody diversity. Light and heavy chain gene recombination. Recombination Signal Sequences. Heavy chain constant region genes. Class switching. T-cell receptor diversity.		11
III	Immune Response: Cell mediated and Humoral immune response and its regulation. Cytokines and interleukins- structure and function. Hypersensitive reactions and their types. Immunodeficiency disorders. Autoimmunity. Major Histocompatibility Complex- types, structural organization, function and distribution. Transplantation and Rejection. Complements in immune function.		11
IV	Immune response to infectious diseases: viral, bacterial and protozoal. Cancer and immune system. Nutrition and Immune response. Principles of vaccination. Immunization practices. Passive immunization (immunotherapy). Role of vaccine in prevention of diseases: vaccines against important viral, bacterial, protozoan and parasitic diseases. DNA vaccines; Antiviral, antibacterial agents.		11
Keywords		Recognition, Response, Antibody, Antigen, Cancer, Disease.	

Name and Signature of Convener & Members of CBoS:



PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
<ul style="list-style-type: none"> ➤ Kuby's Immunology R.A. Goldsby, T. J Kindt and B. A. Osborne ➤ Immunology- A short Course E. Benjamini, R. Coico and G. Sunshine ➤ Immunology Roitt, Brostoff and Male ➤ Fundamentals of Immunology William Paul ➤ Immunology Tizard ➤ Immunology Abbas et al 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		100 Marks
Continuous Internal Assessment (CIA):		30 Marks
End Semester Exam (ESE):		70 Marks
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20 Assignment / Seminar - 10 Total Marks - 30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40 Marks	

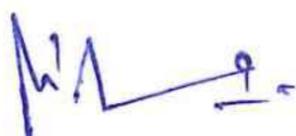
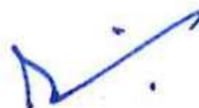
Name and Signature of Convener & Members of CBoS:




FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Degree/Honors)</i>		Semester - VII	Session: 2024-2025
1	Course Code	BCSC-07 P	
2	Course Title	Immunology	
3	Course Type	Discipline Specific Course (Practical)	
4	Pre-requisite (if, any)	As per Program	
5	Course Learning Outcomes (CLO)	<i>On successful completion of the course, the student shall be able to:</i> <ul style="list-style-type: none"> ➤ Apply the techniques to test various clinical conditions. ➤ Perform immunological techniques. ➤ Analyze the different blood cell counting. ➤ Perform qualitative and quantitative test for proteins. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> ➤ Identification of cells of immune system ➤ Identification of Lymphocytes and their subsets ➤ Lymphoid organs and their microscopic organization ➤ Isolation and purification of Antigens ➤ Purification of IgG from serum ➤ Estimation of Levels of gamma globulins and A/G ratio in blood ➤ Antigen antibody interaction 		30
Keywords	Immunoglobulin, Cell, Antibody, Antigen		

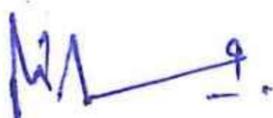
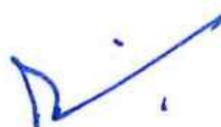
Name and Signature of Convener & Members of CBoS:

PART-C: Learning Resources
Text Books, Reference Books and Others
<i>Text Books Recommended –</i>
<ul style="list-style-type: none"> ➤ Kuby's Immunology R.A. Goldsby, T. J Kindt and B. A. Osborne ➤ Immunology- A short Course E. Benjamini, R. Coico and G. Sunshine ➤ Immunology Roitt, Brostoff and Male

PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:	50 Marks	
Continuous Internal Assessment (CIA):	15 Marks	
End Semester Exam (ESE):	35 Marks	
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on lab. work - 20 Marks B. Spotting based on tools & technology (written) – 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBoS:

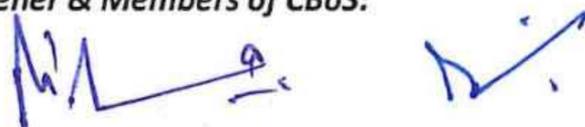
FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

Department of Biochemistry

Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Honors/Honors with Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	BCSE-05 T	
2	Course Title	Human Physiology	
3	Course Type	Discipline Specific Elective (Theory)	
4	Pre-requisite (if, any)	As per the Program	
5	Course Learning Outcomes (CLO)	<p style="text-align: center;"><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Understand mechanism of signal transduction by steroid and polypeptide hormones and the role of second messengers in signal transduction. ➤ Explain the process of gaseous exchange in tissues and lungs, respiratory adaptation to high altitude and the difference between hemoglobin and myoglobin. ➤ Explain muscular dystrophies, the role of steroids in muscle building and the use of hormones in cattle and poultry industry. ➤ Explain role of kidney in erythropoiesis. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	<p>Neurotransmission: Types of neurons, generalized structure of multi polar neuron. Resting membrane potential, Action potential, Transmission of nerve impulse along anaxon and across synapse. Neurotransmitters and inhibitors of neurotransmission.</p> <p>Muscle: Types of muscles and structure. Ultra structure of skeletal muscle. Contractile and regulatory proteins of muscle. Sliding filament model of skeletal muscle contraction.</p> <p>Bone: Composition and structure of long bone, growth and remodeling of long bone. Factors affecting its growth.</p>		12
II	<p>Excretory system: Structure of the nephron, formation of urine – Glomerular filtration, tubular re-absorption and secretions.</p> <p>Body fluids: Blood volume, composition and functions, RBC, WBC and platelets, the structure and functions. Mechanism of blood coagulation. Biochemical events in transport of CO₂ and O₂ in blood. Cerebrospinal fluid, lymph and its function. Blood brain barrier.</p>		11
III	<p>Heart and lungs–Structure and function of cardiac tissue and lungs Acid-base balance: Maintenance of normal pH of the body fluids. Blood buffers. Role of lungs And kidney in acid base balance.</p> <p>GIT and Liver: Structure and function of gastrointestinal tract, Structure of a lobule, functions–metabolic, storage and detoxification.</p>		11
IV	<p>Endocrine system: Endocrine organs, classification of hormones. Dynamic balance and regulation of hormone secretions. Functions of the hormones of hypothalamus, pituitary, adrenal, thyroid, pancreas and gonads. General mechanism of hormone action. Concept of messengers eg: cAMP, DAG, IP₃.</p>		11
Keywords		Heart, Liver, Kidney, Bone, Brain, Neurons	

Name and Signature of Convener & Members of CBoS:



PART-C: Learning Resources**Text Books, Reference Books and Others****Text Books Recommended –**

- Concise Medical Physiology– Choudhary – New Central Book Agency–Calcutta.
- Text Book of Medical Physiology–Guyton–Prism Books Pvt. Ltd.–Bangalore.
- Harper’s Biochemistry–Murray, Granner, Mayes, and Rod well – Prentice Hall International Inc.
- Text book of medical physiology: A. C. Gyton , and J.E Hall Saunders Elsevier.
- Human Physiology, Vol. I & II,-C. C. Chatterjee – Medical Allied Agency–Calcutta.

PART -D: Assessment and Evaluation**Suggested Continuous Evaluation Methods:**

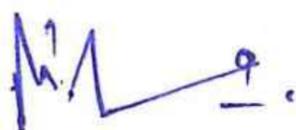
Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10	
Total Marks - 30		
End Semester Exam (ESE):	Two section – A & B	
	Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks	
	Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40 Marks	

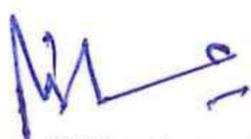
Name and Signature of Convener & Members of CBoS:



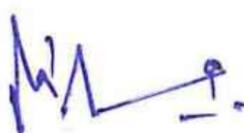

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Honors/Honors with Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	BCSE-05 P	
2	Course Title	Human Physiology	
3	Course Type	Discipline Specific Elective (Practical)	
4	Pre-requisite (if, any)	<i>As per Program</i>	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Understand Qualitative and quantitative analysis of biological molecules and their estimation using multiple methods ➤ Demonstrate the process of gaseous exchange in tissues and lungs, respiratory adaption to high altitude and the difference between hemoglobin and myoglobin. ➤ Explain muscular dystrophies, the role of steroids in muscle building. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> ➤ Preparation of blood smear and differential leukocyte count. ➤ RBC and WBC counting, Calculation of blood Indices. ➤ Estimation of hemoglobin ➤ Colorimetric estimation of Protein by Lowry's method. ➤ Estimation of Uric acid. ➤ Urea by DAMO method. ➤ Creatinine by Jaffe's method. ➤ Phosphorous by Fiske and Subbarow's method. ➤ Iron by Wong's method. ➤ Qualitative analysis of urine-detection of urea, uric acid and creatinine. 		30
Keywords	RBC, WBC, Serum Protein, Estimation, plasma minerals.		

