UNIVERSITY OF CALICUT

(Abstract)

Scheme and Syllabus of M.Sc Bio-Chemistry of affiliated colleges under Credit Semester System (CUCSS-PG-2010) implemented with effect from 2010 admission-orders issued.

GENERAL & ACADEMIC BRANCH-IV 'J' SECTION

No. GA IV/J1/4545/10 Dated, Calicut University PO; 05.08.2010

Read: 1. U.O.No.GAIV/J1/1373/08 dated 23.07.2010.

2. Minutes of the meeting of the Board of Studies in Biochemistry of 11.06.2010.

3. Orders of the Vice-Chancellor in the file of even No. dated 02.08.2010.

O R D E R

As per paper read as (1) above, Credit Semester System at post graduate level in affiliated colleges (CUCSS-PG-2010) has been implemented from the academic year 2010 onwards.

The Board of Studies at its meeting, vide paper read as (2) above, examined and modified the Scheme and Syllabus of M.Sc.Biochemistry programme of affiliated colleges under Credit Semester System to be implemented from the academic year 2010-11 onwards.

The Vice-Chancellor, in view of exigency, has approved the minutes of the meeting of the Board, subject to ratification by the Academic Council.

Sanction has therefore been accorded to implement the scheme and syllabus of M.Sc.Biochemistry of affiliated colleges under Credit Semester System with effect from 2010 admission.

Orders are issued accordingly. Scheme and Syllabus appended.

Sd/-

DEPUTY REGISTRAR(G&A IV)
For REGISTRAR

To

1. The Principals of all affiliated Colleges offering M.Sc.Biochemistry.
2. Self financing centres of the University of Calicut offering Biochemistry (PG)

Copy to:

PS to VC/PA to Registrar/CE/Digital wing (with a request to upload in the University website)/Enquiry/Information Centres/DR III(Exams)/EG-I/DR PG/Tabulation Section/GA I 'F' 'G' sections/GAII/GAIII/SF/FC

Forwarded/By Order

Sd/-

SECTION OFFICER

UNIVERSITY OF CALICUT

SCHEME AND SYLLABUS FOR M. Sc. BIOCHEMISTRY
COURSE UNDER CREDIT –SEMESTER SYSTEM
2010-11.

Regulations, Scheme and Syllabus for M. Sc degree course in Biochemistry

Eligibility: A candidate seeking admission to M. Sc Biochemistry must have B. Sc in Biochemistry
Admission: 50% of marks obtained in B. Sc degree course
Curriculum: Course of study consists of two academic years with four semesters

Course Structure and Distribution of Marks

Course Structure

		No. of papers	External	Internal	Max. marks	Total marks
a)	Theory	13	80	20	100	1300
b)	Practical	6	80*	20	100	600

(*Experiment: 60 marks; Viva voce: 10 marks; Records: 10marks)

c) Dissertation Total marks: 100
(Submission: 75 marks; Presentation: 10 marks; Viva voce: 15 marks)

Grand Total for the Course 2000

Each Practical Examination should be conducted by **two** external examiners in the subject concerned

Internal assessment:

Assessment should include seminar, assignment, written test and marks for attendance with the following split up of marks: Seminar–5 marks; Assignment - 5 marks; Written test - 6 marks; Attendance -4; Total 20 marks

Course Structure

1st Semester

BCH 1C01	General and Analytical Biochemistry	
BCH 1C02	Cell Biology and Physiology	
BCH 1C03	Metabolism & Clinical Biochemistry	
BCH 1C04	Practical I	
BCH 1C05	Practical II	500 marks

2nd Semester

BCH 2C06	Enzymology and Enzyme Technology	
BCH 2C07	Microbiology and Immunology	
BCH 2C08	Structural Biology, Biostatistics and Bioinformatics	
BCH 2C09	Practical III	
BCH 2C10	Practical IV	500 marks

3rd Semester

BCH 3C11	Plant Biochemistry and Environmental Biochemistry	
BCH 3C12	Molecular Biology, Genetic Engineering, Patenting & IPR	
BCH 3C13	Biotechnology and Biosafety	
BCH 3C14	Practical V	

(Any two of the following courses)

BCH 3E01	Neurobiochemistry	
BCH 3E02	Nutritional Biochemistry	
BCH 3E03	Protein chemistry	
BCH 3E04	Clinical and Diagnostic Biochemistry	600 marks

4th Semester

BCH 4C15	Practical VI	
BCH 4C16	Project work and Viva voce	200 marks

(Any two of the following courses)

BCH4E 05	Genetics for Biologists	
BCH 4E06	Biochemical and environmental toxicology	
BCH 4E07	Biochemical engineering	BCH4E08 Cancer Biology 200 marks

Grand Total (500+500+600+400) = **2000 marks**

No	Code	Paper	Credit	Marks		
				Int	Ext	Total
Semester 1						
1	BCH 1C01	General and Analytical Biochemistry 5h/week	4	20	80	100
2	BCH 1C02	Cell Biology and Physiology 5h/week	4	20	80	100
3	BCH 1C03	Metabolism & Clinical Biochemistry 5h/week	4	20	80	100
4	BCH 1C04	Practical I 5h/week	2	20	80	100
5	BCH 1C05	Practical II 5h/week	2	20	80	100
Semester II						
6	BCH 2C06	Enzymology and Enzyme Technology 5h/week	4	20	80	100
7	BCH 2C07	Microbiology and Immunology 5h/week	4	20	80	100
8	BCH 2C08	Structural Biology, Biostatistics and	4	20	80	100
9	BCH 2C09	Practical III 5h/week	2	20	80	100
10	BCH 2C10	Practical IV 5h/week	2	20	80	100
Semester III						
12	BCH 3C11	Plant Biochemistry and Environmental	4	20	80	100
13	BCH 3C12	Molecular Biology, Genetic Engineering	4	20	80	100
14	BCH 3C13	Biotechnology and Biosafety 4h/week	4	20	80	100
15	BCH 3C14	Practical V 5h/week	2	20	80	100
(Any two of the following courses)						
16	BCH 3E01	Neurobiochemistry 4h/week	4	20	80	100
17	BCH 3E02	Nutritional Biochemistry 4h/week	4	20	80	100
18	BCH 3E03	Protein chemistry 4h/week	4	20	80	100
19	BCH 3E04	Clinical and Diagnostic Biochemistry ٤h/week	٤	٢٠	٨٠	١٠٠
Semester IV						
٢٠	BCH٤C١٥	Practical VI ١٠h/week	٦	٢٠	٨٠	١٠٠
٢١	BCH٤C١٦	Project work / Dissertation and Viva voce ٥h/week	٤	٢٠	٨٠	١٠٠
Any Two of the following elective courses						
٢٢	BCH ٤E٠٥	Genetics for Biologists ٥h/week	٤	٢٠	٨٠	١٠٠
٢٣	BCH ٤E٠٦	Biochemical and environmental toxicology ٥h/week	٤	٢٠	٨٠	١٠٠
٢٤	BCH ٤E٠٨	Biochemical engineering ٥h/week	٤	٢٠	٨٠	١٠٠
25	BCH 4C16	Cancer Biology 5h/week	4	20	80	100
		Total	72	2000		

S Y L L A B U S

SEMESTER-I

BCH 1C01. GENERAL AND ANALYTICAL BIOCHEMISTRY

Unit I. **Structure of atoms and molecules**: - Properties of sub atomic particles; concepts of orbits and electron distribution. Chemical bonds, Types of Bonds- covalent bond, ionic bond, hydrogen bond, Van der Waals forces and London forces. Significance of hydrogen bonding in biomolecules Structure and functions of Biomolecules: Structure, classifications and functions of carbohydrates-monosaccharides, disaccharides and polysaccharides. Sugar derivatives- Sugar acids, sugar alcohols, deoxysugars, aminosugars, glycosides and their functions, Glycosidic linkages, amino sugars, sugar derivatives, glycosides and their functions. Heteropolysaccharides, Glycosaminoglycans and Glycoproteins.

