

ADIKAVI NANNAYA UNIVERSITY

RAJAMAHENDRAVARAM



School of Life and Health Sciences

M.Sc. Biochemistry

Course Structure and Syllabus

2019-20 Onwards

**I and II Semester syllabus is common for
M.Sc. Biochemistry and M.Sc. Biotechnology**

M.Sc. Biochemistry Program Structure

Code	Title of the paper	Total Marks	Credits	Hours per week
I SEMESTER				
BCBT101	Cell Biology	100	4	4
BCBT102	Biomolecules	100	4	4
BCBT103	Microbiology	100	4	4
BCBT104	Analytical Techniques	100	4	4
	Lab Course			
BCBT105	Cell Biology lab	50	2	3
BCBT106	Biomolecules lab	50	2	3
BCBT107	Microbiology lab	50	2	3
BCBT108	Analytical Techniques lab	50	2	3
II SEMESTER				
BCBT201	Molecular Biology	100	4	4
BCBT202	Enzymology	100	4	4
BCBT203	Immunology	100	4	4
BCBT204	Bioinformatics and Biostatistics	100	4	4
	Lab Course			
BCBT205	Molecular Biology lab	50	2	3
BCBT206	Enzymology lab	50	2	3
BCBT207	Immunology lab	50	2	3
BCBT208	Bioinformatics and Biostatistics lab	50	2	3
III SEMESTER				
BC301	Endocrinology	100	4	4
BC302	Physiology and Bioenergetics	100	4	4
BC303	Intermediary Metabolism	100	4	4
BC304	Gene regulation and Genetic Engineering	100	4	4
	Lab Course			
BC305	Endocrinology lab	50	2	3
BC306	Physiology and Bioenergetics lab	50	2	3
BC307	Intermediary Metabolism lab	50	2	3
BC308	Gene regulation and Genetic Engineering lab	50	2	3
IV SEMESTER				
BC401	Plant and Environmental Biochemistry	100	4	4
BC402	Clinical Biochemistry and Human Nutrition	100	4	4
BC403	Applied Biochemistry and cancer biology	100	4	4
BC404	Omics, Bioethics and Research Methodology	100	4	4
	Lab Course			
BC405	Plant and Environmental Biochemistry lab	50	2	3
BC406	Clinical Biochemistry and Human Nutrition lab	50	2	3
BC407	Applied Biochemistry and cancer biology lab	50	2	3
BC408	Omics, Bioethics and Research Methodology lab	50	2	3
BC 409	Comprehensive Vive-voce	100	4	
	Total	2500	100	112

ADIKAVI NANNAYA UNIVERSITY: RAJAHMUNDRY

BOARD OF BIOCHEMISTRY

Date: 04-04-2019

AGENDA:

1. Eligibility and Entrance Examinations
2. Revision of the Syllabus
3. Syllabus for practicals
4. Number of teaching hours / Periods theory / Practical
5. Model Question Papers
6. Credits / Evaluation
7. Scheme of Valuation
8. List of Examiners for paper setting
9. List of Practical Examiners

Members:

Dr. A. Matta Reddy

Prof. Lakshmi Devi

Dr. K. Ramaneswari

Dr. P. Vijaya Nirmala

Dr. D. Kalyani

Dr. K. Sarala

Dr. I. J. N. Padmavathi

Dr. K. Satish Kumar

Dr. M. Padmaja

Sri P. Sunila Rani

Minutes of the meeting of the Board of Studies for M.Sc. Biochemistry,
M.Sc. Biotechnology, M.Sc. Clinical Nutrition and M.Sc. Microbiology
courses held on 04-04-2019 at 11:30 AM at the Department
of Zoology, Adikavi Nannaya University, Rajamahendravaram

Members present

1. Dr. A. Matta Reddy, Associate Professor, Department of Zoology
Adikavi Nannaya University, R.T.Y. Convener Amma
4/4/19
2. Prof. Lakshmi Devi, Dept. of Biochemistry, Sri Krishna Devaraya
University, Anantapur. Member
3. Dr. K. Ramaneewari, Associate Professor, Dept. of Zoology,
Adikavi Nannaya University, R.T.Y. Member 4/4/19
4. Dr. P. Vijaya Nirmala, Assistant Professor, HOD, Dept. of
Zoology, Adikavi Nannaya University, R.T.Y. Member 4/4/19
5. Dr. D. Kalyani, Assistant Professor, Dept. of Zoology,
Adikavi Nannaya University, R.T.Y. D. Kalyani
4/4/19
6. Dr. K. Sarala, Principal Scientist, Central Tobacco
Research Institute, R.T.Y. Member Sarala K
7. Dr. I. J. Naga Padmevathi, Assistant Professor (Ad-hoc),
Dept. of Biochemistry, Adikavi Nannaya University, R.T.Y. I. J. Padmevathi
4/4/19
8. Dr. K. Satish Kumar, Assistant Professor (Ad-hoc)
Dept. of Biotechnology, Adikavi Nannaya University, R.T.Y. Satish K
4/4/19
9. Dr. M. Padmaja, Dept. of Clinical Nutrition,
Ch. S.D.S. St. Theresa's College for women, Eluru. M. Pad
10. Sr. P. Sunila Rani, Dept. of Clinical Nutrition, P. Sunila Rani
Ch. S.D.S. St. Theresa's College for women, Eluru.

RESOLUTION:

The common Board consisting of the above members have met in the Department of Zoology, AdikaviNannaya University, Rajamahendravaram and considered the enclosed agenda. After thorough deliberations and discussions, the Board members have resolved the following.

1. The members formulated the syllabus for M.Sc Biochemistry, 2 years course on par with other Universities in the Country to be implemented from 2019-20 academic year.
2. The syllabus for practical for the above course was formulated on par with UGC model curriculum.
3. There shall be 4 to 5 periods per week for each theory paper & 3 periods for each practical.
4. A B.Sc. Graduate with any subject in biology is eligible to apply for admission into M.Sc Biochemistry.
5. I and II semesters are common for M.Sc. Biochemistry and M.Sc. Biotechnology whereas III and IV semesters have separate syllabus for M.Sc. Biochemistry and M.Sc. Biotechnology respectively.
6. Marks and credits are allotted to theory and practical papers in each semester. There will be 100 marks for each theory, and 200 marks for 4 practicals each 50 marks and total marks of (600 x 4) 2400 for the four semesters. There will be 100 marks for comprehensive viva-voce. A grand total of 2500 marks for the 2 year M.Sc. Biochemistry course.
7. **Examination pattern will be as follows.**
 - a) 75% of marks for Semester End Examination(SEE) while the remaining 25 marks for Continuous Internal Assessment(CIA)

Continuous Internal Assessment		
S.No	Scheme of Evaluation	Marks
1	Mid-Semester Examination	10M
2	Assignment/Seminar Presentation	5M
3	Attendance	5M
4	Swachhata Activity	5M
	Total	25M

Details of Attendance Marks		
S.No	Attendance	Marks Allotted
1	95% above	5
2	85-94%	4
3	75-84%	3
4	65-74%	2
5	55-64%	1
6	< 54%	0

- b) The Semester End Examination question paper comprises of two sections –Section A & B , Section-A consists of 4 questions, one question from each unit of syllabus with internal choice ‘a’ or ‘b’. Section-B consists of 8 short questions, two from each unit of the syllabus, with a choice to attempt only 5 out of 8 questions.
- c) For practical, 75% of marks for Semester End Examination (38 Marks) and 25% of marks for Continuous Internal Assessment (12 Marks, 9 + Record-3).

- 8) A comprehensive viva-voce for 100 marks is to be conducted by external examiner at IV semester end examination. For affiliating colleges, University teachers will be the external examiner and for University Department, external examiner is to be invited from other university. The external examiner TA / DA and remuneration will be borne by the respective College / Department strictly as per the approved norms to be notified from time to time.

ADIKAVI NANNAYA UNIVERSITY

M.Sc. BIOCHEMISTRY

Examination pattern:

Theory: 75% for End Semester Examination
25% for Internal Continuous Assessment

Practical: 75% for End Semester Examination
25% for Internal Continuous Assessment

ADIKAVI NANNAYA UNIVERSITY
M.Sc. BIOCHEMISTRY
SEMESTER END EXAMINATION

Model question paper

Time: 3 hrs

Max. Marks: 75

Answer all the questions. Each question carries 15 marks.

