VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY
JNANASAGARA CAMPUS, BALLARI-583105

Department of Studies in Biotechnology

III & IV Semester Syllabus

Bachelor of Science

With effect from 2021-22 and onwards

Chairman
BOS in Biotechonology (PG)
Department of PG. Studies and
Research in Biotechonology
Vijayanagara Sri Krishnadevaraya
University, BALLARI - 583105

Dr. Ashajyothi. C, M.Sc., Ph.D
Assistant Professor
Department of Biotechnology
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Department of Biotechnology

Semester-III

DSC: 21BSC3C3BTL: Biomolecules

Course Title: Biomolecules	**Course code: 21BSC3C3BTL**
Total Contact Hours: 56 Hrs.	**Course Credits: 04**
Internal Assessment Marks: 40	**Duration of SEE: 03 Hrs.**
Semester End Examination Marks: 60	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Acquire knowledge about types of biomolecules, structure, and their functions
2. Will be able to demonstrate the skills to perform bioanalytical techniques
3. Apply comprehensive innovations and skills of biomolecules to biotechnology field

DSC: 21BSC3C3BTL: Biomolecules

Unit	Description	Hours
1	**Carbohydrates:** Introduction, sources, classification of carbohydrates. Structure, function and properties of carbohydrates. Monosaccharides – Isomerism and ring structure, Sugar derivatives – amino sugars and ascorbic acid. Oligosaccharides – Sucrose and Fructose, Polysaccharides – Classification as homo and heteropolysaccharides, Homopolysaccharides - storage polysaccharides (starch and glycogen- structure, reaction, properties), structural polysaccharides (cellulose and chitin-structure, properties), Heteropolysaccharides- glycoproteins and proteoglycans (Brief study). Metabolism: Glycolysis and gluconeogenesis, Kreb's cycle, oxidative phosphorylation.	11
2	**Amino Acids, Peptides and Proteins:** Introduction, classification and structure of amino acids. Concept of – Zwitterion, isoelectric point, pK values. Essential and nonessential amino acids. Peptide bond and peptide, classification of proteins based on structure and function, Structural organization of proteins [primary, secondary (α,), tertiary and quaternary]. Fibrous and globular proteins, Denaturation and renaturation of proteins General aspects of amino acid, Metabolism: Transamination, deamination, decarboxylation and urea cycle.	11
3	**A. Lipids:** Classification and function of lipids, properties (saponification value, acid value, iodine number, rancidity), Hydrogenation of fats and oils Saturated and unsaturated fatty acids. General structure and biological functions of - phospholipids, sphingolipids, glycolipids, lipoproteins, prostaglandins, cholesterol, ergosterol. Metabolism: Beta oxidation of fatty acids. Biosynthesis of cholesterol.	11

	B. Enzymes: Introduction, nomenclature and classification, enzyme kinetics, factors influencing enzyme activity, metalloenzymes, activation energy and transition state, enzyme activity, specific activity. Coenzymes and their functions (one reaction involving FMN, FAD, NAD). Enzyme inhibition-Irreversible and reversible (competitive, non-competitive and uncompetitive inhibition with an example each) Zymogens (trypsinogen, chymotrypsinogen and pepsinogen), Isozymes (LDH, Creatine kinase, Alkaline phosphatase and their clinical significance).	
4	**A. Vitamins:** Water- and fat-soluble vitamins, dietary source and biological role of vitamins Deficiency manifestation of vitamin A, B, C, D, E and K **B. Nucleic acids:** Structures of purines and pyrimidines, nucleosides, nucleotides in DNA Denovo and salvage pathway of purine and pyrimidine synthesis. **C. Hormones:** Classification of hormones based on chemical nature and mechanism of action. Chemical structure and functions of the following hormones: Glucagon, Cortisone, Epinephrine, Testosterone and Estradiol.	**11**
5	**Bioanalytical tools:** **a) Chromatography:** Principle, procedure and applications of - paper chromatography, thin layer chromatography, adsorption chromatography, ion exchange chromatography, gel filtration chromatography, affinity chromatography, gas liquid chromatography and high performanceliquid chromatography. **b) Electrophoresis:** Principle, procedure and applications of electrophoresis (paper electrophoresis, gel electrophoresis -PAGE, SDS- PAGE &agarose electrophoresis) and isoelectric focusing. **c) Spectroscopy:** UV-Vis spectrophotometry; mass spectroscopy, atomic absorption spectroscopy.	**12**

References:

1. Principles of Biochemistry by A.L.Lehninger, 2 Ed. (worth), 2015
2. Lehninger Principles of Biochemistry by Nelson, D and Cox, D. Macmillon Pub, 2017
3. Biochemistry by L.Stryer 5 Ed. (Freeman-Toppan), 2015
4. Text Book of Biochemistry by West et. al., (Mac Millan), 2012
5. Principles of Biochemistry by Smith et. al., (Mc Graw Hill), 1983
6. Harper's Biochemistry (Langeman), 2018
7. Biochemistry by D.Voet and J.G.Voet (John weily).
8. Enzymes by Palmer (East), 2008
9. Biochemistry by U. Satyanarayana (Books & Allied (P) Ltd), 2008

Date Course Coordinator Subject Committee Chairperson

Department of Biotechnology

Semester-III

DSC: 21BSC3C3BTP: Biomolecules Lab

Course Title: Biomolecules Lab	**Course code: 21BSC3C3BTP**
Total Contact Hours:	**Course Credits: 02**
Internal Assessment Marks: 25	**Duration of SEE: 03 Hrs.**
Semester End Examination Marks: 25	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Analyze and identify the protein and carbohydrate concentrations by using qualitative and quantitative methods
2. Choose appropriate analytical techniques to study biomolecules at research labs and industries
3. To understand the strengths, limitations and creative use of techniques for problem solving

DSC: 21BSC3C3BTP: Biomolecules Lab

List of Experiments

1. Introduction to basic instruments (Principle, standard operating procedure) with demonstration.
2. Definitions and calculations: Molarity, Molality, Normality, Mass percent % (w/w), Percent by volume (% v/v), parts per million (ppm), parts per billion (ppb), Dilution of concentrated solutions. Standard solutions, stock solution, solution of acids. Reagent bottle label reading and precautions.
3. Preparation of standard buffers by Hendersen-Hasselbach equation – Acetate, phosphate, Tris and determination of pH of solution using pH meter.
4. Estimation of maltose by DNS method
5. Determination of α-amylase activity by DNS method
6. Estimation of proteins by Bradford method
7. Estimation of amino acid by Ninhydrin method
8. Extraction of protein from soaked/sprouted green gram by salting out method
9. Separation of plant pigments by circular paper chromatography
10. Separation of amino acids by thin layer chromatography
11. Native PAGE
12. Determination of iodine number of lipids

References:

1. An Introduction to Practical Biochemistry, 3rd Edition, (2001), David Plummer; Tata McGraw Hill Edu.Pvt.Ltd. New Delhi, India
2. Biochemical Methods,1st Edition, (1995), S.Sadashivam, A.Manickam; New Age International Publishers, India
3. Introductory Practical biochemistry, S. K. Sawhney&Randhir Singh (eds) Narosa Publishing. House, New Delhi, ISBN 81-7319-302-9
4. Experimental Biochemistry: A Student Companion, BeeduSasidharRao& Vijay Despande(ed).I.K International Pvt. LTD, NewDelhi. ISBN 81-88237-41-8
5. Standard Methods of Biochemical Analysis, S. K. Thimmaiah (ed), Kalyani Publishers, Ludhiana ISBN 81-7663-067

Date Course Coordinator Subject Committee Chairperson

Department of Biotechnology

Semester-III

OEC: 21BSC3O3BT1: Nutrition and Health

Course Title: Nutrition and Health	**Course code: 21BSC3O3BT1**
Total Contact Hours: 42 Hrs.	**Course Credits: 03**
Internal Assessment Marks: 40	**Duration of SEE: 03 Hrs.**
Semester End Examination Marks: 60	

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Study the concepts of food, nutrition, diet and health
2. To apply the best practices of food intake and dietary requirements
3. Acquire knowledge about various sources of nutrients and good cooking practices

OEC: 21BSC3O3BT1: Nutrition and Health

Unit	Description	Hours
1	**Introduction:** Concepts of nutrition and health. Definition of Food, Diet and nutrition, Food groups. Food pyramids. Functions of food. Balanced diet. Meal planning. Eat right concept. Functional foods, Prebiotics, Probiotics, and antioxidants	**08**
2	**Nutrients:** Macro and Micronutrients - Sources, functions and deficiency. Carbohydrates, Proteins, Fats – Sources and calories. Minerals –Calcium, Iron, Iodine.	**08**
3	**Vitamins:** Fat soluble vitamins –A, D, E & K. Water soluble vitamins – vitamin C Thiamine, Riboflavin, Niacin. Water–Functions and water balance. Fibre – Functions and sources. Recommended Dietary Allowance, Body Mass Index and Basal Metabolic Rate.	**08**
4	**Nutrition and Health:** Methods of cooking affecting nutritional value. Advantages and disadvantages. Boiling, steaming, pressure cooking. Oil/Fat – Shallow frying, deep frying. Baking. Nutrition through lifecycle. Nutritional requirement, dietary guidelines: Adulthood, Pregnancy, Lactation, Infancy-Complementary feeding, Pre-school, Adolescence, geriatric. Nutrition related metabolic disorders- diabetes and cardiovascular disease.	**09**
5	**Functional food:** Overview; definition, classification of functional food, functional food science, food technology and its impact on functional food development, key issues in Indian functional food industry and nutraceutical. Relation of functional foods and nutraceutical (FFN) to foods and drugs.	**09**

References

1. Sri Lakshmi B, (2007), Dietetics. New Age International publishers. New Delhi
2. Sri Lakshmi B, (2002), Nutrition Science. New Age International publishers. New Delhi.

3. Swaminathan M. (2002), Advanced text book on food and Nutrition. Volume I. Bappco
4. Gopalan.C., RamaSastry B.V., and S.C.Balasubramanian (2009), Nutritive value of Indian Foods.NIN.ICMR.Hyderabad.
5. Mudambi S R and Rajagopal M V, (2008), Fundamentals of Foods, Nutrition & diet therapy by New Age International Publishers, New Delhi

Date Course Coordinator Subject Committee Chairperson

Department of Biotechnology

Semester-IV

DSC: 21BSC4C4BTL: Molecular Biology

Course Title: Molecular Biology	**Course code: 21BSC4C4BTL**
Total Contact Hours: 56 Hrs	**Course Credits: 04**
Internal Assessment Marks: 40	**Duration of SEE: 03 Hrs**
Semester End Examination Marks: 60	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Study the advancements in molecular biology with latest trends.
2. Will acquire the knowledge of structure, functional relationship of proteins and nucleic acids.
3. Aware about the basic cellular processes such as transcription, translation, DNA replication and repair mechanisms.

DSC: 21BSC4C4BTL: Molecular Biology

Unit	Description	Hours
1	**Molecular basis of life and Nucleic Acids:** An introduction RNA and experimental proof of DNA as genetic material and types of DNA. Structure and functions of DNA and RNA, Watson and Crick model of DNA and other forms of DNA (A and Z) functions of DNA and RNA including ribozymes.	11
2	**DNA Replication:** Replication of DNA in prokaryotes and eukaryote– Enzymes and proteins involved in replication, Theta model, linear and rolling circle model. Polymerases and all enzyme components. The replication complex: Pre-primming proteins, primosome, replisome, unique aspects of eukaryotic chromosome replication, Fidelity of replication	11
3	**Damage and Repair:** DNA damage and Repair mechanism, photo reactivation, excision repair, mismatch repair and SOS repair.	10
4	**Transcription and RNA processing:** Central dogma, RNA structure and types of RNA, Transcription in prokaryotes RNA polymerase, role of sigma factor, promoter, Initiation, elongation and termination of RNA chains. Transcription in eukaryotes: Eukaryotic RNA polymerases, transcription factors, promoters, enhancers, mechanism of transcription initiation, promoter clearance and elongation RNA splicing and processing: processing of pre-mRNA: 5' cap formation, polyadenylation, splicing, rRNA and tRNA splicing.	12

5	**Regulation of gene expression and translation:** Genetic code and its characteristics, Wobble hypothesis**,** Translation- in prokaryotes and eukaryotes- ribosome, enzymes and factors involved in translation. Mechanism of translation- activation of amino acid, aminoacyl tRNA synthesis, Mechanism- initiation, elongation and termination of polypeptide chain. Fidelity of translation, Inhibitors of translation. Protein folding and modifications, Post translational modifications of proteins.	**12**

References:

1. Glick, B.R and Pasternak J.J (1998) Molecular biotechnology, Principles and application of recombinant DNA, Washington D.C. ASM press
2. Howe. C. (1995) Gene cloning and manipulation, Cambridge University Press, USA
3. Lewin, B., Gene VI New York, Oxford University Press
4. Rigby, P.W.J. (1987) Genetic Engineering Academic Press Inc. Florida, USA
5. Sambrook et al (2000) Molecular cloning Volumes I, II & III, Cold spring Harbor Laboratory Press New York, USA
6. Walker J. M. and Ging old, E.B. (1983) Molecular Biology & Biotechnology (Indian Edition) Royal Society of Chemistry U.K
7. Karp. G (2002) Cell & Molecular Biology, 3rdEdition, John Wiley & Sons; I

Date Course Coordinator Subject Committee Chairperson

Department of Biotechnology

Semester-IV

DSC: 21BSC4C4BTP: Molecular Biology Lab

Course Title: Molecular Biology Lab	**Course code: 21BSC4C4BTP**
Total Contact Hours:	**Course Credits: 02**
Internal Assessment Marks: 25	**Duration of SEE: 03 Hrs.**
Semester End Examination Marks: 25	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Apply skills in molecular biology that are generally useful in biological and medical research.
2. Demonstrate an understanding of some basic molecular genetic techniques
3. Demonstrate nucleic acid extraction, resolution, and detection.

DSC: 21BSC4C4BTP: Molecular Biology Lab

List of Experiments

1. Preparation of DNA model
2. Estimation of DNA by DPA method
3. Estimation of RNA by Orcinol method
4. Column chromatography – gel filtration (Demo)
5. Extraction and partial purification of protein from plant source by Ammonium sulphate precipitation.
6. Extraction and partial purification of protein from animal source by organic solvents.
7. Protein separation by SDS-Polyacrylamide Gel Electrophoresis (PAGE)
8. Charts on- Conjugation, Transformation and Transduction, DNA replication, Types of RNA

References:

1. Molecular Cloning, Laboratory Manual, Maniatis, E.F. Fritsch and J. Sambrook (Cold Spring Harber Laboratory, New York).
2. Techniques in Molecular Biology (1992), J. Walker and W. Castra (GeomHelns, London).
3. Practical Methods in Molecular Biology (1991), R.F. Schecleif and PC. Wensik (SpringerVerlag).
4. Sharma AK & A Sharma. 1980. Chromosome techniques: Theory & Practice. Batterworth.

Date Course Coordinator Subject Committee Chairperson

Department of Biotechnology

Semester-IV

OEC: 21BSC4O4BT1: Intellectual Property Rights

Course Title: Intellectual Property Rights	**Course code: 21BSC4O4BT1**
Total Contact Hours: 42 Hrs.	**Course Credits: 03**
Internal Assessment Marks: 40	**Duration of SEE: 03 Hrs.**
Semester End Examination Marks: 60	

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Knowledge about need and scope of Intellectual property rights
2. Acquire knowledge about filing patents, process, and infringement
3. Knowledge about trademarks, industrial designs, and copyright

OEC: 21BSC4O4BT1: Intellectual Property Rights

Unit	Description	Hours
1	**Introduction to Intellectual property rights (IPR):** Genesis and scope. Types of Intellectual property rights - Patent, Trademarks, Copyright, Design, Trade secret, Geographical indicators, Plant variety protection. National and International agencies – WIPO, World Trade Organization (WTO), Trade-Related Aspects of Intellectual Property Rights (TRIPS), General Agreement on Tariffs and Trade (GATT).	**09**
2	**Basics of Patents:** Types of patents; Patentable and Non-Patentable inventions, Process and Product patent. Indian Patent Act 1970; Recent Amendments; Filing of a patent application; Precautions before patenting-disclosure/non-disclosure; WIPO Treaties; Patent Cooperation Treaty (PCT) and implications. Budapest Treaty, Role of a Country Patent Office.	**09**
3	**Patenting, process, and infringement**: Process of patenting. Types of patent applications: Provisional and complete specifications; Concept of "prior art", patent databases (USPTO, EPO, India). Financial assistance, schemes, and grants for patenting. Patent infringement- Case studies on patents (Basmati rice, Turmeric, Neem)	**08**
4	**Trademarks, Copy right, industrial Designs:** Trademarks- types, Purpose and function of trademarks, trademark registration, Protection of trademark. Copy right- Fundamentals of copyright law, Originality of material, rights of reproduction, industrial Designs: Protection, Kind of protection provided by industrial design.	**08**
5	**Biosafety:** Introduction, Historical Background, Introduction to Biological Safety Cabinets, Recommended Biosafety Levels for Infectious Agents and Infected Animals, Biosafety guidelines - Government of India, Definition of GMOs & LMOs, Roles of Institutional Biosafety Committee, RCGM, GEAC etc. for GMO applications in food and agriculture, Environmental release of GMOs.	**08**

References

1. Manish Arora. 2007. Universal's Guide to Patents Law (English) 4th Edition) -Publisher: Universal Law Publishing House
2. Kalyan C. Kankanala. 2012. Fundamentals of Intellectual Property. Asia Law House
3. Ganguli, P. 2001. Intellectual Property Rights: Unleashing the knowledge economy. New Delhi: Tata McGraw-Hill Pub
4. World trade organization - http://www.wto.org
5. World Intellectual Property organization – www.wipo.intOffice of the controller general of Patents, Design & Trademarks - www.ipindia.nic.in

Date Course Coordinator Subject Committee Chairperson

CBCS Question Paper Pattern for UG Semester End Examination with effect from the AY 2021-22

Languages /Discipline Core Courses (DSC) & Open Elective Courses (OEC)

Paper Code: **Paper Title:**
Time: 3 Hours **Max. Marks: 60**
Instruction: Answer all Sections

SECTION-A

1. Answer the following sub-questions, each sub-question carries **ONE** mark. (10X1=10)
a).
b).
c).
.
.
j).
Note for Section-A: Two sub-questions from each unit.

SECTION-B

Answer any **FOUR** of the following questions, each question carries **FIVE** marks. (4X5=20)
2.
3.
4.
5.
6.
7.
Note for Section-B: Minimum One question from each unit (Q No 2 to 6) and remaining one question from unit II to V (Q.No. 7)

SECTION-C

Answer any **THREE** of the following questions, each question carries **TEN** marks. (3X10=30)
8.
9.
10.
11.
12.
Note for Section- C: One question from each unit. Sub-questions such as 'a' and 'b' may be given for a question in section-C only.

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SEC & AECC Subjects

Paper Code: **Paper Title:**

Time: 1 Hours **Max. Marks: 30**

There shall be Theory examinations of **Multiple Choice Based Questions [MCQs]with Question Paper of A, B, C and D Series** at the end of each semester for **AECCs (Environmental Studies and (ii) Constitution of India) and SECs (SEC-1: Digital Fluency, SEC-2: Artificial Intelligence, SEC-3: Cyber Security and SEC-4: Societal Communication) for the duration of One hour (First Fifteen Minutes for the Readiness of OMR and remaining Forty-Five Minutes for Answering thirty Questions). The Answer Paper is of OMR (Optical Mark Reader) Sheet.**

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VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY, BALLARI-583 105
B. Sc. ……(DSCC) SEMESTER PRACTICAL
SUBJECT - BIOTECHNOLOGY

Paper Code: **Paper Title:**
Time: 3 Hours **Max Marks: 25**

Q. 1. Write a Principle, procedure and perform the given experiment…….. and write a report on result obtained (Major experiment) - 8M

Q. 2. Perform Minor experiment-1 - 4M

Q. 3. Perform Minor experiment-2/Answer the given problem/…… - 4M

Q. 4. Identification - 6M
4A. Identify & comment
4B. Identify & comment
4C. Identify & comment

Q. 5. Journal submission - 3M

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