Unit II. **Structure and functions of amino acids and proteins**: Chemical structures and classifications of amino acids. Chemical properties of amino acids; Amino acid derivatives; Non-protein amino acids. Biological amines and their functions; small peptides and cyclic peptides and their biological functions. Proteins: Different types; classifications, physicochemical properties of proteins; structural organization of proteins, primary secondary, tertiary and quaternary structures.

Unit III. Lipids: Structure, properties and classification; Classification of fatty acids – saturated, unsaturated and poly-unsaturated, short chain, medium chain and long chain fatty acids. Triglycerides, phospholipids, prostaglandins, prostacyclins and leukotrienes; Sphingolipids and glycolipids. **Structure and properties of nucleic acids**:- Purine and Pyrimidine bases; Nucleosides, nucleotides, nucleoside analogues. DNA-structure: Watson and Crick structure

Unit IV. Hormones:- Chemical structure, properties and functions of different types of hormones. Classification –based on chemical nature and mechanism of action. Regulation of endocrine function, Hormone receptors, signaling; Nitrous oxide and endocrine hormones; and molecular clinical evaluation.

Unit V. Nutrition and dietary habits- Physiology and nutrition of carbohydrates, fats, proteins and water. Vitamins A, D E, K, vitamin B complex and vitamin C. Minerals and their biological function. Basic food groups, energy providing foods, body building foods and protective foods. Composition of balanced diet, Required Dietary Allowance for an average Indian. Locally available foods, inexpensive quality foods and food stuffs rich in more than one nutrient.

Unit VI. Energy requirements during growth, pregnancy, lactation and various physiological activities. Specific domain action (SDA) of foods. Malnutrition- its implications and relationship with dietary habits. Prevention of malnutrition, especially protein calories malnutrition, Kwashiorkar or Marasmus by improvement of diets. Human milk and its virtues. Food preservation standards, Food adulteration and precautions. Government regulations on preservation and quality of food

Unit VII. Laboratory safety protocols. Preparation of solutions. Preparation of buffers. Nature of radioactivity, properties of α, β,γ rays, measurement of radioactivity. Principles and applications of tracer techniques in Biology, Radioactive isotopes-applications in biological research, Effect of radiations on biological systems. Autoradiography and its applications, Geiger-Muller counter.

Unit VIII. Principles and applications of centrifugation; Different Centrifugation techniques Electrophoretic techniques and applications. Chromatographic techniques-different types. HPLC, GC, Colorimetry, spectrophotometry, fluorimetry and flame photometry.

Unit IX. Spectroscopy – Mass spectroscopy, NMR; Atomic absorption and Emission spectroscopy, ORD and CD, Electron –spray. Rotary evaporator. Lyophilization techniques – principles and applications. Biphasic separation, Colloids-properties. Solutions-properties,

Osmosis, diffusion, dialysis. Polar and non-polar solvents.

Unit X. Basic understanding of clinical samples – Blood, CSF, urine, bile; biopsy specimens. Methods for collection and preservation of samples. Instruments used in an automated Biochemistry laboratory. Auto-Analyzers, spectrophotometer, colorimeter, hematology counter, Blood gas analyzers; ELISA reader

References

1. Conn E E and Stump P K, Outlines of Biochemistry,Wiley, N. Delhi
2. Creighton Thomas E, Proteins: Structures and molecular properties, W H Freeman &Co New York
3. Donald T Haynie, Biological thermodynamics, Cambridge university press
4. Ganong, Medical physiology
5. Garrett Reginald H and Grisham Charles M, Biochemistry, Saunders College Publishing, Philadelphia
6. Gowenlock Alan H, Varley's Practical Clinical Biochemistry, C B S publications
7. Guyton Arthur, Text Book of Medical Physiology, Elsvier, N. Delhi
8. Harold Harper, Review of Physiological chemistry, Marusan Co
9. Keith Wilson & John Walker, Principles and Techniques of Biochemistry & Molecular biology Cambridge Press
10. Lehninger Albert, Biochemistry, Kalyani publications, N. Delhi
11. Plummer David T, An introduction to practical Biochemistry, Tata Mac Graw Hill
12. SK Sawhney, R. Singh, Introductory Practical Biochemistry, Narosa publishing house
13. Stryer Lubert & Hall John E, Biochemistry, Freemann
14. Voet Donald & Voet Judith, Biochemistry, John Wiley sons, US

BCH 1C02 . CELL BIOLOGY AND PHYSIOLOGY

Unit I. Events in the development of Cell Biology. Cell Theory. Prokaryotic and eukaryotic cell; cell structure and integrity; structure, composition and function of organelles; cell division, mitosis, meiosis, cell cycle and its control, apoptosis. Aging and senescence. Properties of cancer cells. Stem cells. Flow cytometry and cell sorting – sub cellular fractionation. cell-cell fusion in both normal and abnormal cells.

Unit II. Biomembranes- structure and composition, preceptor biology and concepts of cell signaling, transport across membrane, passive, active, symport, antiport, uniport, ion channels, Endocytosis, exocytosis, phagocytosis, pinocytosis, cell-cell, cell-matrix interaction, cell adhesion – cell differentiation, and tissue morphogenesis. Cytokines, growth factors

Unit II. Cell signaling: Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two-component signaling systems, bacterial chemotaxis and quorum sensing. Cellular communication: Regulation of hematopoiesis, general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation.

Unit III. Blood: composition, haemopoiesis, Homeostasis and coagulation of blood. Clotting factors, clotting factors. Disorders of clotting. Plasma proteins and their function. Hemoglobin structure and function. Lymph- Composition and function. Reticulo endothelial system. Spleen- structure and function. Heart anatomy, nerve innervations, cardiac cycle, cardiac output, regulatory mechanisms. Respiratory mechanism, transport of gases. Surfactant nature and function, Respiratory membrane and its importance, gas exchange, regulation; Hemophilia.

Unit IV. Composition, structure and functions of muscle cells; molecular basis of skeletal, smooth and cardiac muscles; muscle contraction; biochemical composition of nerves tissue; mechanism of transmission of nerve impulses. Autonomous nervous system- Sympathetic and parasympathetic functions, Neurotransmitters. Functions of hypothalamus. Endocrine glands, secretions and functions, pheromones. Structure and function of eye, ear, taste buds and olfactory receptors.

Muscular dystrophy.α

Unit V. Types of salivary glands, Salivary secretion, Composition of saliva, regulation and functions. Gastric and pancreatic secretion. Gastro intestinal hormones, regulation. Glomerular filtration, urine composition, homeostasis. Acid base balance. Disease related to digestion and absorption of food. Achlorohydria; ulcers gastritis; H.pylori - induced gastritis.

Unit VI. Structure and function of nephron. Renal blood flow and its importance. Composition of urine. GFR, Functions of tubules, Nerve supply to urinary bladder. Thermoregulation: Comfort zone, body temperature – physical, chemical, neural regulation, acclimatization. Stress and adaptation

References

1. De Robertis E D F & De Robertis E M F, Cell and Molecular Biology, Allied Pub Ltd
2. Guyton Arthur, Text Book of Medical Physiology, Elsvier, N. Delhi
3. Harold Harper, Review of Physiological chemistry, Marusan Co
4. William Ganong, Review of medical physiology, McGraw Hill

BCH 1C03 . METABOLISM & CLINICAL BIOCHEMISTRY

Unit 1. Carbohydrate metabolism – Glycolysis – aerobic and anaerobic types; alcohol fermentation; regulation of glycolysis. HMP–shunt and its significance. Gluconeogenesis, glycogenesis and glycogenolysis. Nucleoside diphosphate sugars and glycosidic bond formation; sucrose, lactose, starch and glycogen synthesis. Pyruvate dehydrogenase complex. Krebs cycle, anaplerotic reactions; substrate–level phosphorylation. Electron transport chain- components; oxidative phosphorylation and mechanism of ATP formation; Chemi-osmotic coupling hypothesis and other hypothesis. Structural basis of free energy of hydrolysis of ATP. Glyoxylate cycle-significance, regulation; Cyanide-insensitive respiration and its significance. Uronic acid pathway. Metabolism of alcohol and alcohol toxicity. Disorders of carbohydrate metabolism-glycogen storage diseases; Diabetes mellitus; Galactosemia and lactose intolerance. Mucopolysaccharides. Glucose tolerance tests.