Section-A

4x15=60

Q1. Unit-1

a or b

Q2. Unit-2

a or b

Q3. Unit-3

a or b

Q4. Unit-4

a or b

Section-B

5x3=15

Q5. It contains 8 short questions with at least two from each unit, carrying 3 marks.

5 questions out of 8 are to be answered.

I SEMESTER
BCBT101 Cell Biology

Unit I:

Structure of a typical cell, Differences between prokaryotic and eukaryotic cells; Structural organization and functions of nucleus, endoplasmic reticulum, golgi complex. lysosomes, vacuole, microbodies, ribosomes.

Unit II:

Structural organization and chemical composition of cell membrane, symmetry of the membrane; membrane fluidity; membrane structure models, membrane transport - active transport; active transport of Na^+ K^+ (Sodium potassium ATPase) Ca^{2+} (Ca^{2+} -ATPase); active transport of sugars coupled to phosphorylation; Passive transport - anion exchange proteins; Donnan membrane equilibrium, group translocation (γ -Glutamyl cycle).

Unit III:

Mitochondria - Structural organization, composition and functions; mitochondrial respiratory chain; mechanism of oxidative of phosphorylation; Chloroplast - Structural organization, composition, components and functions of chloroplast.

Unit IV:

Cell cycle – phases and events of cell cycle; Cell division - Mechanism of mitosis and meiosis; Regulation of cell cycle - Molecular events including cell cycle check points and CDK – cyclin complexes, tyrosine kinases; Programmed cell death - apoptosis.

Recommended Books:

1. Cell and Molecular Biology by EDP de Robertis and EMF de Robertis.
2. Cell and Molecular Biology by Baltimore.L
3. The Cell - Hooper
4. Molecular Biology of the Cell by B.Alberts, Garland publications incorporation.
5. Molecular Cell Biology by J. Darnell, Scientific American Books.
6. Cell and Molecular Biology by P.K.Gupta, Rastogi Publ.

BCBT102 Biomolecules

Unit I:

Chemical foundations and chemical bonding of biology; Amino acids – classification, structure and physicochemical properties, Peptide bond – structure; Proteins – classification, structural organization, physicochemical properties; Isolation, purification, sequence determination and characterization of proteins; biological functions of proteins; Denaturation & renaturation of proteins.

Unit II:

Carbohydrates – classification, structure and physicochemical properties, biological importance; Monosaccharides, Oligosaccharides and Polysaccharides; carbohydrate derivatives and glycoconjugates.

Unit III:

Lipids – classification, biological importance; fatty acids – classification, structure and physicochemical properties; Structure and biological roles of triglycerides, phospholipids, sphingolipids, cholesterol, lipid derivatives and lipid conjugates.

Unit IV:

Nucleic acids – classification, structure - nucleotides, purine and pyrimidine bases and physicochemical properties of nucleic acids, biological role; DNA and RNA – structure and types; nucleosome and chromatin formation; DNA – histone interactions; DNA denaturation and renaturation kinetics – T_m , Cot curve and C-value paradox.

Recommended Books:

1. Nelson, D.L., Cox, M. M. Lehninger's Principle of Biochemistry. Freeman.
2. Murray, R.K, Granner, D.K, Mayes, P. A, Rodwell, V. W. Harper's Biochemistry, McGraw Hill.
3. Fundamentals of Biochemistry by Donald Voet.
4. Textbook of Biochemistry West, E.S., Todd, Mason & Vanbruggen, Macmillan & Co.
5. Biochemistry, Lubert Stryer.

BCBT103 Microbiology

Unit I:

History and Scope of Microbiology; Classification and taxonomy – morphological, physiological and metabolic, ecological, genetic analysis and molecular characterizations; Characteristics and importance of Archaeobacteria, Actinomycetes, Eubacteria, Pseudomonads, cyanobacteria, mycoplasma; Bacterial cell - Structural components and their functions; Gram positive and Gram negative bacteria.

Unit II:

Modes of nutrition – phototrophy, chemotrophy, methylotrophy, organotrophy, mixotrophy, saprophytic, symbiotic and parasitic modes of nutrition; Sterilization techniques – Physical, chemical and radiation; Culture media – types, batch and continuous cultures, chemostat; Microbial Growth curve and kinetics, Direct and Indirect methods of microbial growth; Effect of pH and temperature on microbial growth; Preservation of cultures (glycerol stocks, freeze drying).

Unit III:

Virus - morphology, characteristics and life cycle (ØX174, t4, HIV, Rota virus); Methods of culturing of viruses; Biology of subviral agents – Viroids, Prions, Satellite viruses; Antiviral agents- chemical and biological agents; Inactivation of viruses – photodynamic inactivation; Yeasts – morphology, characteristics and reproduction; Molds – morphology, characteristics and reproduction.

Unit IV:

Microbial diseases – Source, Symptoms, Diagnosis and Prevention – bacterial infections (Cholera, Typhoid, Hepatitis B, tuberculosis), viral infections (Polio, Rabies, small pox, HIV), fungal infections (systemic mycoses, candidiasis), protozoan diseases- Malaria, Trypanosomiasis).

Recommended Books:

1. Prescott, Harley and Klein, Microbiology Publisher: McGraw Hill Science
2. Gerard J. Tortora, Berdell, R. Funke, Christine L. Case, Microbiology: An Introduction Benjamin Cummings Publisher.
3. Microbiology by Pelczar, Chan and Krieg McGraw-Hill.
4. A Textbook of Microbiology, R.C. Dubey and D.K. Maheswari, S. Chand Co.
5. Fundamentals of Microbiology – M. Fribisher.
6. Microbiology An Introduction by John L. Ingraham (Author), Davis Catherine A. Ingraham
7. Brock Biology of Microorganisms (15th Edition) by Madigan Michael T, Martinko John M, Bender, Kelly S, Buckley Daniel H, Stahl David A.

BCBT104 Analytical Techniques

Unit I:

Microscopy- Principles and applications of light, phase contrast, fluorescence, scanning and transmission electron microscopy; Properties of electromagnetic radiations; Principles, instrumentation and applications of UV, visible, infrared, NMR spectroscopy; Spectrofluorimetry and mass spectrometry, X-ray diffraction; Flow cytometer.

Unit II:

Chromatography - Principles and applications of gel-filtration, ion-exchange and affinity chromatography, TLC, GLC and HPLC.

Centrifugation - Basic principles of sedimentation. Types of centrifuges. Applications of preparative and analytical ultra-centrifuges.

Principle and applications of lyophilization.

Unit III:

Electrophoresis - General Principle of electrophoretic techniques, Poly Acryl amide Gel Electrophoresis, Isoelectric focusing, Isotachopheresis, 2-D Electrophoresis, Capillary electrophoresis, Agarose gel electrophoresis of DNA and RNA. Blotting techniques.

Unit IV:

Stable and radioactive isotopes. Detection and measurement of radioactivity.

Applications of radioisotopes in biological sciences, Autoradiography, Non-isotopic tracer techniques.

Principles and range of electrochemical techniques. Principles and applications of Ion-selective and gas sensing electrodes, Operation of pH electrodes and Oxygen electrodes.

Recommended Books:

1. Principles and Techniques of Biochemistry and Molecular Biology by Keith Wilson and John Walker. Cambridge Univeristy press.
2. Biophysical chemistry principles and techniques by Upadyay, Upadyay and Nath Himalaya publishing.
3. A Biologists guide to Principles and techniques of practical Biochemistry. By B.D.williams (Edward Arnold).
4. Modern experimental Biochemistry by Rodney Boyer. Pearson Education.

I SEMESTER PRACTICALS

BCBT105 Cell Biology Lab

1. Microscopic observation of cell tissues
2. Observation of stages of mitosis and meiosis
3. Mitosis in onion root tip cells by Squash method
4. Arrest and observation of chromosomes after colchicine treatment in onion roots
5. Blood smear preparation and identification of cells
6. Total RBC count
7. Separation of cell organelles

BCBT106 Biomolecules Lab

1. Qualitative analysis of proteins
2. Quantitative analysis of proteins
3. Qualitative analysis of carbohydrates
4. Quantitative analysis of carbohydrates
5. Qualitative analysis of lipids.
6. Quantitative analysis of nucleic acids.