Name and Signature of Convener & Members of CBoS:




PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
<ul style="list-style-type: none"> ➤ Text Book of Medical Physiology–Guyton–Prism Books Pvt.Ltd.–Bangalore. ➤ Harper’s Biochemistry–Murray, Granner,Mayes,andRodwell– Prentice Hall International Inc. ➤ Text book of medical physiology:A.C.Gyton,andJ.E Hall Saunders Elsevier. 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		50 Marks
Continuous Internal Assessment (CIA):		15 Marks
End Semester Exam (ESE):		35 Marks
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on lab. work - 20 Marks B. Spotting based on tools & technology (written) – 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status




Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

Department of Biochemistry

Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Honors/Honors with Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	BCSE-06 T	
2	Course Title	Cell Biology	
3	Course Type	Discipline Specific Elective (Theory)	
4	Pre-requisite (if, any)	As per Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Describe the chemical and molecular foundations of cell and the role in biological systems. ➤ Define the structure, properties and roles of nucleus. ➤ Explain the protein sorting and its transport in biological system. ➤ Discuss cell signaling mechanism through various pathways. ➤ Classify the cell cycle, its regulation and development. 	
6	Credit Value	3 Credits	Credit = 15 Hours - learning & Observation
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	Molecular organization of membranes - asymmetrical organization of lipids, proteins and carbohydrates. Osmosis, ion channels, membrane pumps and electrical properties of membranes. Active transport by ATP-powered pumps: types, properties and mechanisms.		12
II	Cell Trafficking- Transport of proteins into mitochondria, chloroplast and endoplasmic reticulum. Transport of proteins into and out of nucleus. Transport by vesicle formation: exocytosis, endocytosis and its molecular mechanism.		11
III	Cell signalling: Signalling via G-protein linked and enzyme linked cell surface receptors, MAP kinase pathways. Eukaryotic cell division cycle: different phases and molecular events, regulation and control of cell cycle. Apoptosis. Oncogenes and tumor suppressor genes: viral and cellular Oncogenes, retinoblastoma, E2F and p53 proteins.		11
IV	Organization of chromosomes: Structure of chromosomes, centromere and telomere. States of chromosomes during cell cycle. Mitotic chromosome. Organization of genes in chromosomes. Banding pattern of chromosomes. Lampbrush and Polytene chromosomes. Chromatin, nucleosomes, DNA packaging, heterochromatin and euchromatin.		11
Keywords	Membrane transport, cell signals, chromosoms		

Name and Signature of Convener & Members of CBoS:




PART-C: Learning Resources**Text Books, Reference Books and Others****Text Books Recommended –**

- Lodish, A. Berk, S L Zipursky, P. Matsudaira Molecular Cell Biology
- Alberts, D. Bray, K. Hopkin, A. Johnson Essential of Cell Biology
- Lodish, A. Berk, C. A. Kaiser & M. Krieger Molecular cell Biology
- Gerald Karp Cell and Molecular Biology Concepts and experiments

PART -D: Assessment and Evaluation**Suggested Continuous Evaluation Methods:****Maximum Marks: 100 Marks****Continuous Internal Assessment (CIA): 30 Marks****End Semester Exam (ESE): 70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10 Total Marks - 30	
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40 Marks	

Name and Signature of Convener & Members of CBoS:



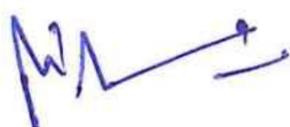

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

Department of Biochemistry

Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Honors/Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	BCSE-06 P	
2	Course Title	Cell Biology	
3	Course Type	Discipline Specific Elective (Practical)	
4	Pre-requisite (if, any)	<i>As per Program</i>	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Examine various cell organelles through micrograph techniques. ➤ Analyze various nucleic acids through staining techniques. ➤ Examine polyploidy through onion root with various treatments. ➤ Analyze various stages of mitosis. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> ➤ Study of chromosome behavior during Mitosis and meiosis (Onion / Garlic root tips, Onion buds, human lymphocytes, rat or bird testis /grass hopper testis or any other materials). ➤ Calculation of mitotic index in growing Onion / Garlic root tips ➤ Squash preparation: Polytene chromosome (in chironomus / Drosophila or other insect salivary gland) and Barr body (in buccal epithelial cells). ➤ Demonstration of secretory granules in the salivary gland cells of insect. ➤ Demonstration of mitochondria by vital staining. ➤ Study of permanent slides. ➤ Estimation of DNA ➤ Estimation of RNA ➤ Study of the effect of chemical agents on chromosomes plant cells. ➤ Preparation of Karyotype of metaphase plate. ➤ Preparation of Meiotic plate and determination of phases. 		30
Keywords	Chromosome, Cell division, DNA, RNA Estimation		

Name and Signature of Convener & Members of CBoS:




PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
<ul style="list-style-type: none"> ➤ Text Book of Medical Physiology–Guyton–Prism Books Pvt.Ltd.–Bangalore. ➤ Harper’s Biochemistry–Murray, Granner,Mayes,andRodwell– Prentice Hall International Inc. ➤ Text book of medical physiology:A.C.Gyton,andJ.E Hall Saunders Elsevier. 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		50 Marks
Continuous Internal Assessment (CIA):		15 Marks
End Semester Exam (ESE):		35 Marks
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on lab. work - 20 Marks B. Spotting based on tools & technology (written) – 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status




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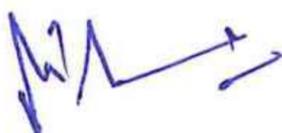
FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science (Honors / Honors with Research)		Semester - VII	Session: 2024-2025
1	Course Code	BCSE - 07 T	
2	Course Title	Microbial Biochemistry	
3	Course Type	Discipline Specific Elective (Theory)	
4	Pre-requisite (if, any)	As per the Program	
5	Course Learning Outcomes (CLO)	<p>On successful completion of the course, the student shall be able to:</p> <ul style="list-style-type: none"> ➤ Explain the structure of bacteria and their microscopic examinations. ➤ Analyze the types bacterial toxins and the toxicology. ➤ Apply the knowledge of fermentation technology in production of antibiotics, enzymes etc. ➤ Apply the knowledge of enzyme technology in enzymes-based production in industry. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	FUNGI: General characteristics of fungi, classification of fungi, life cycle of selected fungal genus (Aspergillus, Pencillium, Fusarium and Mucor). Economic importance of fungi. Fungi and bioremediation, parasitism, mutualism and symbiosis with plants and animals. Heterothallism, sex hormone in fungi, Mycorrhiza, VAM. Algae: Distribution, classification, reproduction, ecology and importance.		12
II	BACTERIA: Morphology and ultra structure of bacteria, morphological types, cell wall of archaeobacteria, gram negative, gram positive eubacteria, eukaryotes. Cell membranes – structure, composition and properties. Structure and function of flagella, cilia, pili, gas vesicles. Cyanobacteria, protozoa, mycoplasma and Rickettsia. Gene transfer mechanisms, transformation, transduction, conjugation and transfection. Plasmids F: factors colicins and col factors, plasmids as a vector for gene cloning.		11
III	NUTRITION IN MICROORGANISM: Nutritional types (autotrophs, heterotrophs, phototrophs, chemotrophs), growth curves, measurement of growth, factors affecting growth, generation time, growth kinetics. Batch and continuous culture, asynchronous, synchronous culture. Basis of microbial classification, classification and salient feature of bacteria according to Bergey's manual of determinative bacteriology, cyanobacteria, prochlorons and cyanelles.		11
IV	VIRUSES: Structure and classification of viruses; morphology and ultra-structure; capsids and their arrangements, types of envelopes, viral genome, their types and structure, virus related agents (viroids, prions). General feature of virus reproductions, early events in virus multiplication, virus restriction and modification of host, virus mRNA. General overview of bacterial viruses, RNA and DNA bacteriophages (MS2, ϕ X174, M13, T3, T4). Lysogeny and Lytic phase. General account of plant and animal viruses (TMV, HIV and other oncogenic virus, Hepatitis virus).		11
Keywords	Fungi, Bacteria, Virus, nutrition, Infection, Disease		

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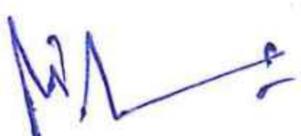
PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
<ul style="list-style-type: none"> ➤ Microbiology L.M. Prescott, J.P. Harley and D.A. Klein ➤ General Microbiology RY Stanier, J L Ingrahamana, ML Wheelis& P. R. Painter ➤ Principles of Microbiology R.M. Atlas 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks: 100 Marks		
Continuous Internal Assessment (CIA): 30 Marks		
End Semester Exam (ESE): 70 Marks		
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20 Assignment / Seminar - 10 Total Marks - 30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4= 20 Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit-4x10=40 Marks	