Unit II. Amino acid metabolism: Deamination, transamination, transmethylation and decarboxylaton reactions of amino acids. Synthesis and degradation of various amino acids; essential, semi-essential and non-essential amino acids; Classification of amino acids based on metabolic end product- glucogenic and ketogenic. Urea cycle and its regulation. Proteolytic enzymes. Protein turnover. Disorders of protein metabolism- PEM; Phenylketonurea and alkaptonurea; Tyrosinaemia; MSUD; Cystienurea; methylmalonyl urea. Urea cycle disorders; albinism.

Unit III. Lipid metabolism – VLDL, LDL, and HDL – their formation and degradation. Fatty acid mobilization; Fatty acid oxidation; α, β, and ω- oxidations; Fatty acid biosynthesis in plants and animals- fatty acid synthetase complex; synthesis of unsaturated and long chain fatty acids. Cholesterol biosynthesis and degradation. Ketone body metabolism. Metabolism of prostaglandins, prostacyclins and leukotrienes. Disorders of lipid metabolism- Hyperlipidemia, Hyper cholesterolemia; Metabolic acidosis, disorders of ketone body metabolism, sphingolipidosis; diseases associated with lipoprotein metabolism- atherosclerosis and coronary artery diseases; fatty liver, and lipotrophic factors

Unit IV. Nucleic acid metabolism: purines and pyrimidines – biosynthesis and regulation, degradation; Uric acid formation; Salvage and de novo pathways. Heme and prophyrin metabolism, Heme biosynthesis and bile pigment formation. Metabolism of xenobiotics. Detoxification mechanisms - different types. Mineral metabolism – Macro and micronutrients – their specific biochemical functions. Disorders of nucleic acid metabolism-Purine and pyrimidine metabolism; Uric acid and gout ; Gouty arthritis.

Unit V. Disorders of hormonal imbalance – Hyper and hypothyroidism, growth hormone imbalance, disorders of sex hormone imbalance, Organ functions and function tests- Liver functions and liver function test. Hepatitis, cirrhosis; jaundice, hepatic coma. Tests for the

assessment of liver functions. Kidney functions and kidney function tests- creatine clearance and insulin clearance. Cardiac function tests. Gastric function test.

Unit VI . Regulation of physiological pH- Different mechanisms. Buffer systems of the body. Quality control in Biochemical analysis. Concepts of accuracy, precision, reliability reproducibility and other factors of quality control; normal values, therapeutic index.

References

1. Donald T Haynie, Biological thermodynamics, Cambridge university press
2. Stryer Lubert & Hall John E, Biochemistry, Freemann
3. Lehninger Albert, Biochemistry, Kalyani publications, N. Delhi
4. Harold Harper, Review of Physiological chemistry, Marusan Co
5. Conn E E and Stump P K, Outlines of Biochemistry,Wiley, N. Delhi
6. Voet Donald & Voet Judith, Biochemistry, John Wiley sons, US
7. Garrett Reginald H and Grisham Charles M, Biochemistry, Saunders College Publishing, Philadelphia
8. Devlin Thomas M, Text Book of Biochemistry with clinical correlations, Wiley Liss, New York
9. Zubay Geoffrey, Biochemistry, Wm C Brown publishers
10. Murray Robert et al, Harper's Biochemistry, Appleton & Lange
11. Vasudevan D M and Sreekumari S, Text Book of Biochemistry for medical students, Jayadeep Brothers, N. Delhi
12. Kaplan Lawrence A et al, Clinical Chemistry, Mosby, Missouri

BCH 1C04 . PRACTICAL I

1. Qualitative analysis of carbohydrates (monosaccharide, disaccharides and polysaccharides)
2. Qualitative analysis of proteins and amino acids
3. Preparation of buffers using pH meter.
4. Detection of isoelectric pH of a protein
5. Quantitative estimation of proteins – Comparative evaluation by Lowry *et al* method, Bradford method, Biuret method and spectrophotometric method.
6. Quantitative estimation of reducing sugar
7. Quantitative estimation of cholesterol.
8. Estimation of muscle and liver glycogen.
9. Extraction and estimation of starch
10. Iodine value and saponification value of oils
11. Detection of abnormal constituents in urine sample
12. Assay of serum AST and ALT
13. Estimation of Serum bilirubin, creatinine and calcium
14. Paper Chromatography of sugars
15. TLC of amino acids
16. Column chromatography of plant pigments and analysis of the spectra of different fractions.
17. Polyacrylamide gel electrophoresis of proteins
18. Centrifugation: Organelle separation by differential centrifugation and density gradient centrifugation.

BCH 1C05 . PRACTICAL II

1. Examination of onion root tip cells for different stages of cell division
2. Karyotype preparation
3. Blood smear preparation, differential WBC count, total WBC count

and total RBC count
4. Erythrocyte sedimentation rate (ESR)
5. Clinical examination of radial pulse
6. Blood pressure measurement
7. Recording of lung volume and lung capacities using students' respirometer

SEMESTER II

BCH 2C06 . ENZYMOLOGY AND ENZYME TECHNOLOGY.

Unit I. Enzymes: Classification, naming and E.C numbering of enzymes. General properties of enzymes. Enzyme structure – apoenzyme and holoenzyme, co-enzyme and co-factors. Structure of active site of enzyme. Mechanisms of enzyme catalysis- different types. Formation of enzyme substrate complex- lock and key and induced fit hypothesis of enzyme-substrate interaction; transition state and energy of activation. Enzyme kinetics: Michaelis – Menten equation; K_M value and its significance. In vitro measurement of enzyme activity- factors affecting enzyme activity. Regulation of enzyme activity – covalent modification; allosteric regulation; feed back regulation. Enzyme inhibition – Competitive and non-competitive and uncompetitive inhibition. Inhibitor constant (K_I) and its determination.

Unit II. Co-enzymes – chemical structures and specific functions. Multimeric enzymes; multienzyme complexes. Structure of pyruvate dehydrogenase complex and the mechanism of catalysis. Isoenzymes - properties and significance. Lactate dehydrogenase. Intracellular and extra cellular enzymes; soluble and membrane bound enzymes.

Unit III. Ribozymes – structure, properties and functions. Abzymes – structure, properties and function. Gastro intestinal enzymes- properties and functions. Microbial enzymes- amylases, lipases and proteases. Enzyme immobilization techniques. Different procedures for immobilization. Applications of immobilized enzymes. Extraction and purification of enzymes from different sources – plant, animal and microbial. Composition of extraction media. Cell disruption and homogenization techniques. Steps in purification- salt fractionation, dialysis, chromatography (molecular sieving, ion exchange, adsorption, affinity). Test of purity. Specific activity determination and enrichment. Enzyme localization.