BCBT107 Microbiology Lab

1. Introduction to sterilization techniques.
2. Preparation of liquid and solid media for growth of microorganisms.
3. Isolation of Bacteria from soil –serial dilution technique.
4. Simple Staining, acid fast staining, spore staining, Grams staining.
5. Biochemical tests for bacteria.
6. Pure culture techniques-streakplate, spread plate and pour plate.
7. Bacterial growth curve.

BCBT108 Analytical Techniques Lab

1. Microscopic examination.
2. Spectroscopic determination of nucleic acids and proteins.
3. Separation of biomolecules by Paper chromatography and Thin Layer Chromatography
4. Subcellular fractionation by differential centrifugation.
5. Polyacrylamide gel electrophoresis of proteins.
6. Qualitative determination of nucleic acids by agarose gel electrophoresis.
7. Preparation of buffers and pH determination by pH meter.

II SEMESTER

BCBT201 Molecular Biology

Unit I:

Models of DNA Replication Origin and direction of replication, Semi discontinuous replication, DNA polymerases of prokaryotes and their mechanism of action, Primase, Ligase, Single strand DNA binding protein, Helicase, Topoisomerases, Replication strategies for replicating circular DNA: ϕ mode replication, σ mode or rolling circle replication and D-loop replication; Inhibitors of replication.

Unit II:

DNA Repair mechanisms, Photoreactivation, Excision Repair mechanism, Postreplication repair mechanisms-recombination repair, mismatch repair system, SOS response, transcription-repair coupling. Recombination-models of general recombination; Holliday model, asymmetric strand transfer model, double strand break repair model, site-specific recombination; Transposition of DNA; Transposable elements, Prokaryotic transposons, Eukaryotic transposons, Retroposons.

Unit III:

Prokaryotic RNA polymerase, Conserved sequences of prokaryotic promoters, Initiation of transcription, Chain elongation, Chain termination, Eukaryotic RNA polymerases, Conserved sequences of eukaryotic promoters, Transcriptional factors and basal eukaryotic transcription complex, Enhancers, Transcriptional termination in eukaryotes, Post transcriptional processing of pre-mRNA-addition of Cap to the 5' end, Polyadenylation to the 3' end, mechanism of intron removal and exon splicing, Processing of r-RNA, Self-splicing of introns, Processing of tRNA, Inhibitors of RNA synthesis.

Unit IV:

General features of genetic code, Structural components of prokaryotic and eukaryotic ribosomes, Mechanism of protein synthesis in prokaryotes and eukaryotes – aminoacylation of tRNA, protein synthesis-initiation, elongation and chain termination, Protein synthesis inhibitors, Post translational modifications of proteins,

Recommended Books:

1. Lehninger Principles of Biochemistry, David L. Nelson, Michael M. Cox Publisher: W.H. Freeman.
2. Molecular Biology of the Cell, Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, Keith Roberts, and James D. Watson. Publisher New York: Garland Science
3. Biochemistry, Donald Voet, Judith G. Voet, Publisher John Wiley & Sons
4. Molecular Biology of the Gene by Watson
5. Molecular Cell Biology by Harvey Lodish, David Baltimore, W.H. Freeman Publisher.
6. Molecular Biology by D. Friefelder

BCBT202 Enzymology

Unit I:

Enzymes - Classification, nomenclature, properties, assay, Units of enzyme activity; Factors affecting enzyme activity; Enzyme – substrate complex formation by Fisher and Koshland models, Active site mapping, Modern concepts of evolution of enzyme catalysis.

Unit II:

Enzyme kinetics - Michaelis – Menten equation, Lineweaver - Burk, Eadie – Hofstee and Hanes plots, Significance of V_{max} , K_m , K_{cat} , specificity constant (K_{cat}/K_m); Kinetics of multisubstrate reaction - Rate expression for non-sequential (ping-pong) and sequential (ordered and random) mechanisms, Enzyme inhibitions – competitive, non-competitive, uncompetitive inhibition, irreversible inhibition, Determination of K_I values.

Unit III:

Enzyme catalysis – General acid – base, electrostatic, covalent, metal – ion catalysis, Proximity and orientation, Mechanism of reaction catalyzed by chymotrypsin, carboxypeptidase, lysozyme, ribonuclease; Mechanism of catalysis with coenzymes – pyridoxal phosphate, flavin nucleotides, thiamine pyrophosphate, biotin.

Unit IV:

Enzyme regulation – Allosteric enzymes (ATCase), Symmetric and sequential models of allosteric enzymes and their significance; Feedback inhibition and feed forward stimulation, Isoenzymes – Lactate Dehydrogenase, Multienzyme complex systems – Pyruvate dehydrogenase complex; Methods for isolation and purification of enzymes.

Recommended Books:

1. Enzymes: Palmer T., Bonner P.
2. Enzyme structure and mechanism. Alan Fersht, Freeman & Co.
3. Principles of enzymology technology: Khan M.Y., Khan Farha, Eastern Economy Edition.
4. Methods in enzymology Ed. Colowick and Kaplan, Academic Press
5. Enzyme kinetics: Siegel interscience – Wiley.

BCBT203 Immunology

Unit I:

Types of immunity – Innate and adaptive; Antigens – properties, Haptens, Adjuvants; Immunoglobulins – structure, types and biological activities; Theories of antibody diversity; Organs of the immune system -Thymus, bone-marrow, spleen, lymph node.

Unit II:

Cells of Immune system - T and B lymphocytes – Origin, activation, differentiation, characteristics and functions; Humoral and cell-mediated immune responses - Immunological memory and immune tolerance; Antigen presenting cells - Processing and presentation of antigens, Major Histocompatibility Complex and its role in immune response.

Unit III:

Antigen-antibody interactions - Precipitation reactions – single immunodiffusion, double immunodiffusion, immunoelectrophoresis; Agglutination reactions - Heme agglutination; complement fixation - components and activation; Immunofluorescence, RIA, ELISA, Immunoblotting, Hybridoma technology - production of monoclonal antibodies and their applications; Vaccines- production of conventional and recombinant vaccines.

Unit IV:

Hypersensitivity: immediate (type I, type II, type III and type V) and delayed hypersensitivity (type IV); Immunodeficiency diseases – SCID and AIDS; Autoimmunity - organ specific (Hashimoto's thyroiditis) and systemic (Rheumatoid arthritis) diseases; Tissue transplantation – types, graft rejection and graft acceptance, immunosuppressive agents.

Recommended Books:

1. Essential immunology- Ivan M. Roitt.
2. Introduction to Immunology – John W.Kinball.
3. Immunology – D.M. Weir.
4. Immunology – Janis Kuby.

BCBT204 Bioinformatics and Biostatistics

UNIT-I

Scope of computers in current biological research. Basic operations, architecture of computer. Introduction of digital computers. Organization, low level and high level languages, binary number system. The soft side of the computer – Different operating systems – Windows, Linux. Introduction of programming in C. Introduction to Internet and its applications.

UNIT-II

Introduction to Bioinformatics, Genomics and Proteomics. Bioinformatics – Online tools and offline tools. Biological databases; An overview of types of biological data bases – NCBI, EMBL, Gen bank, Swiss prot, and PDB. Database searching using BLAST and FASTA. Human Genome Project.

UNIT-III

Sequence alignment-Introduction and significance of sequence alignments. Pair wise and Multiple sequence alignment. Gene and Genome annotation – Tools used. Physical map of genomes. Protein secondary structure prediction. Protein 3D structure prediction. Protein docking. Introduction to homology modeling, Computer Aided Drug Design (CADD) in Drug discovery. Molecular phylogeny - Concept methods of tree construction.

UNIT-IV

Brief description and tabulation of data and its graphical representation. Measures of central tendency - mean, median, mode. Measures of dispersion- range, variance, standard deviation. Simple linear regression and correlation. Types of errors and level of significance. Tests of significance – t- test, Chi-square test, ANOVA.