Name and Signature of Convener & Members of CBoS:




FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

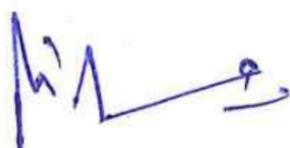
PART- A: Introduction			
Program: Bachelor in Science <i>(Honors/ Honors with Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	BCSE - 07 P	
2	Course Title	Microbial Biochemistry	
3	Course Type	Discipline Specific Elective (Practical)	
4	Pre-requisite (if, any)	As per the Program	
5	Course Learning Outcomes (CLO)	<i>On successful completion of the course, the student shall be able to:</i> <ul style="list-style-type: none"> ➤ Demonstrate the techniques of pure culture of bacteria or fungi. ➤ Interpret the motility of the microbes. ➤ Interpret the biochemical activities of microbes by various tests. ➤ Understand about the impact of antibiotics on microbial survival. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> ➤ Glassware preparation and sterilization techniques- wet heat- dry heat- ➤ Filter types- laminar flow chamber types- CDC- safety levels. ➤ Preparation of liquid & solid media, plating, pouring, inoculation and incubation for growth of microorganism ➤ Methods of obtaining pure culture of microorganisms (a) streak plate (b) Pour plate, and (c) spread plate methods ➤ Microscopic examination of the microorganisms, identification and staining methods ➤ Study of bacterial growth by turbidimetry / spectrophotometry ➤ Biomass measurement for fungi ➤ Isolation and enumeration of microorganisms from soil by serial dilution agar plating method. ➤ Enumeration of viruses by plaque assay technique. ➤ Motility of bacteria by hanging drop technique. 		30
Keywords	Sterilization, Growth, identification		



Name and Signature of Convener & Members of CBoS:

PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
<ul style="list-style-type: none"> ➤ Microbiology L.M. Prescott, J.P. Harley and D.A. Klein ➤ General Microbiology RY Stanier, J L Ingrahamana, ML Wheelis& P. R. Painter ➤ Principles of Microbiology R.M. Atlas ➤ Microbiology Peleczar, Chan & Krieg. ➤ General Virology Luria, Darnell, Baltimore and Campell. ➤ Introduction to Mycology CJ Alexopoulos and CW Mims 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		50 Marks
Continuous Internal Assessment (CIA):		15 Marks
End Semester Exam (ESE):		35 Marks
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment Performed the Task based on lab. work - 20 Marks Spotting based on tools & technology (written) – 10 Marks Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

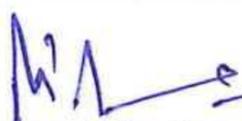
Name and Signature of Convener & Members of CBoS:



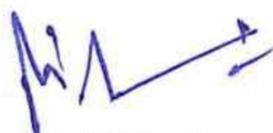

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Honors / Honors with Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	BCSE - 08 T	
2	Course Title	Nutritional and Environmental Biochemistry	
3	Course Type	Discipline Specific Elective (Theory)	
4	Pre-requisite (if, any)	As per Program	
5	Course Learning Outcomes (CLO)	<i>On successful completion of the course, the student shall be able to:</i> <ul style="list-style-type: none"> ➤ Explain the basic components of food stuff and balance diet. ➤ Analyze the food vitamins and minerals with nutritional disorder. ➤ Analyze the effect of toxic substances on environment. ➤ Interpret the effect of toxic chemicals on body parts and their cure. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	Composition of balanced vegetarian and non-vegetarian diets; recommended dietary allowance (RDA) for different categories of the human beings. Food preservation standards, food adulterations and precautions, government regulations on preservation and quality of food. Food processing and loss of nutrients during processing and cooking. Basal metabolism and methods of measuring basal metabolic rate (BMR); energy requirements during growth, pregnancy, lactation and various physical activities.		12
II	Nutritional aspects of Food: carbohydrates, lipids and protein: nutritive value, requirements, and functions. Nutritional aspects of the vitamins and minerals: requirement and functions Malnutrition, its implications, relationship with dietary habits and prevention. Disorders related to the nutrition: Protein energy malnutrition, Starvation, Obesity.		11
III	Environmental Pollution: Types, Outdoor and indoor Air pollution, sources, structure and control strategies. Water and Soil Pollution. Eco-toxicology and its environmental significance. Xenobiotic metabolism, Phase I reaction – oxidation – reduction, hydrolysis and hydration. Phase II reaction – conjugation and methylation.		11
IV	Pesticide toxicity – insecticides, fungicides, herbicides and biopesticides. Toxicology of food additives. Metal toxicity – arsenic, mercury, lead and cadmium. Toxicity testing – Test control, genetic toxicity testing. Occupational toxicology: Occupational hazards and their assessment.		11
Keywords	Food, BMR, Nutrition, Pollution, toxicity		

Name and Signature of Convener & Members of CBoS:



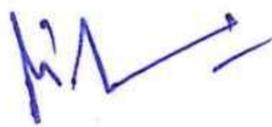

PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
<ul style="list-style-type: none"> ➤ LG Corkerhem and BSS Shane Basic Environmental Toxicology ➤ T Shibamoto & L F Bzeidan Introduction to Food Technology ➤ M. Stipanuk Biochemical, Phys. & Mol. Aspects of Human Nutrition ➤ Tom Brody Nutritional Biochemistry ➤ DA Bender Nutritional Biochemistry of the Vitamins 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		100 Marks
Continuous Internal Assessment (CIA):		30 Marks
End Semester Exam (ESE):		70 Marks
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20 Assignment / Seminar - 10 Total Marks - 30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40 Marks	




Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Honors/ Honors with Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	BCSE - 08 P	
2	Course Title	Nutritional and Environmental Biochemistry	
3	Course Type	Discipline Specific Elective (Practical)	
4	Pre-requisite (if, any)	As per Program	
5	Course Learning Outcomes (CLO)	<i>On successful completion of the course, the student shall be able to:</i> <ul style="list-style-type: none"> ➤ Analyse the contents of mineral and vitamin in food samples. ➤ Analyse the chemical and microbial contents in various effluents. ➤ Demonstrate TLC for different food components. ➤ Analyse the adulterants present in food samples. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> ➤ Separation and purification of sub-cellular organelles and assay of marker enzymes. ➤ Protein fractionation - salt, solvent and isoelectric precipitation. ➤ Identification and assay of certain toxicants. ➤ Effect of various toxicants on serum enzymes and proteins ➤ Effect of various toxicants on liver and kidney metabolism ➤ Estimation of carbohydrate, protein and fat in food materials. ➤ Titrimetric method of ascorbic acid estimation in fruit. ➤ Separation of casein protein from milk 		30
Keywords	Toxins, metabolism, Separation		




Name and Signature of Convener & Members of CBoS:

PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
<ul style="list-style-type: none"> ➤ DA Bender Nutritional Biochemistry of the Vitamins ➤ R.L. Pike and M.L. Brown Nutrition: An integrated approach - ➤ G.P. Talwar Text book of Biochemistry and Human Biology ➤ DWS Wong Mechanism and theory in food chemistry ➤ M.S. Banji N P. Rao & V. Reddy Text book of Human Nutrition ➤ Linten Nutritional Biochemistry and Metabolism 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		50 Marks
Continuous Internal Assessment (CIA):		15 Marks
End Semester Exam (ESE):		35 Marks
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment Performed the Task based on lab. work - 20 Marks Spotting based on tools & technology (written) – 10 Marks Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBoS:




FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

Department of Biochemistry

Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Honors/Honors with Research)</i>		Semester - VIII	Session: 2024-2025
1	Course Code	BCSC-08 T	
2	Course Title	Nutraceutical Biochemistry and Functional Foods	
3	Course Type	Discipline Specific Course (Theory)	
4	Pre-requisite (if, any)	As per the Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Understand the Nutraceuticals in the context of the human well-being. ➤ Demonstrate necessary to understand the diet-health relationships and the importance of human evidence-based nutrition. ➤ Apply regulatory aspects of functional foods and the requirements for safety and efficacy assessment of nutraceutical and functional food. ➤ Apply the use of perspectives for improving the formulation of potential functional ingredients/foods. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	Introduction to Nutraceuticals as Science: Historical perspective, classification, scope and future prospects. Scrutinising the term 'nutraceutical', Regulation of various countries. Medicinal Plants: Ethnomedicine in India, Applied aspects of the Nutraceutical Science. Sources of Nutraceuticals. Relation of Nutraceutical Science with other Sciences: Medicine, Human physiology, genetics, food technology, chemistry and nutrition		12
II	Properties, structure and functions of various Nutraceuticals: Glucosamine, Octacosanol, Lycopene, Flavonoids, Carnitine, Melatonin and Ornithine alpha, ketoglutarate. Use of proanthocyanidins, grape products, flaxseed oil as Nutraceuticals. Nutraceutical Industry and Market Information, New technologies in development of Nutraceuticals and functional foods Functional Foods, Scope of Genetic engineering, Nutritional Genomics		11
III	Food as remedies: Nutraceuticals bridging the gap between food and drug, Special Dietary Needs, Disease and Nutrition; Nutraceuticals in treatment for cognitive decline, Nutraceutical remedies for common disorders like Arthritis, Bronchitis, circulatory problems, hypoglycemia, Nephrological disorders, Liver disorders, Osteoporosis, Psoriasis and Ulcers etc. Brief idea about some Nutraceutical rich supplements e.g. Bee pollen, Caffeine, Green tea, Lecithin, Mushroom extract, Chlorophyll, Kelp and Spirulina etc.		11
IV	Anti-nutritional Factors present in Foods: Types of inhibitors present in various foods and how they can be inactivated. General idea about role of Probiotics and Prebiotics as nutraceuticals. Recent advances in techniques & feeding of substrates. Assessment of nutritional status and Recommended Daily allowances.		11
Keywords	Plant product, Active compounds, food, remedy		

Name and Signature of Convener & Members of CBoS:

PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
<ul style="list-style-type: none"> ➤ Stryer E.A., Biochemistry ➤ Zubay, Geoffrey L. Biochemistry, ➤ Greenberg David M. Metabolic Pathways, Vol 3 Todd and others, Clinical Diagnosis and Management, 17th Ed, ➤ Gopalan C., et al Dietary Allowances for Indians, NIH, Hyderabad. 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		100 Marks
Continuous Internal Assessment (CIA):		30 Marks
End Semester Exam (ESE):		70 Marks
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20 Assignment / Seminar - 10 Total Marks - 30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40 Marks	

Name and Signature of Convener & Members of CBoS:




FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Honors/ Honors with Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	BCSC-08 P	
2	Course Title	Nutraceutical Biochemistry and Functional Foods	
3	Course Type	Discipline Specific Course (Practical)	
4	Pre-requisite (if, any)	As per the Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Student will be skilled with basic Research on bioactive compounds. ➤ Understand the concept of functional foods and their role in the human health and well-being. ➤ Apply the diet and dietary components in the modulation of risk factors associated with chronic diseases (e. g cardiovascular diseases) and human health; 	
6	Credit Value	1 Credits	<i>Credit = 30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> ➤ Extraction, purification and evaluation of activity of any one digestive enzyme (e.g. Beta amylase from sweet potato) ➤ Estimation of ascorbic acid from lemon & amla juice by titration method ➤ Reactions of mono, di and polysaccharides and their identification in unknown mixtures ➤ Determination of Acid value, Saponification and Iodine number of natural fats & oils. ➤ Estimation of proteins with Bradford's and other methods. ➤ Extraction and estimation of total sugars from food products (dairy product, fruit juices, bread). ➤ Identification using characteristic features of nutraceutically important plants like; Phyllanthusemblica, Curcuma longa, Zinziberofficinalis, Solanaceae (Withaniasomnifera), Aloe vera, Lilliaceae (Aliumsativum), Lamiaceae (Ocimum sanctum), Apiaceae (Coriandrumsp) and Liliaceae (Asparagus sps.), Centellaasiatica. 		30
Keywords	Beta amylase, Acid value, ascorbic acid, Bioactive Compound		

Name and Signature of Convener & Members of CBoS:

PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
<ul style="list-style-type: none"> ➤ Kuby's Immunology R.A. Goldsby, T. J Kindt and B. A. Osborne ➤ Immunology- A short Course E. Benjamini, R. Coico and G. Sunshine ➤ Immunology Roitt, Brostoff and Male 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		50 Marks
Continuous Internal Assessment (CIA):		15 Marks
End Semester Exam (ESE):		35 Marks
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on lab. work - 20 Marks B. Spotting based on tools & technology (written) – 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBoS:




FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Honors / Honors with Research)</i>		Semester - VIII	Session: 2024-2025
1	Course Code	BCSE - 09 T	
2	Course Title	Bioinformatics	
3	Course Type	Discipline Specific Elective (Theory)	
4	Pre-requisite (if, any)	As per the Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Understand various databases and GenBank used in storing biological data. ➤ Analyze the basic concepts of sequence similarity by BLAST and FASTA algorithms. ➤ Explain the phylogenetic analysis and various genome projects. ➤ Apply the techniques for the protein structure prediction.chem.-informatics and medicinal biochemistry. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	Introduction to bioinformatics and data generation: Bioinformatics and its relation with molecular biology Examples of related tools (FASTA, BLAST, BLAT, RASMOL), databases (GENBANK, Pub med, PDB) and software (RASMOL, Ligand Explorer). Data generation; Generation of large scale molecular biology data. (Through Genome sequencing, Protein sequencing, Gel electrophoresis, NMR Spectroscopy, X-Ray Diffraction, and microarray). Applications of Bioinformatics.		12
II	Biological Database and its Types: Introduction to data types and Source. Population and sample. Classification and Presentation of Data. Quality of data, private and public data sources. General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL). Protein databases (Primary, Composite, and Secondary). Specialized Genome databases: (SGD, TIGR, and ACeDB). Structure databases (CATH, SCOP, and PDB sum)		11
III	Data storage and retrieval and Interoperability: Flat files, relational, object oriented databases and controlled vocabularies. File Format (Genbank, DDBJ, FASTA, PDB, SwissProt). Introduction to Metadata and search; Indices, Boolean, Fuzzy, Neighboring search. Data exchange and integration. Ontologies, interchange languages and standardization efforts. General Introduction to XML, UMLS, CORBA, PYTHON and OMG/LIFESCIENCE.		11
IV	Gene Expression and Representation of patterns and relationship General introduction to Gene expression in prokaryotes and eukaryotes, transcription factors binding sites. SNP, EST, STS. Regular Expression, Hierarchies, and Graphical models (including Marcov chain and Bayes notes). Genetic variability and connections to clinical data.		11
Keywords	FASTA, BLAST, BLAT, RASMOL, NCBI, DDBJ, SNP, EST, STS		

Name and Signature of Convener & Members of CBoS:

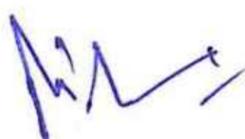
PART-C: Learning Resources**Text Books, Reference Books and Others****Text Books Recommended –**

- BAXEVANIS, AD & OUELLETTE, BFF : Bioinformatics: a practical guide to the analysis of genes and proteins. 2nd Ed.. 2002.
- BAXEVANIS, AD, DAVISON, DB, PAGE: Current protocols in bioinformatics. 2004.
- RDM & PETSKO, GA ORENGO, C, JONES, D & : Bioinformatics: genes, proteins and computers. 2003
- THORNTON, J Ingvar Eidhammer, IngeJonassen, : Protein Bioinformatics. 2003
- William R Taylor HIGGINS, D & TAYLOR, W : Bioinformatics: sequence, structure, and databank. 2000.
 - David Mount: Bioinformatics: sequence and genome analysis. 2004

PART -D: Assessment and Evaluation**Suggested Continuous Evaluation Methods:****Maximum Marks: 100 Marks****Continuous Internal Assessment (CIA): 30 Marks****End Semester Exam (ESE): 70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10	
Total Marks - 30		
End Semester Exam (ESE):	Two section – A & B	
	Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks	
	Section B: Descriptive answer type qts., 1 out of 2 from each unit- 4x10=40 Marks	

Name and Signature of Convener & Members of CBoS:




FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Honors/ Honors with Research)</i>		Semester - VIII	Session: 2024-2025
1	Course Code	BCSE - 09 P	
2	Course Title	Bioinformatics	
3	Course Type	Discipline Specific Elective (Practical)	
4	Pre-requisite (if, any)	As per Program	
5	Course Learning Outcomes (CLO)	<i>On successful completion of the course, the student shall be able to:</i> <ul style="list-style-type: none"> ➤ Demonstrate the use of databases. ➤ Demonstrate the gene and protein sequence retrieval techniques. ➤ Produce novel DNA and protein structures to be used in therapeutics. ➤ Perform phylogenetic studies to establish the relationship between two genomes. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> ➤ Retrieval of sequences from NCBI, EBI and EMBL databases. ➤ Retrieval of sequences from NBRF-PIR, SWISSPROT and P databases. ➤ Transition and Translation of sequences. ➤ Retrieval of genome from genome databases. ➤ Exploring DIP and PPI. ➤ Exploring BIND and PIM. ➤ Exploring MINT and GRID. ➤ Analysis of phylogenetic tree ➤ Exploring PDB file. ➤ Analysis of active site by pymol 		30
Keywords	DIP, MINT and GRID, PDB file		