Unit IV. Measurement of enzyme activity: direct and indirect methods. Applications of enzymes in genetic engineering and biotechnology. Taq Polymerase and reverse transcriptases – their applications. Restriction endonucleases and ligases – their applications. Applications of enzyme in food, beverages and pharmaceutical industries. Enzyme-based diagnostic techniques – ELISA. Enzymes in quantitative biochemical procedures and diagnostic kits. Enzymes used as diagnostic tools. Therapeutic enzymes and their future prospects.

References

1. Price Nicholas C, Fundamentals of Enzymology, Oxford city press, New York
2. Voet Donald & Voet Judith, Biochemistry, John Wiley sons, US
3. Dixon & Webb, Enzymes, Acdemic press
4. Palmer Trevor, Enzymes: Biochemistry, Biotechnology and Clinical chemistry, Horwood Publishing, Chichester
5. Conn E E , Stump P K Bruening G and Doi R H Outlines of Biochemistry, 5 th Ed, John Wiley & Sons, New York
6. Creighton Thomas E, Proteins: Structures and molecular properties, W H Freeman &Co New York

BCH 2C07 . MICROBIOLOGY AND IMMUNOLOGY

Unit I. History of microbiology –mile stones. Five kingdom classification of living systems. Prokaryotes and Eukaryotes. Various approaches used in microbial classification. Molecular level approaches used in microbial taxonomy. Microscopy: Bright field, dark field, phase contrast and electron microscopy. Specimen preparation and staining.

Unit II. Ultra structure of bacterial cell. Movement of substances across membranes and membrane transport systems. Cytosol and cell organelles. Storage granules, chromosome and extra cellular genetic materials. Spores, sporulation and associated production of usefuls. Structure of virus, bacteriophage, fungi and protozoa. Cultivation of bacteria; Nutritional types of

bacteria; phototrophs, chemotrophs, auxotrophs, and heterotrophs. Bacterial media, types of media, preparation of media, physical condition required for growth- temperature, pH, gaseous requirement etc. Culture methods- anaerobic culture method, method of isolating pure cultures. Brief account of viral and fungal cultivation. Virus attack on cells; phage attack on bacteria.

Unit III. Sterilization and disinfection; physical agents – dry heat, moist heat, pasteurization, autoclaving, boiling, filtration, radiation. Chemical agents – alcohol, aldehyde, dyes, halogen, phenol, surface acting agents, metallic salts. Testing of disinfectants. Rideal Walker coefficient. Microbial genetics; Spontaneous and induced mutation, UV damage and repair, replica plating, genetic transfer, bacterial transformation, transduction and conjugation.

Unit IV. Environmental microbiology, biochemical role of soil microorganism, nitrogen cycle, proteolysis, ammonification, nitrification, denitrification, nitrogen fixation – symbiotic and non symbiotic. Air microbiology; Source of microbes in air, factors effecting the extent and type of microorganisms in air. Air sanitation; microbiology of water and waste water. Bacteriological techniques for detecting water quality, presumptive test, confirmed and complete test.

Unit V. Host parasite interaction: Recognition and entry processes of different pathogens like bacteria, viruses into animal and plant host cells, alteration of host cell behavior by pathogens, virus-induced cell transformation, pathogen-induced diseases in animals and plants **.** Types of immunity- innate, acquired, passive and active. Physiology of immune response, influencing factors, phagocytosis, fever, complement system. Antigens and antibody interaction- its biochemistry. Types of antigens, Structural aspects of biological antigens-determinants/epitopes-linear, conformational. Haptens; structure of immunoglobulin; synthesis and secretion of immunoglobulin molecules. Regulation. Catalytic antibodies. Plantibodies, Classes of Immunoglobulins, distribution and function. Organs of the immune system. Ontogeny and physiology of immune system-origin, development, activation and differentiation of B & T cell receptors.

Unit VI. Structure and functions of class I and class II molecules. MHC restriction. Antigen processing and presentation. Effector mechanisms of immune response; macrophage activation; Cell mediated cytotoxicity.

Unit VII. The complement system, classical and alternative pathway- biological functions; immunoregulation helper and suppressor cells, immune response genes, immunological tolerance, immunosuppressive drugs and immunity. Preparations of vaccines and vaccination. Immunotherapy, Immunologic tolerance. Immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections, congenital and acquired immunodeficiencies, vaccines.

Unit VII. Hyper sensitivity reaction – type I reaction- components of type 1 reaction; mechanism of IgE – mediated degranulation, mediators, consequences, regulations, type II transfusion reactions, hemolytic diseases of newborn, drug induced hemolytic anemia-type III- localized and centralized reactions. Immunological methods – interpretation and application of immunological diagnostic techniques. Immunohistochemistry- localization of antigen in cells and tissues. Hybridoma technology.

References

1. Abbas Abdul K, Cellular and Molecular Immunology, W B Saunders Co
2. Alcamo Edward, Fundamentals of Microbiology, Jones & Barrett Publications, Massqchusetts
3. Anantha Narayanan & Jayaram Panicker, Text Book of Microbiology, Orient Longmann
4. Cappuccino James G & Sherman Natalie, Microbiology: A Laboratory Manual, Pearson Education (P), Singapore
5. Casida L E, Industrial Microbiology, New Age International publications, N. Delhi
6. Janeway Charles A and Travers Paul, Immunobiology, Blackwell scientific publications
7. Kuby Janis, Immunology, W H Freeman, New York
8. Lim Daniel V, Microbiology, West Publishing Co, New York
9. Mitchell Ralph, Environmental Microbiology, John Wiley &Sons Inc

10. Pelczar Michael J, Microbiology, Mc Graw Hill, N.Delhi
11. Reed Gerald, Prescott and Dunn's industrial Microbiology, C B S publications
12. Roitt Ivan et al, Immunology, Mosby, London
13. Stainer Roger Y, General Microbiology, Mac Millon, London
14. Tortora Gerard J et al, Microbiology An Introduction, Benjamin Cummings Pub Co

BCH 2C08. STRUCTURAL BIOLOGY, BIOSTATISTICS AND BIOINFORMATICS

UnitI. Principles and practice of statistical methods in biological research. Basic statistics-averages, statistics of dispersion, coefficient of variations, standard deviation, standard error, probability, distributions, tests of statistical significance, Students T-test, basics of correlation and regression, analysis of variance.

Unit II. Structural organization in proteins – Ramachandran Map and protein conformation. Role of individual amino acids in protein structure; amino acid propensities, Structure prediction methods. Protein engineering. Three dimensional structure of Hb, Immunoglobulins, Rubisco, Interferon, Interleukins and ATP-ase.

Unit III. Structure, conformation and properties of polysaccharides. Structure and conformation of nucleic acids-DNA and RNA; Different forms of DNA-A, B and Z types; Structure, properties and functions of different forms of RNAs. 3-D structure of tRNA. Organization of chromatin structure. DNA-protein interactions. Structure and properties of high-energy phosphate compounds such as ATP, GTP, CTP, phosphoarginine, acetyl phosphate and phosphocreatine. Crystallization techniques for biomolecules, Crystallography.

Unit IV. Computers and Bioinformatics: Computer, operating systems, File management. Technical writing- Preparation of a scientific report, Presentation of a review, Design of the experiment, Parameters used, Data obtained, Interpretation and summary

Unit V. Data bases, Biological data bases; sequencing and sequences of information networks, Protein information resources, Genome information resources, Internet sites, search tools, sequence including pair wise alignment, multiple sequences alignment, analysis packages; image analysis. Molecular modeling studies.