Recommended

Books:

1. T.K. Attwood & D.J. Parry-Smith 1999. Introduction to Bioinformatics. Pearson Education Asia.
2. Stephen Misener & S.A. Krawez 2000. Bioinformatics: Methods and Protocol.
3. R. Durbin, S. Eddy, A. Krogh & G. Mitchson. 1998. Biological sequence analysis. Cambridge University Press.
4. C.P. Freidman & J.C. Wyatt, 1997. Computers and machine: Evaluation methods in Medical information. Springer Verlag, New York.
5. M.J. Bishop & C.J. Wyatt, 1997. DNA and Protein structure analysis: A Practical approach. Oxford University Press.
6. S.B. Primrose. 1998. Principle of genome analysis, 2nd edition. Blackwell Science..
7. Bioinformatics – D.Mount
8. Programming in C by Balaguru Swamy.
9. Introduction to Bioinformatics by Arthur M.Lesk, Oxford.
10. Biostatistics – Daniel. (Wiley).
11. Methods in biostatistics by Mahajan and Srimathi
12. PSS Sundar Rao & J Richard. An introduction to biostatistics and Research methods

II SEMESTER PRACTICALS

BCBT205 Molecular Biology Lab

1. Isolation of DNA from bacterial, plant and animal cells.
2. Isolation of RNA from yeast cells.
3. Estimation of DNA and RNA by UV absorption method and determination of purity of nucleic acids.
4. Agarose gel for RNA, DNA, blotting gel
5. Determination of sugar and phosphate ratios in DNA and RNA samples.
6. Determination of melting temperature (T_m) of DNA.

BCBT206 Enzymology Lab

1. Assay of Amylase from saliva
2. Assay of Acid phosphatase from potato
3. Effect of substrate concentration on enzyme activity
4. Time course effect on enzyme activity
5. Effect of pH on enzyme activity
6. Effect of temperature on enzyme activity
7. Isoenzymes of LDH – electrophoretic separation and specific staining technique-demonstration

BCBT207 Immunology Lab

1. Determination of A, B, O and Rh blood groups in human beings
2. Diagnostic test for typhoid fever
3. VDRL Test
4. Bleeding time and clotting time
5. Total WBC count
6. Radial Immunodiffusion
7. Rocket immunoelectrophoresis- demonstration
8. Enzyme Linked Immuno Sorbent Assay (ELISA)- demonstration

BCBT208 Bioinformatics and Biostatistics Lab

1. Searching Data from NCBI Database.
2. Working on EMBL.
3. Searching structural data from PDB.
4. Genome Map viewer from NCBI.
5. Database search using BLAST.
6. Sequence alignments.
7. Measures of dispersion- Standard deviation
8. Correlation coefficient calculation
9. Tests of significance - one way ANOVA.

III SEMESTER

BC301 Endocrinology

Unit I:

Hormones - Classification, chemistry, biosynthesis, secretion, regulation, transport and assays (RIA, ELISA); Signal cascade mechanisms - Autocrine, paracrine & endocrine systems; Growth factors – EGF, PDGF, VEGF, IGF; Second messengers – Ca, calmodulin, inositol, cAMP, cGMP; Receptor mediated signal transduction; Insulin signaling, MAPK pathway.

Unit II:

Hypothalamic and pineal hormones - structure, function, regulation and abnormalities of hypothalamic releasing hormones and inhibitory hormones, melatonin and serotonin;
Thyroid and parathyroid hormones - structure, biosynthesis, function, regulation and abnormalities of thyroid and parathyroid hormones.

Unit III:

Hormones of Pancreas and Gastro intestine - structure, biosynthesis, secretion, function, regulation and abnormalities of insulin and glucagon, gastrin, secretin, cholecystokinin;
Adrenal hormones - Structure, biosynthesis, secretion, function, regulation and abnormalities of adrenaline and noradrenaline, corticosteroids.

Unit IV:

Hormones of Reproduction - structure, biosynthesis, secretion, function, regulation and abnormalities of testosterone, estrogens, progesterone, Human chorionic gonadotropin;
Hormonal regulation of menstrual cycle.

Recommended Books:

1. The Biochemistry of Cell Signaling, Helmreich JM, Oxford Press
2. Cell signaling – John T Hancock, Oxford University press
3. Cell biology by C A Smith and E J Wood. Chapman & Hall publ
4. Molecular Cell Biology, Harvey Lodish, Arnold Berk, S Lawrence Zipursky, Paul Matsudaira, David Baltimore, and James Darnell. New York: W. H Freeman
5. Text book of Endocrinology – William, Saunders Elsevier

BC302 Physiology and Bioenergetics

Unit I:

Introduction- Digestion- digestive processes at various regions of digestive system, regulation of gastric secretion and motility, intestinal secretion and motility, role of gastrointestinal hormones; Renal physiology- structure of nephron, glomerular filtration, tubular reabsorption and secretion. Regulation of water and mineral excretion, counter current multiplier and exchanger, renal role in acid base balance.

Unit II:

Nerve physiology-Structure of neuron and synapse, action potential, conduction of nerve impulse, synaptic transmission, neurotransmitter systems, Blood brain barrier; Muscle physiology- skeletal and smooth muscle, types of muscle contraction, Neuromuscular transmission.

Unit III:

Circulatory physiology - Formation and composition of blood, total and differential counts in blood, Development of erythrocytes, leukocytes and platelets, Plasma proteins and blood clotting mechanism, Erythrocyte Sedimentation Rate; Cardio physiology- functional anatomy of heart, genesis and spread of cardiac impulses, cardiac cycle, cardiovascular regulatory mechanisms, basic E.C.G; Respiratory physiology- functional anatomy of air passages and lung, respiratory muscles, mechanism of respiration, regulation of respiration.

Unit IV:

Laws of thermodynamics, Gibbs free energy, relevance of entropy and enthalpy in biological systems and reactions; Biological oxidation, high energy compounds; proton gradients, role of transporters and channels; Electron Transport Chain and its inhibitors; Biological fluorescence, Bioluminescence.

Recommended Books:

1. Pal, G.K. Textbook of Medical Physiology, Ahuja Publishing House, Delhi.
2. Guyton and Hall Textbook of Medical Physiology, Elsevier Publisher
3. Barrett KE, Brooks HL, Boitano S and Barman SM, Ganong's Review of Medical Physiology, McGraw-Hill Medical.
4. Lehninger Principles of Biochemistry, David L. Nelson, Michael M. Cox Publisher: W. H. Freeman
5. Molecular Biology of the Cell, Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, Keith Roberts, and James D Watson. Publisher New York: Garland Science.
6. The Cell: A Molecular Approach by Geoffrey M. Cooper and Robert E. Hausman, published by ASM Press.

BC303 Intermediary Metabolism

Unit I:

Carbohydrate metabolism - Glycolysis and its regulation, TCA cycle and its regulation; Glyoxylate cycle, Gluconeogenesis and its regulation; HMP shunt pathway; Uronic acid pathway, Glycogen metabolism; Metabolism of monosaccharides; In born errors of carbohydrate metabolism.

Unit II:

Amino acid metabolism - Ketogenic and glucogenic amino acids, Essential and Non essential amino acids, urea cycle and its regulation; Biosynthesis and regulation of branched chain amino acids, aromatic amino acids; In born errors of amino acid metabolism.

Unit III:

Lipid metabolism – Oxidation of fatty acids, Biosynthesis of fatty acids and regulation; Metabolism of arachidonic acid; formation of prostaglandins, thromboxanes, leukotrienes, Biosynthesis of triglycerides; Metabolism of phospholipids; Biosynthesis of cholesterol and its regulation; In born errors of lipid metabolism.

Unit IV:

Nucleic acid metabolism - Biosynthesis and degradation of purines and pyrimidines and their regulation – Denovo and salvage pathways; regulation of ribonucleotidoreductase; In born errors of nucleic acid metabolism.

Recommended Books:

1. Principles of Biochemistry, White. A, Handler, P and Smith.
2. Biochemistry, Lehninger A.L.
3. Biochemistry, David E. Metzler.
4. Biochemistry, Lubert Stryer.
5. Text of Biochemistry, West and Todd.