Name and Signature of Convener & Members of CBoS:

PART-C: Learning Resources		
Text Books, Reference Books and Others		
Text Books Recommended –		
<ul style="list-style-type: none"> ➤ DA Bender Nutritional Biochemistry of the Vitamins ➤ R.L. Pike and M.L. Brown Nutrition: An integrated approach - ➤ G.P. Talwar Text book of Biochemistry and Human Biology ➤ DWS Wong Mechanism and theory in food chemistry ➤ M.S. Banji N P. Rao & V. Reddy Text book of Human Nutrition ➤ Linten Nutritional Biochemistry and Metabolism 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		50 Marks
Continuous Internal Assessment (CIA):		15 Marks
End Semester Exam (ESE):		35 Marks
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on lab. work - 20 Marks B. Spotting based on tools & technology (written) – 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

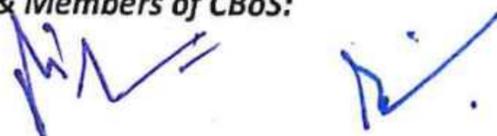
Name and Signature of Convener & Members of CBoS:




FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

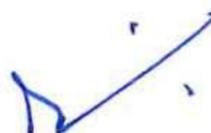
PART- A: Introduction			
Program: Bachelor in Science <i>(Honors / Honors with Research)</i>		Semester - VIII	Session: 2024-2025
1	Course Code	BCSE - 10 T	
2	Course Title	Industrial Biochemistry	
3	Course Type	Discipline Specific Elective (Theory)	
4	Pre-requisite (if, any)	As per the Program	
5	Course Learning Outcomes (CLO)	<i>On successful completion of the course, the student shall be able to:</i> <ul style="list-style-type: none"> ➤ Understand Industrial production of Bio substance ➤ Analyze the basic concepts of industrial operations of bioreactors. ➤ Demonstrate the Various control points of industrial operations. ➤ Apply control mechanism of bioreactor in an industry. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	Bioreactors and its Operations: Bioreactor design. Concept of bioreactor. Type of bioreactors. Working scales. Elements of a bioreactor. Requirements of industrial bioreactors. Auxiliary facilities. Operation of a bioreactor. Aseptic operations. Aseptic inoculation and sampling. Seals and valves. Measurement and control of fermentation conditions: temperature, pH, dissolved oxygen concentration (DO), foaming, consumption and formation of gases and products.		12
II	Sterilization, Aeration and Agitation in Bioreactor: Sterilization of the bioreactor and culture media. General considerations. Sterilization of the culture medium. Methods of sterilization. Heat sterilization. Theory of heat sterilization. Calculation of the duration of media sterilization. Continuous sterilization. Sterilization by filtration. Air sterilization. Aeration of the bioreactor. General considerations. Transfer of gas-liquid matter. Specific rate of oxygen uptake. Critical oxygen concentration (C). Stirring of the bioreactor. Geometry and types of agitators. Required power for stirring: power number and Reynolds number.		11
III	Down Stream Processing- Separation of cells and other insoluble from fermented broth. Filtration and microfiltration, centrifugation (batch, continuous, basket). Cell disruption: Physical methods (osmotic shock, grinding with abrasives, solid shear, liquid shear), Chemical methods (alkali, detergents), Enzymatic methods Products isolation: Extraction and adsorption method, precipitation (ammonium sulphate. Organic solvents, high molecular weight polymers), column chromatography; ultra filtration, Products polishing: Crystallization and drying.		11
IV	Bioreactor Products: Production of enzymes on an industrial scale. Production of ethanol, acetone-butanol. Production of antibiotics. Production of food and fermented beverages. Authorized microorganisms (GRAS). Biochemistry of the production of alcoholic beverages. Biochemistry of the production of lactic and meat products. Biochemistry of bread fermentation. Biochemistry of food additives. Quality assurance.		11
Keywords	Cell product, production, harvesting, bioreactor		

Name and Signature of Convener & Members of CBoS:



PART-C: Learning Resources								
Text Books, Reference Books and Others								
<i>Text Books Recommended –</i>								
<ul style="list-style-type: none"> ➤ Patel AH. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited. ➤ Jackson AT., Bioprocess Engineering in Biotechnology, Prentice Hall, Engelwood Cliffs, 1991. ➤ Shuler ML and Kargi F., Bioprocess Engineering: Basic concepts, 2nd Edition, Prentice Hall, Engelwood Cliffs, 2002. ➤ Stanbury RF and Whitaker A., Principles of Fermentation Technology, Pergamon press, Oxford, 1997. ➤ Baily JE and Ollis DF., Biochemical Engineering fundamentals, 2nd Edition, McGraw-Hill Book Co., New York, 1986. 								
PART -D: Assessment and Evaluation								
Suggested Continuous Evaluation Methods:								
Maximum Marks:		100 Marks						
Continuous Internal Assessment (CIA):		30 Marks						
End Semester Exam (ESE):		70 Marks						
Continuous Internal Assessment (CIA): (By Course Teacher)	<table border="1"> <tr> <td>Internal Test / Quiz-(2):</td> <td>20 +20</td> </tr> <tr> <td>Assignment / Seminar -</td> <td>10</td> </tr> <tr> <td>Total Marks -</td> <td>30</td> </tr> </table>	Internal Test / Quiz-(2):	20 +20	Assignment / Seminar -	10	Total Marks -	30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
Internal Test / Quiz-(2):	20 +20							
Assignment / Seminar -	10							
Total Marks -	30							
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40 Marks							

Name and Signature of Convener & Members of CBoS:

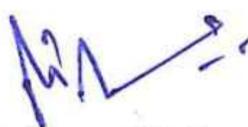
FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Honors/ Honors with Research)</i>		Semester - VIII	Session: 2024-2025
1	Course Code	BCSE - 10 P	
2	Course Title	Industrial Biochemistry	
3	Course Type	Discipline Specific Elective (Practical)	
4	Pre-requisite (if, any)	As per Program	
5	Course Learning Outcomes (CLO)	<i>On successful completion of the course, the student shall be able to:</i> <ul style="list-style-type: none"> ➤ Demonstrate production of bioactive compounds in an industry. ➤ Demonstrate the key features of Bioreactors. ➤ Produce novel mechanism for production. ➤ Apply knowledge of bioreactors in industry. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> ➤ To prepare broth media for microbial growth. ➤ To culture the microbial organisms in a shake flask using orbital shaker incubator. ➤ To estimate the Microbial biomass produced through shake flask culturing. ➤ To plot Microbial growth curve for shake flask culturing using turbidity method. ➤ To get familiarized with the lab scale fermenter (bench top fermenter) ➤ Heat balance across a batch sterilization process. ➤ Production of Ethanol in lab. ➤ Production of organic acid in lab. 		30
Keywords	Fermentation, Sterilization, Media, Broth		

Name and Signature of Convener & Members of CBoS:

PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
<ul style="list-style-type: none"> ➤ Stanbury RF and Whitaker A., Principles of Fermentation Technology, Pergamon press, Oxford, 1997. ➤ Baily JE and Ollis DF., Biochemical Engineering fundamentals, 2nd Edition, McGraw-Hill Book Co., New York, 1986. ➤ Aiba S, Humphrey AE and Millis NF, Biochemical Engineering, 2nd Edition, University of Tokyo press, Tokyo, 1973. ➤ Comprehensive Biotechnology: The Principles, Applications and Regulations of Biotechnology in Industry, Agriculture and Medicine, Vol 1, 2, 3 and 4. Young M.M., Reed Elsevier India Private Ltd, India, 2004. ➤ Mansi EMTEL, Bryle CFA. Fermentation Microbiology and Biotechnology, 2nd Edition, Taylor & Francis Ltd, UK, 2007. 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		50 Marks
Continuous Internal Assessment (CIA):		15 Marks
End Semester Exam (ESE):		35 Marks
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on lab. work - 20 Marks B. Spotting based on tools & technology (written) – 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBoS:




FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Honors / Honors with Research)</i>		Semester - VIII	Session: 2024-2025
1	Course Code	BCSE - 11 T	
2	Course Title	Entrepreneurship Development	
3	Course Type	Discipline Specific Elective (Theory)	
4	Pre-requisite (if, any)	As per Program	
5	Course Learning Outcomes (CLO)	<i>On successful completion of the course, the student shall be able to:</i> <ul style="list-style-type: none"> ➤ Generate, evaluate and shape ideas. ➤ Identify the resources needed to establish and sustain a successful venture. ➤ Demonstrate an understanding of how basic science can be commercialized. ➤ Assess the commercial potential of a business opportunity. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	Introduction: Meaning, needs and importance of Entrepreneurship, Promotion of Entrepreneurship, Factors influencing entrepreneurship, Features of a successful Entrepreneurship		10
II	Establishing an Enterprises- Forms of business, organisation, project identification, selection of the product, project formulation, assessment of project feasibility		10
III	Financing the Enterprise: importance of Finance loans and repayments characteristics of Business Finance fixed Capital Management source of fixed capital working capital its source and how to move for loans inventory direct and indirect raw materials and its management.		11
IV	Marketing Management Meaning and importance marketing, mix product management, product line, product mix, stages of product, like cycle marketing research and importance of service physical distribution and stock management. Entrepreneurship and International Business- Meaning of international business selection of a product selection of a market for international business expert financing institutional support for exports.		14
Keywords	Finance, Marketing		

Name and Signature of Convener & Members of CBoS:

PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
<ul style="list-style-type: none"> ➤ Shreefal S. Mehta (2008) Commercializing Successful Biomedical Technologies: Basic Principles for the Development of Drugs, Diagnostics and Devices. Cambridge University Press ➤ Yali Friedman (2004) Building Biotechnology: Starting, Managing, And Understanding Biotechnology Companies. 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		100 Marks
Continuous Internal Assessment (CIA):		30 Marks
End Semester Exam (ESE):		70 Marks
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20 Assignment / Seminar - 10 Total Marks - 30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40 Marks	

Name and Signature of Convener & Members of CBoS:




FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Honors/ Honors with Research)</i>		Semester - VIII	Session: 2024-2025
1	Course Code	BCSE - 11 P	
2	Course Title	Entrepreneurship Development	
3	Course Type	Discipline Specific Elective (Practical)	
4	Pre-requisite (if, any)	As per Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Critically evaluate information in order to improve decision making, formulate objectives, determine strategies and plan actions. ➤ Assess the commercial potential of a business opportunity. ➤ Evaluate the issues that can impact on the successful commercialisation of a business idea. ➤ Develop and utilise creative problem-solving skills. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ol style="list-style-type: none"> 1. Students will be allotted with a topic on a potential commercial application. Students have to go research the scientific background behind the given topic. Once the service/product is decided, one or two students will undertake the product development section which requires very applied and technical research. 2. Business/regulatory: All students will carry out a preliminary feasibility study for their commercial application. Once a concept is chosen, students will need to establish the regulatory paths, business model, value proposition, competition, market, operations 3. Students will present the bioscience behind their business idea to their supervisor and receive feedback on their draft poster. 		30
Keywords	Market, Business, product development		

Name and Signature of Convener & Members of CBoS:




PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
<ul style="list-style-type: none"> ➤ Shreefal S. Mehta (2008) Commercializing Successful Biomedical Technologies: Basic Principles for the Development of Drugs, Diagnostics and Devices. Cambridge University Press ➤ Yali Friedman (2004) Building Biotechnology: Starting, Managing, And Understanding Biotechnology Companies. 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:	50 Marks	
Continuous Internal Assessment (CIA):	15 Marks	
End Semester Exam (ESE):	35 Marks	
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on lab. work - 20 Marks B. Spotting based on tools & technology (written) – 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBoS:



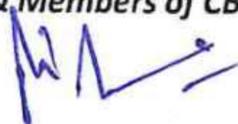

-FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

Department of Biochemistry

Course Curriculum

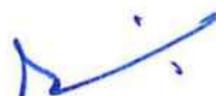
PART- A: Introduction			
Program: Bachelor in Science <i>(Honors / Honors with Research)</i>		Semester - VIII	Session: 2024-2025
1	Course Code	BCSE - 12 T	
2	Course Title	Research Methodology	
3	Course Type	Discipline Specific Elective (Theory)	
4	Pre-requisite (if, any)	As per the Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Understand, analyse the problem. ➤ Apply Scientific process know the cause of the problem. ➤ Apply different mathematical tools to correlate factors responsible for the problem. ➤ Apply knowledge of bioethics in research. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	<p>Foundations of Research: Definition, purpose - Relevance and scope, Motivation and objectives – Research methods vs Methodology. Types of research- pure versus applied, incremental versus innovative; multidisciplinary research.</p> <p>Research Process and Design: Steps involved in research process; Identifying and defining research problems; Importance of literature review in defining a problem, Formulation of research objectives; Hypothesis, Research design- Meaning and need- induction - deduction. Features of good design- important concepts and different types; basic principles of experimental design.</p>		12
II	<p>Data Collection and Analysis : Observation and Collection of data - Methods of data collection – Sampling Methods- Data Processing and Analysis strategies – Measures of central tendency, standard deviation and standard error, ANOVA, Correlation, T test, Data Analysis with Statistical Packages, Generalisation and interpretation of results.</p>		11
III	<p>Scientific Reporting: Types of scientific reports – journal articles – Presentation at conferences- Thesis and dissertations – Books. Structure and components of scientific reports – Layout, Illustrations and tables - Bibliography, referencing and footnotes - Oral presentation – Planning – Preparation – Practice – Making presentation – Use of visual aids - Importance of effective communication. Publication of scientific reports, Impact factor of Journals, h-index, i10-Index, g-index.</p>		10
IV	<p>Application of Results and Research Ethics: Commercialization – Copyright and Copy left – royalty - Intellectual property rights and patent law – Ethical issues - Ethics in human and animal experimentation. Guidelines for using animals in biological research- The Prevention of Cruelty to Animals Act, India. Scientific misconduct such as Fabrication, Falsification, Plagiarism and Self-Plagiarism; software for checking plagiarism. Conflicts of interests; Citation and acknowledgement - Reproducibility and accountability.</p>		12
Keywords	Research, hypothesis, Data analysis, impact factor, bioethics.		

Name and Signature of Convener & Members of CBoS:




PART-C: Learning Resources								
Text Books, Reference Books and Others								
Text Books Recommended –								
<ul style="list-style-type: none"> ➤ Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research methodology, RBSA Publishers. ➤ Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p. ➤ Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p ➤ Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, EssEss Publications. 2 volumes. ➤ Wadehra, B.L. 2000. Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing. 								
PART -D: Assessment and Evaluation								
Suggested Continuous Evaluation Methods:								
Maximum Marks:		100 Marks						
Continuous Internal Assessment (CIA):		30 Marks						
End Semester Exam (ESE):		70 Marks						
Continuous Internal Assessment (CIA): (By Course Teacher)	<table border="1"> <tr> <td>Internal Test / Quiz-(2):</td> <td>20 +20</td> </tr> <tr> <td>Assignment / Seminar -</td> <td>10</td> </tr> <tr> <td>Total Marks -</td> <td>30</td> </tr> </table>	Internal Test / Quiz-(2):	20 +20	Assignment / Seminar -	10	Total Marks -	30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
Internal Test / Quiz-(2):	20 +20							
Assignment / Seminar -	10							
Total Marks -	30							
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit-4x10=40 Marks							

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

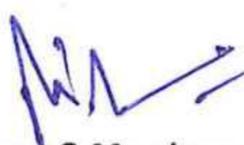
PART- A: Introduction			
Program: Bachelor in Science <i>(Honors/ Honors with Research)</i>		Semester - VIII	Session: 2024-2025
1	Course Code	BCSE - 12 P	
2	Course Title	Research Methodology	
3	Course Type	Discipline Specific Elective (Practical)	
4	Pre-requisite (if, any)	As per Program	
5	Course Learning Outcomes (CLO)	<i>On successful completion of the course, the student shall be able to:</i> <ul style="list-style-type: none"> ➤ Understand, analyse the problem. ➤ Apply Scientific process to know the cause of the problem. ➤ Apply different mathematical tools to correlate factors responsible for the problem. ➤ Apply methods to represent results in scientific way. ➤ Apply knowledge of bioethics in research. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> ➤ To prepare a word document of the Ph.D. synopsis with proper formatting. ➤ To prepare a word document of 20 references related to your Research work in a standard format. ➤ To write a short note on the importance of e-journals in research work using internet. ➤ Exercises for data distribution. ➤ Exercises for computation of measures of central tendency. ➤ Exercises for computation of measures of variability. ➤ Data analysis by ANOVA and multiple-range tests. ➤ Hypothesis testing by t-test, F-test, and Chi-square test. ➤ Graphical presentation of data using a suitable package. ➤ Statistical analysis of a data using a suitable package. ➤ Preparation of document using a suitable package. 		30
Keywords	Research, hypothesis, Data analysis, impact factor, bioethics.		