References

1. Creighton Thomas E, Proteins: Structures and molecular properties, W H Freeman &Co New York
2. Lehninger Albert, Biochemistry, Kalyani publications, N. Delhi
3. Donald T Haynie, Biological thermodynamics, Cambridge university press
4. Keith Wilson & John Walker, Principles and Techniques of Biochemistry & Molecular biology Cambridge Press
5. W W Daniel John, Biostatistics a foundation for analysis in the health, (7 th ed 1999) Wley and Sons Inc., Newyork

BCH 2C09 . PRACTICAL III

1. Assay of Alkaline and acid phosphatases in serum samples
2. Assay of serum amylase
3. Enzyme assays: Determination of optimum pH, optimum temperature, enzyme proportionality and time proportionality.
4. Ammonium sulfate fractionation of enzyme and desalting by dialysis/Sephadex G-25 filtration
5. Determination of total activity and specific activity of an enzyme.
6. Determination of Michaelis-Menten constant (K_M) of an enzyme by Lineweaver-Burk method.
7. Determination of inhibitor constant (K_I) of an enzyme by Dixon's method.

8. Extraction of enzymes from animal tissues and isoenzyme analysis by PAGE

BCH 2C10 . PRACTICAL IV

1. Gram's staining
2. Acid fast staining
3. IMVIC tests
4. Fermentation of carbohydrates
5. Antibiotic sensitivity test
6. Production of microbial enzymes- amylase, cellulase, lipase and pectinolytic enzymes
7. Widal test
8. VDRL test
9. Elisa
10. Immunodiffusion method
11. Immunoelectrophoresis
12. Complement fixation

SEMESTER III

BCH 3C11. PLANT BIOCHEMISTRY AND ENVIRONMENTAL BIOCHEMISTRY

Unit I. General properties of fungi, lichens, pteridophytes and bryophytes, gymnosperms, angiosperms; monocots and dicots. General scheme for classification of plants. Photosynthesis – Different photo systems; Light and dark reactions. Photosynthesis in C-4 plants. C-2 and C-3 pathways, Photorespiration, Rubisco, CAM plants

Unit II. Plant pigments – structure, properties sand functions of chlorophylls, xanthophylls and carotenoids; lycopene. Secondary plant products– Flavanoids, polyphenols, coumarins, terpenoids, phytosterols steroidal alkaloids etc; Essential oils chemical composition and properties. Roles of secondary metabolites in plants.

Unit III. Plant alkaloids- Caffeine, theophylline, nicotine and caryophyillin. Lignin chemistry and functions; Chemistry and functions of pectin, tannins, hemicelluloses and cellulose; Chemistry of fibers. Lectins, Plant toxins ; Plant hormones and growth regulators –chemistry and functions. Plant Defense mechanisms; Phyto allexins – chemistry and functions.

Unit IV. Biochemistry of leaf senescence and abscission ; Biochemistry of fruit ripening. Biochemistry of seed germination and dormancy. Biochemistry of nitrogen fixation –Nitrogenase enzyme – structure and functions. Sensory photobiology: Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins; stomatal movement; photoperiodism and biological clocks.

Unit V. Biochemistry of humus formation. Bio-geochemical cycles – carbon cycle; nitrogen cycle, sulphur cycle, phosphorus cycle. Bioremediation and phytoremediation. Xenobiotic metabolism: Absorption & distribution. Phase I reactions. Oxidation, Reduction, Hydrolysis and Hydration. Phase II reactions/Conjugation: Methylation, Glutathione and amino acid conjugations. Detoxification. Biochemical basis of toxicity: Mechanisms of Toxicity: Disturbance of Excitable membrane function. Altered calcium Homeostasis. Covalent binding to cellular macromolecules & Genotoxicity. Tissue specificity of Toxicity.

References

1. Buchnan B B and Gruissem W and Jones R L , Molecular biology of plants, Society of American Plant physiologists
2. Anderson J W and Boardall J, Molecular activities of plant cell
3. Bonner J and Varner J E, Plant Biochemistry, Acdemic Press, New York
4. Taiz L and Zeiger E, Plant Physiology, 2 nd Ed., Sinauer Associates, Inc Publishers,Massachussetts
5. Hopkins W G , Introduction to plant physiology, John Wiley & Sonsa, New York
6. Salisbury F B & Ross C W, Plant Physiology, 4 th Ed Wadsworth Publishing Company, California
7. Noggle G R and Fritz G J , Introductory Plant Physiology, Prantice Hall of India Pvt Ltd, N. Delhi

BCH3C12. MOLECULAR BIOLOGY, GENETIC ENGINEERING, PATENTING & IPR

Unit I. Chromosome- structure and organization. Chromatin, nucleosome, histones, Super coiling of DNA, Topoisomerases, mitochondrial DNA, chloroplast DNA. Nucleic acid as genetic information carriers. DNA replication, DNA polymerase and ligases. Regulation of DNA synthesis. Mechanism of transcription and its regulation. RNA polymerase. Post transcriptional modification. Role of histones in gene expression. Introns, exons, split genes, overlapping genes. Types of RNA; genetic code. Translation, regulation of gene expression, operons, eukaryotic gene expression, attenuation and antitermination. DNA damage and repair. Human genome project. Genomics

Unit II. Restriction digestion of DNA, separation by isopycnic & agarose gel methods. Cloning vectors – plasmids, BACs, PACs & YACs, cutting & joining DNA molecules, linkers, adaptors & homopolymer tailing, DNA libraries – construction of DNA libraries, genomic & DNA libraries, PCR- different types like RT-PCR, long PCR, inverse PCR, quantitative PCR, differential display PCR, RAPD etc., probes- radio labelled DNA/RNA probes, synthetic oligonucleotide probes, cloning strategies – cloning in E.coli, yeast & gram positive bacteria, expression strategies for heterogenous genes, vector engineering & codon optimization, screening strategies, screening by hybridization, colony hybridization, plaque lift assay, Northern, southern & western blotting, FISH, reporter assays, Genomic analysis

Unit III. DNA sequencing, nucleic acid microarrays, site directed mutagenesis & protein engineering, DNA introduction methods like calcium chloride facilitated uptake, micro injection, electroporation, particle bombardment, use of Ti plasmid in generating transgenic plants. Molecular markers in genome analysis: RFLP, RAPD, AFLP analysis. RNA interference.

Unit IV. Ethical aspects of interfering in natural process; hidden dangers in altering genetic make up. Objectives of the patent system, basic principles and general requirements of patent law, technological inventions and patent law, legal development, patentable subjects and protection in biotechnology, international convention for the protection of new varieties – Strasbourg convention, UPOV convention.

Unit V. The patentability of micro organisms – claims, characterization and repeatability, disposition in the culture collections, legal protection for plants and other higher organisms, new plant varieties by rights, tissue culture protocols, transfer of technology. Patentability of inanimate products of nature – vectors, FDA, FPA. Patent office practice – trade secrets, copy right, infringement problems, harmonization of patent law, IPR and plant genetic resources, GAAT and TRIPS.

References

1. Lodish Harvey, Molecular cell Biology, Scientific American Books Inc, New York
2. Friefelder David, Molecular Biology, Narosa Publications, N. Delhi
3. Prescott Lansing M, Harley John P & Klein Donald A, Microbiology, Mc Graw Hill, New York
4. Primrose S B, Principles of Gene Manipulation, Blackwell Science, U S A
5. Karp Gerald, Cell and Molecular Biology Concepts and Experiments, John Wiley & Sons Inc, New York
6. Lewin Benjamin, Genes, Wiley Eastern Ltd
7. Weaver Robert F, Molecular Biology, Mc Graw Hill
8. Sambrook Joseph & Russell David W, Molecular Cloning- A laboratory Manual, Cold Spring Harbour laboratory press, New York
9. W R Cornish, Intellectual property patents,copy right, trade marks and allied rights, Sweet and Maxwell, London
10. Walter E Hill, Genetic engineering- A primer, Taylor and Francis, London and Newyork

BCH 3C13 . BIOTECHNOLOGY AND BIOSAFETY

Unit 1. Totipotency. Tissue culture techniques and its applications. Callus formation; dedifferentiation, redifferentiation and morphogenesis. Composition of MS medium, Tissue culture techniques in the production of secondary metabolites. Anther culture, Embryo culture, Somatic embryogenesis, Somaclonal variations. Protoplast fusion, Cybrids. Cell lines, cell clones, Hybridoma technology. Transgenic plants and animals. *Agrobacterium tumefaciens*, Ti plasmid and its applications, Biopesticides and bioinsecticides- *Bacillus thuringenesis* Biopharming

Unit II Plasmids, Cosmids, Vectors, Recombinant DNA technology / gene cloning and its potential applications. Restriction enzymes, Ligases, Restriction map. Production of vaccines, Gene therapy, Tissue engineering, Stem cell therapy, Cell cloning.

Unit III Introduction to Environmental biotechnology, Biodegradation, Bioremediation, Biomagnification, Degradation of pesticides- residual metabolism. Role of microbes in abatement of pollution, Biofilms, Biosensors, Bioindicators, Biofertilizers, Biosurfactants.

Unit IV Fermentation of foods; Fermentors and bioreactors, Production of antibiotics; enzymes, hormones, organic acids, alkaloids, steroids, alcohol. Production of Biopolymers. Single cell protein – Importance of spirulina. Genetically modified foods.

Unit V Biosafety – objectives, definition, recombinant DNA safety, classification of pathogenic microorganisms, biological containment (BC) and physical containment (PC) biosafety levels. Guidelines for rDNA research activities – large scale experiments. Release to the environment, import and shipment, quality control of biological produced by rDNA technology. Mechanism of implementation. Biosafety practices – code of practice, containment laboratory design and facilities. Large scale operations – physical containment condition for large scale fermentation experiment and production criteria for DNA.

References:-

1. Bhojwani S S & Razdan M K, Plant tissue culture Theory and Practice, Elsevier, London
2. Buchnan B B and Gruissem W and Jones R L, Molecular biology of plants, Society of American Plant physiologists
3. Casida L E, Industrial Microbiology, New Age International publications, N. Delhi
4. David W Mount, Bioinformatics-Sequence & genome analysis, Cold Spring Habor Laboratory Press
5. De Robertis E D F & De Robertis E M F, Cell and Molecular Biology, Allied Pub Ltd
6. Freifelder David, Essentials of Molecular Biology, Narosa publishing House, N. Delhi
7. Hassen A Sadek, Bioinfomatics- principles and basic internet applications
8. Karp Gerald, Cell and Molecular Biology Concepts and Experiments, John Wiley & Sons Inc, New York
9. Lewin Benjamin, Genes, Wiley Eastern Ltd
10. Lodish Harvey, Molecular cell Biology, Scientific American Books Inc, New York
11. Micromanufacturing and Nanotechnology. N.P. Mahalik (Ed.) Springer.
12. Mitchell Ralph, Environmental Microbiology, John Wiley &Sons Inc
13. Prescott Lansing M, Harley John P & Klein Donald A, Microbiology, Mc Graw Hill, New York
14. Primrose S B, Principles of Gene Manipulation, Blackwell Science, U S A
15. Principles of Nanotechnology by G. Ali Mansoori. World Scientific, New Jersey.
16. Reed Gerald, Prescott and Dunn's Industrial Microbiology, C B S publications
17. Snustad Peter D &Simmons Michael J, Principles of Genetics, John Wiley & Sons Inc, USA
18. Weaver Robert F, Molecular Biology, Mc Graw Hill

BCH 3C14. Practical V

1. Using Swiss-Prot, GenBank and PDB
2. Similarity search - BLAST
3. Multiple Sequence Alignment - CLUSTAL W
4. Secondary Structure Prediction of Protein
5. Protein/Nucleotide Sequence Analysis using EMBOSS
6. Molecular Visualisation of Protein- RASMOL
7. Small molecule building using ISIS Draw and visualization using Rasmol
8. Small molecule building using Chemsketch and visulisation using 3D viewer and Rasmol
9. Small molecule visualization using SPDBV
10. Homology modeling using SPDBV
11. Biostatistics problems

BCH 3E01 . NEUROBIOCHEMISTRY

Unit I Role of the Nervous System in Homeostasis: Cellular organization of specific regions such as cerebellum, cerebral cortex, hippocampus, retina, evolution of the nervous system – a comparative aspect. Electrophysiology of Channels: EEG patterns. Chemical Composition of Brain: Formation, structure and biochemistry of myelin, chemistry of major brain lipids, developmental changes, lipid composition, biosynthesis and catabolism of major lipids, characteristics of brain lipids, regional variations. Neurotransmitter: Chemistry, synthesis, storage and release of nervous neurotransmitters, transmitter action, synaptic modulation and mechanism of neuronal integration.

Unit II. Biochemical aspects of muscle disease, muscular dystrophies, myotonic dystrophy, periodic paralysis, glycogen storage diseases affecting muscle functions. BBB –characteristics and morphology. Structure of the synapse, correlation of structure and function at the synapse, transmission across the synapse, pre and post synaptic events, membrane potential in the steady state action, action potential and propagation of nerve impulse.

Unit III. Neurotoxic agents and diseases related to them. Chemistry of neuroleptics and anxiolytics, antidepressants, hallucionogenic agents, biochemical theories of mental disorders. Neurodegenerative Disorders: Parkinson's Alzheimer's disease, amyotrophic lateral sclerosis, senile dementia.

References

1. Basic Neurochemistry by Siegel.
2. Elements of Molecular Neurotoxicology by CUM Smith.
3. Neuru anatomy Grossman & Neavy.

BCH 3E02 . NUTRITIONAL BIOCHEMISTRY

Unit I. Composition of human body. Energy content of foods. Measurement of energy expenditure: Direct & indirect calorimetry. Definition of BMR and SDA and factors affecting these. Thermogenic effects of foods. Energy requirements of man and woman and factors affecting energy requirements.

Unit II. Dietary requirements and sources of available and unavailable carbohydrates. Physico-chemical properties and physiological actions of un-available carbohydrates (dietary fibre). Protein reserves of human body. Nitrogen balance studies and factors influencing nitrogen balance. Essential amino acids for man and concept of protein quality. Cereal proteins and their limiting amino acids. Protein requirement at different stages of development. Major classes of dietary lipids. Properties and composition of plasma lipo-proteins. Dietary needs of lipids. Essential fatty acids and their physiological functions.

Unit III. Electrolyte concentrations of body fluids. Acid base regulation bty the human body. Concept of metabolic and respiratory acidosis and alkalosis.

Unit IV. Nutritional significance of dietary calcium, phosphorus, magnesium, iron, iodine, zinc and copper. Dietary sources, biochenmical functions and specific deficiency diseases associated with fat and water-soluble vitamins. Hypervitaminosis symptoms of fat-soluble vitamins. Nutritional requirements during pregnancy, lactation and of infants and children.

Unit V. Food processing and loss of nutrients during processing and cooking. Anti-nutrients: Naturally occurring food born toxicants: Protease inhibitors, Hemagglutins, Hepatotoxins, Allergens, Oxalates, Toxins from Mushrooms, Animal food stuffs and sea foods.Protein energy malnutrition (PEM): aetiology, clinical features, metabolic disorders and management of Marsmus and Kwashiorkar diseases.

Unit VI. Techniques for the study of starvation. Protein metabolism in prolonged fasting. Protein sparing treatments during fasting. Basic concept of High protein, low caloric weight reduction diets. Definition and classification. Genetic and environmental factors leading to obesity. Obesity related diseases and management of obesity. Role of leptin in regulation of body mass.

Unit VII. Role of diets & nutrition in the prevention and treatment of diseases: Dental caries, Fluorosis, Hyperlipidemia, Atherosclerosis. Food allergy, Definition, Role of antigen, host and environment. Types of Hypersensitivities. Diagnosis and management of allergy.

References

1. Modern Nutrition in Health and Diseases by Whol and Goodhart.
2. Human Nutrition and Dietics – S Davidson and J R Pasmore; ELBS, Zurich.
3. Tietz Fundamentals of Clinical Chemistry by Carl A Burtis & E R Ashwood (eds.) (5th Edn.) Saunders WB Co.
4. Lecture Notes on Clinical Biochemistry – L G Whitby, A F Smith, G J Beckett, S M Walker, Blackwell Sci inc.

BCH 3E03 . PROTEIN CHEMISTRY

Unit I. Chemical structures and classifications of amino acids. Chemical properties of amino acids; Amino acid derivatives; Non-protein amino acids. Biological amines and their functions; small peptides and cyclic peptides and their biological functions. Proteins: Different types; classifications, physicochemical properties of proteins

Unit II. structural organization of proteins, primary secondary, tertiary and quaternary structures. Protein structure – 3-D conformation of a protein molecule. Protein function in terms of biological processes, molecular function and cellular components. e.g. structural, storage, transport, hormonal, receptor, contractile, defensive, enzymatic

Unit III. Enzymes, catalytic mechanism, active site, cofactors, coenzymes, measurement of enzyme activity, specific activity, enzyme kinetics, Km value, Line Weaver Burk plot, Enzyme

inhibitors, activators, enzyme regulation, allosteric enzymes, enzyme immobilization, ELISA

Unit IV. Protein sample preparation, Separation of macromolecules (and organelles) in cells by ultra-centrifugation, Chromatography and electrophoresis, Separation techniques – 2-D gel and polyacrylamide gel electrophoresis (PAGE).Protein identification – mass determination and Edman degradation

Unit V. Analysis of biomolecules using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy, structure determination using X-ray diffraction and NMR; analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods. Protein data bases

References

1. Conn E E and Stump P K, Outlines of Biochemistry,Wiley, N. Delhi
2. Creighton Thomas E, Proteins: Structures and molecular properties, W H Freeman &Co New York
3. Garrett Reginald H and Grisham Charles M, Biochemistry, Saunders College Publishing, Philadelphia
4. Keith Wilson & John Walker, Principles and Techniques of Biochemistry & Molecular biology Cambridge Press
5. Lehninger Albert, Biochemistry, Kalyani publications, N. Delhi
6. Plummer David T, An introduction to practical Biochemistry, Tata Mac Graw Hill
7. SK Sawhney, R. Singh, Introductory Practical Biochemistry, Narosa publishing house
8. Stryer Lubert & Hall John E, Biochemistry, Freemann
9. Voet Donald & Voet Judith, Biochemistry, John Wiley sons, US

BCH 3E04 . CLINICAL AND DIAGNOSTIC BIOCHEMISTRY

Unit I. Basic understanding of clinical samples – Blood, CSF, urine, bile; biopsy specimens. Methods for collection and preservation of samples. Instruments used in an automated Biochemistry laboratory. Auto-Analyzers, spectrophotometer, colorimeter, hematology counter, Blood gas analyzers; ELISA reader

Unit II. Histochemical techniques. Disorders of carbohydrate metabolism-glycogen storage diseases; Diabetes mellitus; Galactosemia and lactose intolerance. Mucopolysaccharides. Disorders of protein metabolism- PEM; Phenylketonurea and alkaptonurea; Tyrosinaemia; MSUD; Cystienurea; methylmalonyl urea. Urea cycle disorders; albinism. Glucose tolerance tests. Disorders of lipid metabolism- Hyperlipidemia, Hyper cholesterolemia; Metabolic acidosis, disorders of ketone body metabolism, sphingolipidosis; diseases associated with lipoprotein metabolism- atherosclerosis and coronary artery diseases; fatty liver, and lipotrophic factors.

Unit III. Disorders of nucleic acid metabolism-Purine and pyrimidine metabolism;
Uric acid and gout ; Gouty arthritis. Disorders of hormonal imbalance – Hyper and hypothyroidism, growth hormone imbalance, disorders of sex hormone imbalance, Organ functions and function tests- Liver functions and liver function test. Hepatitis, cirrhosis; jaundice, hepatic coma. Tests for the assessment of liver functions. Kidney functions and kidney function tests- creatine clearance and inulin clearance.

Unit IV. Cardiac function tests. Gastric function test. Disorders associated with vitamin deficiency. Disorders of mineral metabolism. Disorders of porphyrin and heme metabolism – Porphyrins – different types, Jaundice. Disorders of clotting mechanisms – Agranulocytosis; different types of anemias. Hypertension, Heamaturia, thrombocytosis; Hemophilia; sickle cell anemia. Regulation of physiological pH- Different mechanisms. Buffer systems of the body. Quality control in Biochemical analysis. Concepts of accuracy, precision, reliability reproducibility and other factors of quality control; normal values, therapeutic index. Muscular dystrophy; hemophilia. Disease related to digestion and absorption of food. Achlorohydria; ulcers gastritis; H.pylori - induced gastritis.

Unit V. Principles of diagnostic enzymology. Clinical significance of aspartate amino transferase,

alanine aminotransferase, creatine kinase, aldolase, lactate dehydrogenase, Enzyme tests in determination of myocardial infarction, enzymes of pancreatic origin and biliary tract

References

1. Devlin Thomas M, Text Book of Biochemistry with clinical correlations, Wiley Liss, New York
2. Zubay Geoffrey, Biochemistry, Wm C Brown publishers
3. Murray Robert et al, Harper's Biochemistry, Appleton & Lange
4. Vasudevan D M and Sreekumari S, Text Book of Biochemistry for medical students, Jayadeep Brothers, N. Delhi
5. Harold Harper, Review of Physiological chemistry, Marusan Co
6. Conn E E and Stump P K, Outlines of Biochemistry,Wiley, N. Delhi
7. Voet Donald & Voet Judith, Biochemistry, John Wiley sons, US
8. Garrett Reginald H and Grisham Charles M, Biochemistry, Saunders College Publishing, Philadelphia
9. Kaplan Lawrence A et al, Clinical Chemistry, Mosby, Missouri

BCH 4C15 . PRACTICAL VI

1. Assay of cellulase activity by agar diffusion method.
2. Estimation of ascorbic acid from plant tissues.
3. Extraction and estimation of essential oils.
4. Extraction and estimation of oleoresins.
5. Estimation of dissolved oxygen water
6. Preparation of media and sterilization techniques in tissue culture
7. Callus culture
8. Suspension culture of plant cells
9. Estimation of RNA by colorimetric and spectrophotometric methods.
10. Extraction of DNA and estimation of DNA by colorimetric and spectrophotometric methods.
11. Isolation of RNA from yeast.
12. Agarose gel electrophoresis of DNA.
13. Transformation
14. Hyperchromic shift on DNA melting
15. Isolation of plasmids
16. Bacterial conjugation

BCH4C16 Project work and viva voce

General instructions: The project work shall be preferably carried out within the institution. In case the project work is carried out partially or fully outside the institution, ample justification for same must be furnished in the authorized format.

While selecting topics for the project, emphasis must be given to local issues/environment.

The project shall be submitted in a generally accepted standard format. Survey of literature, use of up-to-date experimental methods, analyses of data with appropriate statistical tools,etc must be adhered to.

BCH 4E05 . GENETICS FOR BIOLOGISTS

Unit I. Totipotency, Requirements for cell and Tissue cultures; Explant culture; callus formation, shoot culture and Micropropagation; cell culture; Protoplast fusion and somatic hybridization; Another and Pollen culture; Somaclonal variation. Possible approaches for tackling genetic disorders; Diagnosis of genetic defects; Positive eugenics; Negative eugenics; genetic counseling (antenatal diagnosis, fetus sexing).