BC304 Gene regulation and Genetic Engineering

Unit I:

Structure and function of *lac* operon, Induction of *lac* operon – a negative control system, Catabolite repression – a positive control system, Function and regulation of *trp* operon, Attenuation of *trp* operon, *ara* operon - dual functions of the repressor, Diversity of sigma factor - Bacterial sporulation and Phage infection in *Bacillus subtilis*.

Unit II:

Structural changes in the eukaryotic active chromatin - hypersensitive sites, chromatin remodeling, Levels of eukaryote gene control - Control at the level of transcription, processing of RNA, mRNA stabilization in the cytoplasm and translation of mRNA; Eukaryote promoter and enhancer sequence organization, Interaction of eukaryote transcriptional factors with DNA - helix-turn-helix motif, zinc-finger motif, leucine zipper, helix-loop-helix motif; Regulation of galactose metabolism in yeast; Steroid hormone induced gene expression; Regulation of gene expression by anti-sense RNA.

Unit III:

Restriction endonucleases, Restriction maps, isolation of gene fragments using restriction endonucleases and mechanical shearing; Cloning vectors - Isolation and properties of plasmids, bacteriophage cosmids, Ti plasmid (binary vector), expression vectors, viral vectors, YAC, BAC, phagemids and vectors used for cloning in mammalian cells, Hosts - Prokaryotic: *E.coli*, *B.subtilis*, Eukaryotic: Yeast and mammalian cell lines; Ligation of fragments - Cohesive and blunt ends.

Unit IV:

Cloning strategies, shot gun experiments, isolation of poly mRNA, synthesis of cDNA, cDNA cloning in bacteria; Genomic and cDNA libraries, Identification of recombinants - structural and functional analysis of recombinants; Design and preparation of DNA and RNA probes for hybridization, Southern and Northern blotting, South-Western blotting, PCR, DNA fingerprinting; Expression of cloned genes in bacteria, yeast, animal and plant cells; Biological, Medical and Industrial applications of recombinant DNA technology, Transgenics - Making Golden rice and Dolly.

Recommended Books:

1. Genes VIII, Lewin, B, Publish Oxford University Press
2. Principles of Gene Manipulation: An introduction to GE – Old, R. and Primrose, S.B. Blackwell Sci. Pub
3. Molecular Biotechnology Glick, BR and Paternak, JJ. Publish ASM Press
4. Molecular Biology of the Gene by Watson JD, Losick R. Pub Pearson Education.

III SEMESTER PRACTICALS

BC305 Endocrinology Lab

1. Microscopic observation of endocrine glands
2. Estimation of sugar by anthrone reagent
3. Study of scavenging activity (Indirect method)
4. Pregnancy Test (strip method)
5. Effect of iodine on metamorphosis
6. Effect of thyroid hormone on metamorphosis
7. Estimation of plasma insulin by RIA- demonstration
8. Estimation of TSH by ELISA- demonstration

BC306 Physiology and Bioenergetics Lab

1. Microscopy
2. RBC count & WBC count
3. Differential leucocyte count by Leishman' s staining
4. Estimation of Haemoglobin by Sahli's acid haematin method
5. Determination of Packed cell volume (PCV)
6. Determination of Erythrocyte sedimentation rate (ESR)
7. Determination of Coagulation time & Bleeding time
8. Determination of blood group

BC307 Intermediary Metabolism Lab

1. Isolation of casein from milk
2. Preparation of lactalbumin from milk
3. Estimation of reducing sugar by DNSA (dinitrosalicylic acid) method
4. Titration of glucose by Benedict's method
5. Estimation of urea by Diacetylmonoxime method
6. Estimation of creatinine in serum
7. Estimation of cholesterol by ZAK's method

BC308 Gene regulation and Genetic Engineering Lab

1. Culture of *E.coli* cells & plasmid isolation
2. Preparation of competent cells
3. Calcium chloride mediated transformation
4. Primer design for PCR
5. Polymerase chain reaction
6. Restriction fragment length polymorphism

IV SEMESTER
BC401 Plant and Environmental Biochemistry

Unit I:

Photosynthesis – components and mechanisms; photophosphorylation - Cyclic and Non-cyclic mechanisms; Proton gradient and ATP synthesis, CO₂ fixation in C₃, C₄ and CAM plants; factors effecting photosynthesis, regulation of photosynthesis; Mechanism of photorespiration and its significance.

Unit II:

Nitrogen fixation – types and mechanisms, seed germination and dormancy, Factors effecting seed germination; Secondary metabolites in plants – Nature, distribution and function; Structure, physiological function and mechanism of action of phytohormones – auxins, gibberellins, cytokinins, ethylene and abscisic acid.

Unit III:

Renewable and non-renewable resources - Forest resources, Water resources, Mineral resources, Food resources, Energy resources; Ecosystem - Structure and function, Energy flow, Ecological succession, food chains, food webs and ecological pyramids; Forest, Desert and Aquatic ecosystems.

Unit IV:

Environmental Pollution - Definition, cause, effects and control measures of Air pollution, Water pollution, Soil pollution; Solid waste Management - Causes, effects and control measures of urban and industrial wastes; Role of Information Technology in Environmental Protection.

Recommended Books:

1. Mukherji, S and Gosh A. K., Plant Physiology, New Central Book Agency, Kolkata.
2. Slater A, NW Scott, MR Fowler, Plant bio technology, Oxford University Press.
3. Hopkins, W. G and Huner, N. P. A. Introduction to Plant Physiology, John Wiley & Sons Inc. New York.
4. Plant Biochemistry, Hans-Walter Heldt and Birgit Piechulla
5. Plant Biochemistry by Dr.V.Arun Kumar, Dr.K.Siva Kumar, Dr. N. Senthil Kumar.
6. Environmental Biochemistry by NeelimaRajvaidya, Dilip Kumar Markandey.
7. Environmental and Ecological Biochemistry by P.W. Hochachka T.P. Mommsen.

BC402 Clinical Biochemistry and Human Nutrition

Unit I:

Introduction to Clinical Biochemistry - Introduction and maintenance of clinical biochemistry laboratory, quality control in laboratory as per WHO standards, Selection of analytical methods, Collection and preservation of specimens; Pancreas function tests, renal function tests - osmolality and free water clearances, Liver function tests - bile pigments level, plasma changes, prothrombin time; Gastric function tests - gastric residuum examination, FTM, tubeless gastric analysis.

Unit II:

Prenatal Diagnosis - Newborn screening for PKU, cystic fibrosis and sweat tests. Prenatal diagnosis of diseases, Acetylcholinesterase test in amniotic fluid and fetal blood examination; Diagnosis of genetic diseases by molecular biology techniques (thalassemia, sickle cell diseases), DNA probes, restriction fragment length polymorphism (RFLP), polymerase chain reaction (PCR).

Unit III:

Nutrients-Essential Nutrients and their classification. Carbohydrates dietary requirements; Nitrogen balance studies for Proteins, Biological values of proteins, protein quality improvement by supplementation and fortification; Dietary needs of lipids, essential fatty acids; Calorific values of foods, Basal metabolic rate, factors influencing BMR; role of diet and nutrition in prevention of atherosclerosis and obesity, role of leptin in regulation of body mass, malnutrition – Kwashiorkar and Marasmus, Nutritional requirements for pregnant and lactating women.

Unit IV:

Biological effects of non nutrients (dietary fibre), Antinutrients – Protease inhibitors, hemagglutinins, hepatotoxin, goitrogens, toxins from mushrooms; Biological effects of food contaminants – DDT, cadmium, mercury, lead, aflatoxins; Food allergy – role of allergens, diagnosis and management of food allergy; Vitamins - sources, physiological role and deficiency disorders of water soluble and fat soluble vitamins; functions and deficiency disorders of minerals.

Recommended Books:

1. Essentials of Food and Nutrition, Vol. I & II, M.S. Swaminathan.
2. Text Book of Biochemistry with clinical correlations. Thomas M. Devlin (John Wiley).
3. Biochemical aspects of human disease – R.S. Elkeles and A.S. Tavit. (Blackwell Scientific Publications).
4. Varley's Practical clinical Biochemistry – Ed. Alan W. Gowenlock (Heinemann Medical Books, London).

BC403 Applied Biochemistry and Cancer Biology

Unit I:

Molecular markers – RFLP, RAPD, SNPs, Chromosomal Walking, Chromosomal jumping, foot printing, gel shift analysis; Mapping Genes – Somatic cell hybridization mapping, FISH, Transposon tagging; RNA silencing by siRNAs and epigenetics; Microarrays – principle, types and applications; Gene therapy – types and applications.

Unit II:

Plant tissue culture - Culture conditions, components, types and its applications - Somatic embryogenesis, Micropropagation, Somatic hybridization, secondary metabolites production; Animal cell culture - Culture conditions, components, types and its applications; Stem cells – types and its applications.

Unit III:

Fermentation Technology - principle, types of fermenters and productions of citric acid, lactic acid, butanol, penicillin, streptomycin, riboflavin, vitamin B12, glutamic acid and single cell protein (SCP); Enzyme Technology- Immobilization of enzymes, types and its applications; Nanotechnology and its applications.

Unit IV:

Cancer biology – Morphological properties and growth characteristics of cancer cells; types of cancers and types of growth; Differences between benign and malignant tumors; Tumor markers; cellular protooncogenes- oncogene activation; Strategies of anticancer drug therapy – chemotherapy, gene therapy, Immunotherapy and Radiotherapy.

Recommended Books:

1. Fermentation Technology, Standury (Pergman press)
2. Biotechnology: Textbook of Industrial microbiology by Crueger and Crueger.
3. Principles of Gene manipulation: An Introduction to genetic Engineering. R.V.Old and S.B.Primrose (Blackwell Scientific Publications).
4. Principles of Biotechnology, Alen Weisman, Surrey University Press.
5. Industrial Microbiology, L.E.Casida, JR. New Age International.
6. The Biological Basis of Cancer: R. G. McKinnell, R. E. Parchment, A. O. Perantoni, G.Barry Pierce, I. Damjanov. 2nd Edition, Cambridge University Press, 2006.
7. The Biology of Cancer: R. A. Weinberg. Garland Science. 2006.

BC404 Omics, Bioethics and Research Methodology

Unit I:

Proteomics - Introduction, principle and techniques – 2D gel electrophoresis, 2D-DIGE, MALDI-TOF, Quadrupole Time-of-Flight (Q-TOF); Significance and applications of proteomics in modern biology; Molecular Modeling – Structure of protein at Primary, secondary, tertiary and quaternary level; Understanding Molegro Molecular viewer for protein 3D visualization – RASMOL.

Unit II:

Genomics- Whole genome sequencing and/or analysis; Preparation of cosmid libraries, bacterial artificial chromosomal libraries, shotgun libraries; Sequencing - conventional sequencing (Sanger, Maxam and Gilbert Methods), automated sequencing, Sequence analysis – BLAST, Sequence assembly, Gene prediction; Comparative genomics - Orthologs, paralogs, and homologs.

Unit III:

Introduction to Bioethics, Genetic Testing- Merits and Demerits; Human Genome Project Ethical, Legal, Social Issues (ELSI); Biosafety- Guidelines for Research in Transgenic organisms; Introduction of Genetically Modified Organisms into environment; Regulations to Biotech companies, Good laboratory practices (GLP), Good Manufacturing Practices (GMP), laboratory accreditation; Patenting and Intellectual Property Rights (IPR).

Unit IV:

Research Methodology – Basics, Origin and identification of problem, Literature survey, Formulation of hypothesis, Experimental design, Execution, Sampling, Analysis of data, Testing of hypothesis, Interpretation of research findings; Methodology for writing science report and program of writing, use of vocabulary, art of illustration and manuscript writing for publication in peer reviewed scientific journals; Preparation of project proposal- Project description, goals, work plan, progress reporting.

Recommended Books:

1. Primrose SB. Principles of Genome Analysis: a guide to mapping and sequencing DNA from different organisms, Blackwell Science: Oxford.
2. Genome Mapping: A practical approach. Dear P (Editor), Oxford University Press: Oxford.
3. Developing Bioinformatics Skills, Alfonso Valencia and Blaschke. L O'Reilly Publication.
4. Bioinformatics sequence, structure and data banks by Des Higgins Willie Taylor.
5. Bioinformatics: Principles and Applications by Zhumur Ghosh and Bibekanand Mallick
6. A Practical Guide for Basic Bioinformatics and Biostatistics by Pallavi Pandey Pooja Tiwari
7. Bioethics and Biosafety in Biotechnology by V. Sree Krishna, New Age International Publishers.
8. Bioethics and Biosafety by M.K. Sateesh I.K. International Publishing House Pvt.Ltd.

IV SEMESTER PRACTICALS

BC405 Plant and Environmental Biochemistry Lab

1. Estimation of total chlorophyll, chlorophyll a and chlorophyll b pigments from the leaves.
2. Estimation of starch content by Anthrone reagent.
3. Spectrophotometric estimation of Indole acetic acid in plant tissues.
4. Determination of Gibberlic acid by half seed method.
5. Determination of protein under abiotic stress.
6. Isolation of chloroplast DNA

BC406 Clinical Biochemistry and Human Nutrition Lab

1. Estimation of blood glucose.
2. Estimation of blood urea.
3. Estimation of creatinine in serum.
4. Estimation of uric acid in serum.
5. Estimation of serum total protein.
6. Estimation of Serum albumin.
7. Estimation of Serum cholesterol.
8. Estimation of serum calcium.
9. Estimation of serum phosphate.
10. Estimation of serum bilirubin.

BC 407 Applied Biochemistry and Cancer Biology Lab

1. Isolation of genomic DNA from animal cell culture
2. Quantitative and qualitative analysis of genomic DNA isolated from animal cell culture
3. TLC of Plant tissue culture compounds
4. Estimation of plant tissue culture proteins
5. SDS PAGE of cell culture proteins.
6. Immobilization of enzymes (demonstration)
7. Primer designing for oncogenes
8. Gene expression analysis of oncogenes by polymerase chain reaction.

BC408 Omics, Bioethics and Research Methodology Lab

1. OMIM database and human genetic disorders
2. Retrieve DNA sequence from database (NCBI)
3. Retrieve protein sequence from database (NCBI)
4. Retrieve protein structure from database(PDB)
5. KEGG database for pathways
6. Local alignment of DNA, protein
7. Global alignment of DNA, protein
8. Multiple sequence alignments
9. *In silico* restriction mapping

AdikaviNannaya University, Rajamahendravaram

M.Sc Biochemistry I Semester

Model Question Paper: Paper-I

BCBT101-Cell Biology

Time: 3hours

Max. Marks: 75

Answer ALL questions.

All questions carry equal marks

Section-A

1. a) Explain in detail about nucleus, its organization and its biological role.
(OR)
b) Describe the structure, and application of ER, Golgibody, lysosomes and ribosomes.
2. a) Give the complete information about plasma membrane composition and various theories.
(OR)
b) Explain various transport mechanisms performed by plasma membrane.
3. a) Write about mitochondrial structural organization and its applications.
(OR)
b) Explain the structure, composition, and functions of chloroplast.
4. a) Discuss the mechanism of meiotic cell division and its regulation.
(OR)
b) Explain cell cycle regulation mechanism.

Section-B

5. Answer any **FIVE** of the following:
 - a) Nucleosome
 - b) Vacuole
 - c) Ionophores
 - d) Liposomes
 - e) Metaphase
 - f) Oxidative phosphorylation
 - g) apoptosis
 - h) CDK – cyclin

AdikaviNannaya University, Rajahmundry
M.Sc Biochemistry I Semester
Model Question Paper: Paper-II
BCBT102-Biomolecules

Time: 3hours

Max. Marks: 75

Answer ALL questions.
All questions carry equal marks

Section-A

1. a) Describe the structure, classification and properties of amino acids.
(OR)
b) Explain the characterization and determination of proteins.
2. a) Write about the classification, structure, properties and functions of monosaccharides.
(OR)
b) Explain polysaccharides and their occurrence in nature.
3. a) Discuss about the classification, structures, properties and biological functions of fatty acids.
(OR)
b) Explain phospholipids with their biological role.
4. a) Discuss about the structure, types and physicochemical properties of Nucleic acids.
(OR)
b) Write in detail about RNA and its functions

Section-B

5. Answer any **FIVE** of the following:
 - a) Vander waal's interaction
 - b) Stereo isomerism
 - c) Isoelectric pH
 - d) Chitin
 - e) Wax
 - f) Leukotrienes
 - g) mRNA
 - h) Cot curve

ADIKAVI NANNAYA UNIVERSITY, RAJAHMUNDRY

**M.Sc Biotechnology I Semester
Model Question Paper: Paper-III
BCBT103-Microbiology**

Time: 3hours

Max. Marks: 75

**Answer ALL questions.
All questions carry equal marks**

Section-A

1. a) Write about the history and classification criteria of microorganisms.
(OR)
b) Explain about Bacterial cell - Structural components and their functions
2. a) Discuss about modes of nutrition of microorganisms, add a note on culture media
(OR)
b) Explain the growth kinetics of bacterial cells.
3. a) Write about the classification, morphology, ultra structure and life cycle of viruses.
(OR)
b) Describe about morphology, characteristics and reproduction of Yeasts and Molds
4. a) Explain about source, symptoms, diagnosis and prevention of bacterial diseases
(OR)
b) Give detailed information about viral diseases infecting humans.

Section-B

5. Answer any **FIVE** of the following:
 - a) Chemoautotrophs
 - b) Actinomycetes
 - c) Symbiosis
 - d) Chemostat culture
 - e) Prions
 - f) Antiviral agents
 - g) Malaria
 - h) Rabies

ADIKAVI NANNAYA UNIVERSITY, RAJAHMUNDRY

**M.Sc Biotechnology I Semester
Model Question Paper: Paper-IV
BCBT104-Analytical Techniques**

Time: 3hours

Max. Marks: 75

Answer ALL questions.

All questions carry equal marks

Section-A

1. a) Explain the principle, instrumentation, and applications of Electron Microscopy.
(OR)
b) Write the principle, instrumentation, and uses of UV-visible spectroscopy.
2. a) Describe the principle, and application of HPLC.
(OR)
b) What is centrifugation? Describe the application of analytical ultra centrifugation.
3. a) Write the principle, instrumentation, and applications of PAGE
(OR)
b) Describe the different blotting techniques procedure and their applications.
4. a) What is radioactive isotope? Explain different measures of radioactivity
(OR)
b) Discuss the working methods of pH electrodes and their applications.

Section-B

5. Answer any **FIVE** of the following:
 - a) Flow cytometer
 - b) X-ray diffraction
 - c) TLC
 - d) Lyophilization
 - e) Agarose electrophoresis
 - f) Isoelectric focusing
 - g) Isotope
 - h) Autoradiography

ADIKAVI NANNAYA UNIVERSITY, RAJAHMUNDRY

M.Sc Biochemistry II Semester

Model Question Paper: Paper-I

BCBT201-Molecular Biology

Time: 3hours

Max. Marks: 75

Answer ALL questions.

All questions carry equal marks

Section-A

1. a) Describe the various modes of replication in Prokaryotes.
(OR)
b) List out the proteins involved in replication and explain the mechanism of their action in replication process.
2. a) Write about DNA repair mechanisms.
(OR)
b) What is DNA recombination? Explain the different recombination mechanisms of DNA.
3. a) Explain the process of RNA synthesis and list out the differences of RNA synthesis between prokaryotes and eukaryotes.
(OR)
b) Write about splicing process of synthesized RNA.
4. a) Discuss protein synthesis with a note on post translational modifications.
(OR)
b) Explain ubiquitin proteasome pathway and its occurrence.

Section-B

5. Answer any **FIVE** of the following:
 - a) Helicase
 - b) Semi conservative replication
 - c) SOS
 - d) Transposons
 - e) Promoters
 - f) Exons and Introns
 - g) Genetic code
 - h) Signal peptide

ADIKAVI NANNAYA UNIVERSITY, RAJAHMUNDRY

M.Sc Biochemistry II Semester

Model Question Paper: Paper-I

BCBT202-Enzymology

Time: 3hours

Max. Marks: 75

Answer ALL questions.

All questions carry equal marks

Section-A

1. a) Explain enzyme classification, nomenclature and the characterization of active site.
(OR)
b) What is enzyme activity? Explain the factors effecting enzyme activity and its measurement.
2. a) Discuss enzyme kinetics and the significance of K_m and V_{max} .
(OR)
b) Explain enzyme inhibitions with their mechanism of action.
3. a) Write about the mechanism of lysozyme catalysis.
(OR)
b) Describe the covalent catalysis mechanism of enzyme substrate interaction.
4. a) Explain about allosteric enzymes and cooperativity phenomenon.
(OR)
b) Write about methods for isolation and purification of enzymes.

Section-B

5. Answer any **FIVE** of the following:
 - a) Specific activity
 - b) Abzymes
 - c) K_{cat}
 - d) Irreversible inhibition
 - e) Metal ion catalysis
 - f) Pyridoxal phosphate
 - g) isoenzymes
 - h) Feedback inhibition

ADIKAVI NANNAYA UNIVERSITY, RAJAHMUNDRY

**M.Sc Biochemistry II Semester
Model Question Paper: Paper-III
BCBT203-Immunology**

Time: 3hours

Max. Marks: 75

**Answer ALL questions.
All questions carry equal marks**

Section-A

1. a) Write about various immune cells and organs of the body.
(OR)
b) Explain various classes of immunoglobulins and their biological role.

2. a) What is major histocompatibility complex? Describe the antigen presentation and processing mechanism by MHC molecules.
(OR)
b) Discuss the theories and recombination process of antibody diversity.

3. a) Mention the antigen – antibody interactions and various techniques and reactions involved.
(OR)
b) Explain vaccine preparation and types of vaccines developed for defence mechanism.

4. a) What are the different types of hypersensitivity? Describe them with examples.
(OR)
b) Explain the mechanism involved in autoimmune disorders.

Section-B

5. Answer any **FIVE** of the following:
 - a) Adjuvant
 - b) Lymph node
 - c) Idiotype
 - d) Interleukins
 - e) Agglutination
 - f) ELISA
 - g) Immunological tolerance
 - h) Xenograft

ADIKAVI NANNAYA UNIVERSITY, RAJAHMUNDRY

M.Sc Biotechnology II Semester

Model Question Paper: Paper-IV

BCBT204-Bioinformatics and Biostatistics

Time: 3hours

Max. Marks: 75

Answer ALL questions.

All questions carry equal marks

Section-A

1. a) Describe the basic architecture of a computer
(OR)
b) Define operating system. Describe different operating systems.
2. a) Give a note on online and offline tools in bioinformatics
(OR)
b) Describe database searching using BLAST
3. a) What is Multiple sequence alignment in bioinformatics explain in detail.
(OR)
b) Define molecular phylogeny and describe methods of tree construction.
4. a) What is measure of dispersion and explain standard deviation.
(OR)
b) Write an essay on tests of significance.

Section-B

5. Answer any **FIVE** of the following:
 - a) Internet
 - b) Binary system
 - c) Genomics
 - d) NCBI
 - e) Dot matrix
 - f) CADD
 - g) Histogram
 - h) Correlation coefficient

ADIKAVI NANNAYA UNIVERSITY, RAJAHMUNDRY

M.Sc Biochemistry III Semester

Model Question Paper: Paper-I

BC301-Endocrinology

Time: 3hours

Max. Marks: 75

Answer ALL questions.

All questions carry equal marks

Section-A

1. a) Describe the general mechanism of action of hormones and their analysis.
(OR)
b) What is signal transduction? Explain briefly about any one of the signaling pathways.
2. a) Explain the metabolism and function of thyroid hormone.
(OR)
b) Discuss about synthesis and regulation of pineal hormones.
3. a) Write then biosynthesis, secretion and action of glucagon hormone on glucose metabolism.
(OR)
b) Explain the metabolism of corticosteroids and their deficiency disorders.
4. a) Write in detail about the function and regulation of testosterone.
(OR)
b) Explain the role of female reproductive hormones in menstruation cycle.