Name and Signature of Convener & Members of CBoS:




PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
<ul style="list-style-type: none"> ➤ Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p ➤ Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, EssEss Publications. 2 volumes. ➤ Wadehra, B.L. 2000. Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing. 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		50 Marks
Continuous Internal Assessment (CIA):		15 Marks
End Semester Exam (ESE):		35 Marks
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment D. Performed the Task based on lab. work - 20 Marks E. Spotting based on tools & technology (written) – 10 Marks F. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBoS:



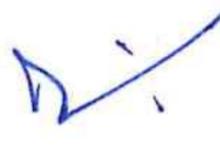

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

Department of Biochemistry

Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Certificate / Diploma / Degree/ Honors)</i>		Semester - II / IV / V/ VI	Session: 2024-2025
1	Course Code	BCSEC- 01	
2	Course Title	Biostatistics	
3	Course Type	Skill Enhancement Course	
4	Pre-requisite (if, any)	As Per the Course.	
5	Course Learning Outcomes (CLO)	<p style="text-align: center;"><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Understand the principles of collection of data in biological experiments, proper statistical analysis of the data and its presentation. ➤ Understand the importance of sample size and various variables that affect data. ➤ Know the importance of mean, standard error, standard deviation, significance in presenting the data. ➤ Knowing statistical methods will help students in improving their analytical and interpretation skill. 	
6	Credit Value	2 Credits (1C + 1C)	<i>Credit = 15 Hours – Theoretical learning and = 30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of Teaching–learning Periods: Theory – 15 Periods (15 Hrs) and Lab. or Field learning/Training 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Theory Contents	<p>Data Collection and Presentation: Biological data management using statistical tools. Concepts of population and sample, advantages of sampling, Basic concepts in sampling and designing experiments, Modes of presenting data: Frequency distributions, Relative frequency</p> <p>Analysis of variance: Mean, median, mode; Co-efficient of variation and standard deviation.</p> <p>Probability: Laws of Probability.</p> <p>Hypothesis testing: General concepts – Null hypothesis, alternative hypothesis, Rejection of hypothesis; Type I and Type II errors; P value and sample size estimation. Chi Square Test – Observed and expected frequencies, Calculating p values, assumptions of a chi square goodness of fit; One-way ANOVA, student's t-test.</p>		15
Lab./Field Training Contents	<p>Estimation of population means and variance in simple random sampling.</p> <p>Collection of data - Random sampling method.</p> <p>Data representation - Frequency and relative frequency distribution table, Plotting of biological data in a representative graphical format.</p> <p>Data analysis - Calculating Mean, median, mode, variance, standard deviation and standard error for a given data set. S</p> <p>Standard t-test for grouped samples. Analysis of one way variance</p> <p>Chi square goodness of fit test.</p> <p>Learning to analyze data using SPSS/ Prism software</p>		30
Keywords	Sampling, Frequency and relative frequency, variance, standard deviation, Hypothesis testing.		

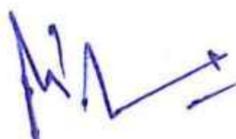
Name and Signature of Convener & Members of CBoS:

PART-C: Learning Resources
Text Books, Reference Books and Others
Text Books Recommended –
➤ Principles of Biostatistics, M. Pagano and K. Gauvreau (2000); Duxbury Thomas learnings.
➤ Analysis of Biological Data, M. Whitlock and D. Schluter (2009); Roberts and company publishers.

PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:	50 Marks	
Continuous Internal Assessment (CIA):	15 Marks	
End Semester Exam (ESE):	35 Marks	
Continuous Internal Assessment (CIA): (By Course Coordinator)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on learned skill - 20 Marks B. Spotting based on tools (written) - 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Coordinator as per skilling

Name and Signature of Convener & Members of CBoS:



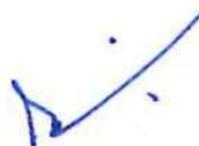

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Certificate / Diploma / Degree/Honors)</i>		Semester - I / III / V	Session: 2024-2025
1	Course Code	BCVAC- 01	
2	Course Title	Ethno Medicine in Chhattisgarh	
3	Course Type	Value added Course	
4	Pre-requisite (if, any)	As Per the Course	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Explain the basic components of Medicinal plant. ➤ Summarize the bioactive compound in herbs. ➤ Recognize the disorder and ethno medicine for it. ➤ Understand the effect of bioactive compound on the disease as well as interpret the effect of toxic chemicals on body parts and their cure. 	
6	Credit Value	2 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 30 Periods (30 Hours)			
Unit	Topics (Course contents)		No. of Period
I	Historical perspective, scope and future prospects. Scrutinizing the term 'Ethno medicine'. Common and crucial Medicinal Plants in Chhattisgarh: Ethno medicine in India.		07
II	Properties and functions of photochemical and their medicinal effects - Glucosamine, Octacosanol, Lycopene, Flavonoids, Carnitine, Melatonin and Ornithine alpha, ketoglutarate. Use of proanthocyanidins, grape products, flaxseed oil as Medicine.		08
III	Disease and Ethno medicine; Common Herbal/ House hold/ food used as Medicines in in treatment for cognitive decline. Herbal/ House hold/ food used as Medicines for common disorders like Arthritis, Bronchitis, circulatory problems, hypoglycemia, Nephrological disorders, Liver disorders, Osteoporosis, Psoriasis and Ulcers etc.		07
IV	Brief idea about Medicinal effect of some Nutraceutical rich supplements e.g. Bee pollen, Caffeine, Green tea, Lecithin, Mushroom extract, Chlorophyll, Kelp and Spirulina etc.		08
Keywords	Phytochemical, Nutraceuticals, Herbal Medicine, Disorders, Disease.		

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PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
<ul style="list-style-type: none"> ➤ 1. Gopalan C., et al Dietary Allowances for Indians, NIH, Hyderabad. ➤ 2. Anita F.P. Clinical Dietetics and Nutrition, 4th Ed, 1997, ➤ 3. Devlin, T.M. Text Book of Biochemistry with Clinical Correlation, ➤ 4. Mahan, L.K. & Ecott- Stump, S. [Ed.] Krause's Food, Nutrition and Diet Therapy . 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		50 Marks
Continuous Internal Assessment (CIA):		15 Marks
End Semester Exam (ESE):		35 Marks
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 05 x1= 05 Mark ; Q2. Short answer type- 5x2 =10 Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit- 4x05 =20 Marks	

Name and Signature of Convener & Members of CBoS:

Generic Elective Courses

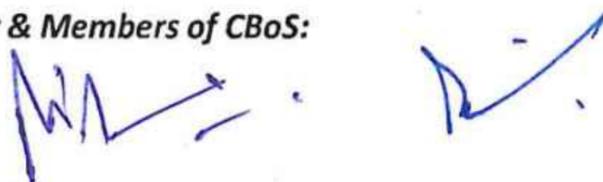
FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

Department of Biochemistry

Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science (Certificate / Diploma / Degree/Honors)		Semester - I	Session: 2024-2025
1	Course Code	BCGE - 01 T	
2	Course Title	Introductory Biochemistry and Biomolecules	
3	Course Type	Generic Elective (Theory)	
4	Pre-requisite (if, any)	As per program	
5	Course Learning Outcomes (CLO)	<p>After completion of the course, the students would be able:</p> <ul style="list-style-type: none"> ➤ Students will be exposed to the history of Biochemistry and key contributions of scientists. ➤ Understand the properties of carbohydrates, proteins, lipids, cholesterol, DNA, RNA and their importance in biological systems. ➤ Understand the methods of determination of amino acid and nucleotide sequence of proteins and DNA respectively. ➤ They will understand the methods of estimation of DNA & RNA 	
6	Credit Value	3 Credits	Credit = 15 Hours - learning & Observation
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	General understanding of Biochemical Molecular Logic of Life. Definition. Experiments and discoveries of Acharya Nagarjuna. Famous Indian and foreign Biochemists and their inventions/ Discoveries. Importance of Yog, Pranayam, food and healthy lifestyle for balance of biochemical (kaf, vat, pitta) of our body and role in maintaining good mental and physical health. Biochemical basis of Lifestyle disorders.		09
II	Structure and functions of Carbohydrates and lipids: Definition, classification, biological importance. Monosaccharides: Disaccharides: Establishment of structures of sucrose and lactose and maltose. Polysaccharides: Partial structure, occurrence and importance of starch, glycogen, inulin, cellulose, chitine. heparin, hyaluronic acid. Lipids: Classification and biological role. Fatty acids – Nomenclature of saturated and unsaturated fatty acids. Phosphoglycerides: function of lecithin, cephalins, phosphatidylinositol, plasmalogens, and cardiolipin, importance of sphingomyelin, gangliosides and cerebroside.		12
III	Structure and functions of Amino acids and Proteins: General Structure, classification of amino acids based on R Group. Amino acids D & L notation. Proteins: Peptides, Primary Structure of proteins, N- and C- terminal amino acids, Secondary Structure – α Helix. β -sheet, β -bend. Tertiary and quaternary structure, denaturation and renaturation of proteins.		12
IV	Structure and functions of Nucleic acids: Composition of DNA and RNA. Nucleosides and nucleotides. Chargaff's rule. Primary and secondary structure of DNA, Watson and Crick model of DNA. Melting of DNA (T_m).		12
Keywords	Biomolecules, Carbohydrate, Lipids, Fatty acids, Nucleotides, Nucleosides, Nucleic acids,		