Unit II. Principles of plant/animal breeding; Techniques of plant/plant breeding; Goal and Objects of plant/plant breeding; methods of crop and livestock improvement. Restriction Maps and Molecular Genetic Maps. Restriction Mapping. Restriction fragment length polymorphisms (RFLPs); Linkage and recombination between molecular and phenotypic markers; Random amplified polymorphic DNA (RAPDs) using PCR. Chromosome walking; reverse genetics and chromosome jumping.

Unit III. Restriction enzymes in cloning; Techniques used in recombinant DNA technology (Polyacrylamide gel electrophoresis, Southern, Northern and Western blotting); Cloning vectors for recombinant DNA; cloning in bacteria, Molecular probes, Construction and screening of genomic and c DNA libraries; PCR and its applications.

Unit IV. Isolation of genes (genes with Tissue specific expression; mutant complementation, transpose tagging); Sequencing of genes (Maxam-Gitbert's method0; Synthesis of genes (organochemical synthesis of tRNA gene and interferon gene).

Unit V. Gene transfers methods for animals and plants; Agro-bacterium mediated gene transfer,

electroporation and particle gun. Transgenic animals (mouse and rabbit); Transgenic plants (Herbicide insect and virus resistance).

References

1. General Genetics Sub Owen and Edger.
2. Genes VII Benjamin Lewin, Oxford Univ Press.
3. Molecular Biology of Gene, Watson *et al.* Freeman Pub. San Francisco.

BCH 4E06. BIOCHEMICAL AND ENVIRONMENTAL TOXICOLOGY

Unit I. Eco-toxicology and its environmental significance. Toxic effects: Basis for general classification & nature. Dose – Response relationship: Synergism and Antagonism, Determination of ED50 & LD50. Acute and Chronic exposures. Factors influencing Toxicity. Pharmacodynamics & Chemodynamics.

Unit II. Absorption & distribution. Phase I reactions. Oxidation, Reduction, Hydrolysis and Hydration. Phase II reactions/Conjugation: Methylation, Glutathione and amino acid conjugations. Detoxification. Mechanisms of Toxicity: Disturbance of Excitable membrane function. Altered calcium Homeostasis. Covalent binding to cellular macromolecules & Genotoxicity. Tissue specificity of Toxicity.

Unit III. Principles & Procedures of testing for acute toxic effects: Regulatory guidelines, Mammalian systems affected & the clinical signs of Systemic Toxicity. Factors affecting acute Toxicity studies. Toxicity testing**:** Test Protocol, Genetic toxicity testing & Mutagenesis assays: In vitro Test systems – Bacterial Mutation Tests: Reversion Test, Fluctuation Tests and Eukaryotic Mutation Tests. In vivo Mammalian Mutation tests – Host mediated assay & Dominant Lethal Test. Use of Drosophila in Toxicity testing. DNA repair assays. Chromosome damage test. Toxicological evaluation of Recombinant DNA – derived protiens.

Unit IV. Pesticide toxicity: Insecticides: Organochlorines, Anti-cholinesterases – Organophosphates and Carbamates. Fungicides. Herbicides. Environmental consequences of pesticide toxicity. Biopesticides. Diagnosis of toxic changes in liver and kidneys**:** Metabolism of Haloalkanes, Haloalkenes & Paracetamol with their toxic effects on tissues.

Unit V. Food toxicology**:** Role of diet in cardio-vascular diseases and cancer. Toxicology of food additives. Metal toxicity**:** Toxicology of Arsenic, mercury, lead and cadmium. Environmental factors affecting metal toxocity – effect of light, temperature & PH.

Unit VI. Air pollution**:** Common air Pollutants & their sources. Air pollution & ozone. Air pollution due to chlorofluorocarbons (CFCS) and asbestos. Occupational toxicology & assessment of occupational hazards**:** Industrial effluent toxicology & Environmental health. An overview of regulatory agencies: Responsibilities of regulatory agencies. Management of Toxicological risk. Regulatory approaches. Regulatory systems & organizations.

References

1. General and Applied Toxicology by Marrs and Turner, Macmillan Press Ltd.
2. Basic Environmental Toxicology by Lorris G. Corkerthm and Barbara S S Shane CRP Press Inc.
3. Introduction to Food Technology by Takayurki Shibamato & Leonard F. Bzeldanes.
4. Molecular Biotechnology by Barnard R Glick & J J Pastmak.

BCH 4E07 . BIOCHEMICAL ENGINEERING

Unit I. Introduction to bioscience. Types of Microorganisms: Structure and function of microbial cells. Fundamentals of microbial growth, batch and continuous culture. Isolation and purification of enzymes from cells. Assay of Enzymes.

Unit II. Functioning of cells and fundamental molecular biology. Metabolism and bio-

energetics, Photosynthesis, carbon metabolism, EMP pathway, tricarbocyclic cycle and electron transport chain, aerobic and anaerobic metabolic pathways. Synthesis and regulation of biomolecules, fundamentals of microbial genetics, role of DNA and RNA.

Unit III. Enzyme technology and kinetics. Applied Enzyme catalysis, Applications of enzymes in industry and medicine. Immobilization of enzymes. Kinetics of enzyme catalytic reactions involving isolated enzymes. Reversible inhibition.

Unit IV. Reactions catalysed by enzymes, reactors, analysis. Reactor Design and Analysis for soluble enzyme systems. Cofactor regeneration. Membrane reactor. Effect of mass transfer in immobilized enzyme particle systems. Reactors for immobilized enzyme systems.

Unit V. Bio reactors, effect of transport processes: Introduction to Bioreactor design: continuously stirred aerated tank bioreactors. Mixing power correlation. Determination of volumetric mass transfer rate of oxygen from air bubbles and effect of mechanical mixing and aeration on oxygen transfer rate, heat transfer and power consumption. Multiphase bioreactors and their applications. Downstream processing and product recovery in bioprocesses.

References

1. J. E. Bailey and D. F. Ollis. "Biochemical Engineering Fundamentals", 2nd Edn., McGraw Hill, New York
2. Trevan, Boffey, Goulding and Stanbury, "Biotechnology", Tata McGraw Hill Publishing Co., New Delhi
3. M. L. Shuler and F. Kargi, "Bio Process Engineering : Basic concepts", Tata McGraw Hill, Englewood Cliffs, New Jersey 07632

BCH 4E08 . CANCER BIOLOGY

Unit I. Classification of viruses. Virus at molecular level; replication and plaque assay; LD50, host specificity, physical and chemical properties; various types of viruses including DNA, RNA viruses.

Unit II. Viral vectors. Strategies for developing viruses as cloning vectors; vaccinia and cytomegalovirus (CMV) vectors; properties, selection and cloning strategies.

Unit III. Tumorigenesis. Chemical and physical carcinogenesis – theories of carcinogenesis – transformation of animal cells by tumor viruses – characteristics of transformed cells – virus host interactions – morphological and biochemical studies – oncogenes.

Unit IV. Mechanisms of tumor metastatses. Metastatic cascade – survival of tumors in blood and lymphatics – invasion characteristics of cancer causing agents – role of growth factors in carcinogenesis – tumor markers – collegians – extracellular matrix molecules – proteoglycans and tumor metastasis.

Unit V. Antitumor agents. Antibiotics, toxin immunoconjugates and immunomodulators, chemoprevention of cancer through dietary and nutritional agents, live and killed viral vaccines, vaccines based on vaccinia virus.

References

1. Maly B.W.J. Virology a practical approach, IRL Press, Oxford
2. Dunmock N.J. and Primrose S.B. Introduction to modern virology, Blackwell Scientific Publications, Oxford
3. Franks W. and Teich N.M. An introduction to cellular and molecular biology of cancer, Oxford Medical Publications