Section-B

5. Answer any **FIVE** of the following:
 - a) Parathyroid hormone
 - b) Ligand-receptor action
 - c) Gastrin
 - d) Adrenal gland
 - e) cortisol
 - f) Second messengers
 - g) IGF
 - h) Progesterone

ADIKAVI NANNAYA UNIVERSITY, RAJAHMUNDRY

M.Sc Biochemistry III Semester

Model Question Paper: Paper-II

BC302-Physiology and Bioenergetics

Time: 3hours

Max. Marks: 75

Answer ALL questions.

All questions carry equal marks

Section-A

1. a) Explain the process of digestion and adsorption of foods.
(OR)
b) Explain the physiology of renal system
2. a) Describe the structure of nerve and its function in the body.
(OR)
b) Write about the muscle physiology
3. a) Discuss the composition of blood and the mechanism of blood clotting
(OR)
b) Explain the regulation mechanism of respiration by lungs.
4. a) Write about various reactions involving high energy compounds.
(OR)
b) Explain the mechanism of proton motive force and energy changes in ETC.

Section-B

5. Answer any **FIVE** of the following:
 - a) Chymotrypsin
 - b) Acid base homeostasis
 - c) Synaptic transmission
 - d) Muscle proteins
 - e) Platelets
 - f) ECG
 - g) Gibb's free energy
 - h) Luminescence

ADIKAVI NANNAYA UNIVERSITY, RAJAHMUNDRY

**M.Sc Biochemistry III Semester
Model Question Paper: Paper-III
BC303-Intermediary Metabolism**

Time: 3hours

Max. Marks: 75

Answer ALL questions.

All questions carry equal marks

Section-A

1. a) Describe the path way of glucose metabolism
(OR)
b) Explain the metabolism of glycogen in the tissues.
2. a) Write the biosynthesis of methionine.
(OR)
b) Discuss the metabolism of urea.
3. a) Explain the fatty acid oxidation and its regulation.
(OR)
b) Describe the metabolism of triglycerides.
4. a) Explain the metabolism of purines and its regulation.
(OR)
b) Describe the metabolism of pyrimidines and its regulation.

Section-B

5. Answer any **FIVE** of the following:
 - a) Fructose metabolism
 - b) Glyoxylate cycle
 - c) Ubiquitin
 - d) Essential amino acids
 - e) Ketone bodies
 - f) Gaucher disease
 - g) Salvage pathway
 - h) Rifampicin

ADIKAVI NANNAYA UNIVERSITY, RAJAHMUNDRY

M.Sc Biochemistry III Semester

Model Question Paper: Paper-IV

BC304-Gene regulation and Genetic Engineering

Time: 3hours

Max. Marks: 75

Answer ALL questions.

All questions carry equal marks

Section-A

1. a) Explain the *lac* operon concept in prokaryotes.
(OR)
b) Discuss the reproductive cycles of virus.
2. a) Write the gene regulation in eukaryotic cells.
(OR)
b) Explain the regulation of galactose metabolism in yeast.
3. a) What are restriction endonucleases? Explain their role in genetic engineering.
(OR)
b) Explain different cloning vectors involved in gene modification.
4. a) Describe the construction of genomic and cDNA libraries.
(OR)
b) Explain the principle and applications of PCR technology.

Section-B

5. Answer any **FIVE** of the following:
 - a) Attenuation
 - b) Enhancers and repressors
 - c) Zinc finger motif
 - d) Chromatin remodeling
 - e) Ti plasmid
 - f) Knockout
 - g) RNA probe
 - h) Western Blot

ADIKAVI NANNAYA UNIVERSITY, RAJAHMUNDRY

M.Sc Biochemistry IV Semester

Model Question Paper: Paper-I

BC401-Plant and Environmental Biochemistry

Time: 3hours

Max. Marks: 75

Answer ALL questions.

All questions carry equal marks

Section-A

1. a) Explain the process of cyclic and non-cyclic photophosphorylation.
(OR)
b) Describe the Calvin cycle process in plants.
2. a) Describe the nitrogen cycle, assimilation of nitrogen in plants.
(OR)
b) Discuss the structure, physiological function and mechanism of action of phytohormones.
3. a) Explain the scope and importance of renewable and non renewable resources.
(OR)
b) Describe the energy flow in aquatic ecosystem and their conservation.
4. a) Explain the sources and causes of environmental pollution and suggest some remedial strategies for environment protection.
(OR)
b) Describe the causes and effects of urban and industrial wastes and explain solid waste management.

Section-B

5. Answer any **FIVE** of the following:
 - a) Hill reaction
 - b) Quantum efficiency
 - c) Lectins
 - d) Seed dormancy
 - e) Mineral resources
 - f) Biodiversity
 - g) Nuclear hazards
 - h) Marine pollution

ADIKAVI NANNAYA UNIVERSITY, RAJAHMUNDRY

M.Sc Biochemistry IV Semester

Model Question Paper: Paper-II

BC402-Clinical Biochemistry and Human Nutrition

Time: 3hours

Max. Marks: 75

Answer ALL questions.

All questions carry equal marks

Section-A

1. a) Discuss the scope and maintenance of biochemical laboratory assays.
(OR)
b) Explain the pancreatic and gastric function tests.
2. a) Describe the various prenatal diagnostic tests for screening genetic disorders.
(OR)
b) Explain the molecular markers for identifying the genetic defects.
3. a) Write the dietary requirements and bioavailability of macro and micronutrients for humans.
(OR)
b) Discuss the nutritional treatment for the prevention of non communicable adult diseases.
4. a) Explain the biological effects of food contaminants, non nutrients and anti nutrients.
(OR)
b) Write about the biological effects of vitamins and their deficiency disorders.

Section-B

5. Answer any **FIVE** of the following:
 - a) Quality control
 - b) Glucose tolerance test
 - c) RFLP
 - d) AIDS
 - e) BMR
 - f) Marasmus
 - g) Hemagglutinins
 - h) Pellagra

ADIKAVI NANNAYA UNIVERSITY, RAJAHMUNDRY

M.Sc Biochemistry IV Semester

Model Question Paper: Paper-III

BC403-Applied Biochemistry and Cancer Biology

Time: 3hours

Max. Marks: 75

Answer ALL questions.

All questions carry equal marks

Section-A

1. a) Discuss the molecular markers used for gene manipulation.
(OR)
b) Explain the principle, instrumentation and applications of Microarray.
2. a) Describe the isolation, propagation and maintenance of plant tissue culture.
(OR)
b) Write about stem cell technology and stem cell therapy.
3. a) Write the methodology for the production of various molecules with the help of fermentation technology.
(OR)
b) Describe the process and production of different biomolecules utilizing enzyme technology.
4. a) Explain the morphological and growth characteristics of cancer cells.
(OR)
b) What is gene therapy? Write about the role of gene therapy on cancer.

Section-B

5. Answer any **FIVE** of the following:
 - a) Chromosomal walking
 - b) RNA silencing
 - c) Totipotency
 - d) Embryonic stem cells
 - e) Pencillin
 - f) Nanotechnology
 - g) Oncogenes
 - h) chemotherapy

ADIKAVI NANNAYA UNIVERSITY, RAJAHMUNDRY

M.Sc Biochemistry IV Semester

Model Question Paper: Paper-IV

BC404 - Omics, Bioethics and Research Methodology

Time: 3hours

Max. Marks: 75

Answer ALL questions.

All questions carry equal marks

Section-A

1. a) What is MALDI-TOF? Mention its methodology, significance and applications in proteomics.

(OR)

- b) Explain protein structure prediction by Homology modeling.

2. a) Describe the steps involved in whole genome analysis.

(OR)

- b) Explain the concept of comparative genomics with molecular phylogeny.

3. a) Explain the Human Genome Project with its benefits, legal, ethical and social implications.

(OR)

- b) What are the genetically modified organisms? Discuss the moral, ethical and safety issues related to them.

- 4.a) Write the methodology for conducting research programme.

(OR)

- b) Explain the research paper writing and communication to peer reviewed research journals.

Section-B

1. Answer any **FIVE** of the following:

- a) RASMOL
- b) Molecular docking
- c) Cosmid library
- d) Genome annotation
- e) Laboratory accreditation
- f) GLP
- g) Impact factor
- h) Research hypothesis