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PART-C: Learning Resources**Text Books, Reference Books and Others****Text Books Recommended –**

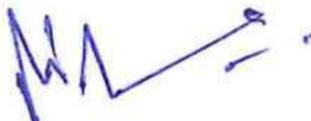
- Nelson, Cox and Lehninger Principles of Biochemistry, 7th Edition
- Medical Biochemistry By Styanarayan.

Online Resources–

- **e-Resources / e-books and e-learning portals**
- <https://www.britannica.com/>
- <https://en.wikibooks.org/wiki/Biochemistry>
- <https://www.pdfdrive.com/biomolecules-books.html>
- <https://byjus.com/biology/biomolecules/>
- <https://www.vedantu.com/biology/biomolecules>

PART -D: Assessment and Evaluation**Suggested Continuous Evaluation Methods:****Maximum Marks: 100 Marks****Continuous Internal Assessment (CIA): 30 Marks****End Semester Exam (ESE): 70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10	
Total Marks - 30		
End Semester Exam (ESE):	Two section – A & B	
	Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks	
	Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40 Marks	




Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Certificate / Diploma / Degree / Honors)</i>		Semester - I	Session: 2024-2025
1	Course Code	BCGE – 01 P	
2	Course Title	Biomolecules	
3	Course Type	Generic Elective (Practical)	
4	Pre-requisite (if, any)	As per the Course	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Describe the basic lab requirements and their uses. ➤ Explain various instruments using in separation and isolation of various analytical compounds. ➤ Analyze the characteristics of the compound on the basis of their pH. ➤ Understand to Prepare normal, molar and stock solution. ➤ To estimate Biomolecules in mixture. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> ➤ Safety measures in laboratories. ➤ Preparation of normal, molar and stock solution. ➤ Preparation of buffers. ➤ Qualitative tests for carbohydrates, lipids, amino acids, proteins and nucleic acids. ➤ Short write-ups on disease privations practices in Indian Knowledge system. 		30
Keywords	<i>Laboratory Safety, Estimation, Sugar, Fat, Proteins</i>		

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PART-C: Learning Resources**Text Books, Reference Books and Others****Text Books Recommended –**

- Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox,
- Experimental Biochemistry by Beedu Shashidhar Rao

Online Resources–

- **e-Resources / e-books and e-learning portals**
- <https://en.wikibooks.org/wiki/Biochemistry>
- <https://www.pdfdrive.com/biomolecules-books.html>
- <https://ncert.nic.in/textbook.php>

PART -D: Assessment and Evaluation**Suggested Continuous Evaluation Methods:****Maximum Marks: 50 Marks****Continuous Internal Assessment (CIA): 15 Marks****End Semester Exam (ESE): 35 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on lab. work - 20 Marks B. Spotting based on tools & technology (written) – 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBoS:




FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

Department of Biochemistry

Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Certificate / Diploma / Degree / Honors)</i>		Semester - II	Session: 2024-2025
1	Course Code	BCGE – 02 T	
2	Course Title	Bioanalytical Techniques	
3	Course Type	Generic Elective (Theory)	
4	Pre-requisite (if, any)	As per the Programm	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Understand basic concepts of Spectroscopy. ➤ Describe amino acids with application of chromatography. ➤ Understand basic concepts of centrifugation. ➤ Understand working principle, instrumentation and applications of various electrophoretic techniques. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	Spectroscopy - Concepts of spectroscopy, Laws of photometry. Beer-Lambert's law, Principles and applications of colorimetry. Visible and UV spectroscopy. Electrophoretic techniques – Principles of electrophoretic separation. Types of electrophoresis including paper and gel.		12
II	Chromatography – Principles and applications of paper, thin layer, ion exchange, affinity, gel permeation, adsorption and partition chromatography. HPLC and FPLC.		09
III	Centrifugation – Principle of centrifugation, concepts of RCF, different types of instruments and rotors, preparative, differential and density gradient centrifugation, analytical, ultra-centrifugation, determination of molecular weights and other applications.		12
IV	Microscopy – Bright field, Dark field, Phase contrast and Fluorescence microscopy Transmission and scanning microscopy, freeze fracture techniques, Immunological Techniques: Immuno diffusion, immune electrophoresis, radioimmunoassay, ELISA, Immuno fluorescence.		12
Keywords	Spectroscopy, Chromatography, Centrifugation, Electrophoresis, Microscope, ELISA.		

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PART-C: Learning Resources		
Text Books, Reference Books and Others		
Text Books Recommended –		
<ul style="list-style-type: none"> ➤ K Wilson and John Walker Practical Biochemistry: Principles & Techniques ➤ RF Boyer Biochemistry Laboratory: Modern Theory & Techniques ➤ Physical biochemistry by D Friefelder, WH Freeman & Co., USA. ➤ Biophysical Chemistry By Upahyaya & Nath 		
Online Resources–		
<ul style="list-style-type: none"> ➤ e-Resources / e-books and e-learning portals ➤ https://en.wikibooks.org/wiki/Biochemistry ➤ https://www.pdfdrive.com/biomolecules-books.html ➤ https://ncert.nic.in/textbook.php 		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		100 Marks
Continuous Internal Assessment (CIA):		30 Marks
End Semester Exam (ESE):		70 Marks
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20 Assignment / Seminar - 10 Total Marks - 30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit- 4x10=40 Marks	

Name and Signature of Convener & Members of CBoS:




FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

Department of Biochemistry

Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Certificate / Diploma / Degree/ Honors)</i>		Semester -II	Session: 2024-2025
1	Course Code	BCGE- 02P	
2	Course Title	Bioanalytical Techniques	
3	Course Type	Generic Elective (Practical)	
4	Pre-requisite (if, any)	As Per the Course	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Examine different components present in the extract of radish leaves by using chromatography technique. ➤ Analysis independently of various biomolecules in the laboratory. ➤ Demonstrate the effect of inorganic compound and its percent purities in various types of samples. ➤ Analyze characteristics of UV absorption spectra of by different methods in samples in different biomolecules. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> ➤ Verification of Beer-Lambert's law. ➤ Separation of sugars using paper chromatography. ➤ Separation of amino acids by paper chromatography ➤ Separation of plant pigments by Paper chromatography 		30
Keywords	Spectroscopy, Estimation, Quantitative, Separation, Techniques		

Name and Signature of Convener & Members of CBoS:




PART-C: Learning Resources**Text Books, Reference Books and Others****Text Books Recommended –**

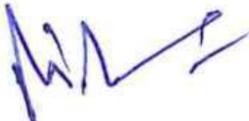
- K Wilson and John Walker Practical Biochemistry: Principles & Techniques
- RF Boyer Biochemistry Laboratory: Modern Theory & Techniques
- Physical biochemistry by D Friefelder, WH Freeman & Co., USA.
- Biophysical Chemistry By Upahyaya & Nath

Online Resources–

- **e-Resources / e-books and e-learning portals**
- <https://en.wikibooks.org/wiki/Biochemistry>
- <https://www.pdfdrive.com/biomolecules-books.html>
- <https://ncert.nic.in/textbook.php>

PART -D: Assessment and Evaluation**Suggested Continuous Evaluation Methods:****Maximum Marks: 50 Marks****Continuous Internal Assessment (CIA): 15 Marks****End Semester Exam (ESE): 35 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on lab. work - 20 Marks B. Spotting based on tools & technology (written) – 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status




Name and Signature of Convener & Members of CBoS: