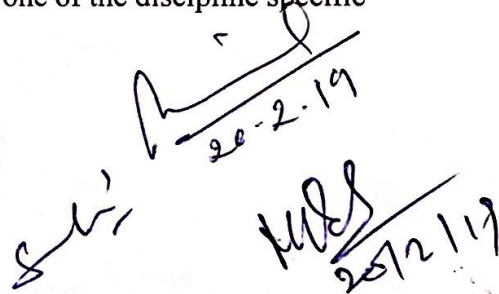


HEMWATI NANDAN BAHUGUNA GARHWAL UNIVERSITY (A Central University)**CURRICULUM FOR B. Sc. BIOCHEMISTRY (SIX SEMESTER (THREE YEAR) BACHELOR'S DEGREE COURSE) SEMESTER SYSTEM**

1. There will be one core course of biochemistry in Semester I & Semester II of 6 credits each (4credits for theory +2 credits for lab course based on core course).
2. In Semester III & IV besides 6 credits for core course of biochemistry (Theory of 4 credits + lab course of 2 credits based on core theory paper), there will be 2 credits for skill enhancement courses SEC (one in each from semester III to VI from any of the three disciplines).. However, maximum 4 SEC may be taken by the student during Semester III to VI.
3. Semester V shall comprise of 6 credits (4credits for theory +2 credits for lab course) for discipline specific elective (one from each discipline) there will be 2 credits for skill enhancement courses SEC
4. In Semester VI dissertation would also be there as one of the discipline specific elective (6 credits) besides SEC (2 credits)



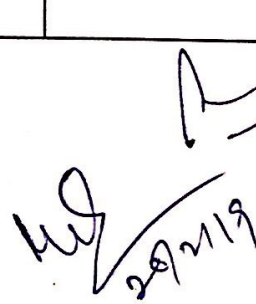
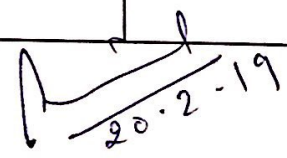
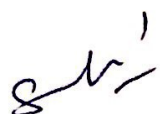
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	CORE COURSE (12)	Ability Enhancement Compulsory Course (AECC) (2)	Skill Enhancement Course (SEC) (2)	Discipline Specific Elective DSE (6)
<u>I</u>	CC-Discipline 1-A CC-Discipline 2-A CC-Discipline 3-A (BCH-CC-A)	<u>(English/MIL Communication)/ Environmental Science</u>		
<u>II</u>	CC-Discipline 1-B CC-Discipline 2-B CC-Discipline 3-B (BCH-CC-B)	<u>Environmental Science / (English/MIL Communication)</u>		
<u>III</u>	CC-Discipline 1-C CC-Discipline 2-C CC-Discipline 3-C (BCH-CC-C)		SEC-1	
<u>IV</u>	CC-Discipline 1-D CC-Discipline 2-D CC-Discipline 3-D (BCH-CC-D)		SEC-2	
<u>V</u>			SEC-3	DSE 1-A DSE 2-A DSE 3-A (BCH-DSE-A)
<u>VI</u>			SEC-4	DSE 1-B DSE 2-B DSE 3-B (BCH-DSE-B)



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DETAILS OF COURSES

CORE COURSES

1. BIOMOLECULES & FUNDAMENTAL CHEMISTRY
2. BIOPHYSICAL CHEMISTRY, THERMODYNAMICS & ENZYMOLOGY
3. METABOLISM, CELL BIOLOGY AND MEMBRANE BIOCHEMISTRY
4. MOLECULAR BIOLOGY, CLINICAL AND NUTRITIONAL BIOCHEMISTRY

DISCIPLINE SPECIFIC ELECTIVES

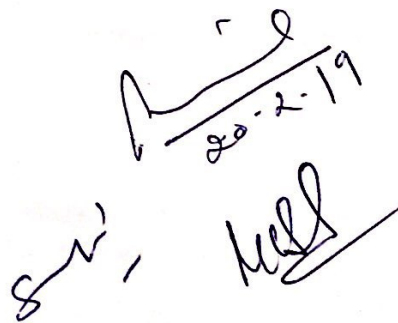
1. BASIC MICROBIOLOGY
2. IMMUNOLOGY
3. BIOTECHNOLOGY
4. PLANT BIOCHEMISTRY
5. ADVANCED CHEMISTRY
6. DISSERTATION

SKILL ENHANCEMENT COURSES

1. HEALTH AND DISEASES
2. ANIMAL CELL CULTURE PRINCIPLE AND APPLICATIONS
3. INDUSTRIAL BIOTECHNOLOGY
4. BASICS OF PLANT TISSUE CULTURE
5. TOOLS AND TECHNIQUES IN BIOCHEMISTRY



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Paper I: CC-A BIOMOLECULES AND FUNDAMENTAL CHEMISTRY

UNIT I

Introduction to Biochemistry, Water as a biological solvent. Acids, Bases and Buffer, concepts of pH. Brønsted theory of acids and bases. Buffers in biological system, Henderson-Hasselbalch equation.

SI UNITS – International System of UNITS – Basic UNITS, Derived UNITS. Simple problems

UNIT II

Carbohydrates: Structure, occurrence and biological importance of monosaccharides, disaccharides, oligosaccharides and polysaccharides (Cellulose, glycogen and starch, chitin, agar).

Fatty acids: Classification, structure and functions. Essential fatty acids. Triacylglycerols, saponification, halogenation, Acetyl number, Rancidity of fats.

UNIT III

Amino acids: Structure and classification of amino acids, physical and chemical properties. Protein structure: Classification of proteins, primary, secondary and tertiary structure of proteins

UNIT IV

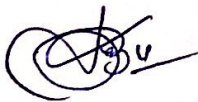
Nucleic acid: Composition of DNA and RNA. Features of DNA double helix. Watson Crick model. Types of RNA and their role.

UNIT V

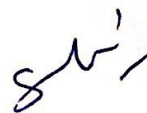
Solutions: Meaning of normality, molarity, molality, percentage solution, mole fractions, isotonic, hypotonic and hypertonic solution

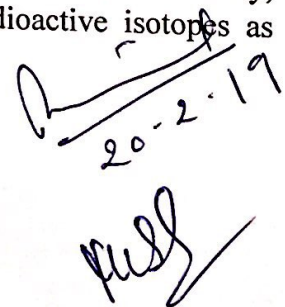
UNIT VI

Nuclear chemistry: Nature and properties of α , β and γ rays. Measurement of radioactivity, natural radioactivity, isotopes, isobars. Principle and applications of radioactive isotopes as tracers in biochemistry.



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PAPER II : LAB COURSE-I

1. Qualitative tests for-carbohydrates, proteins, amino acids and lipids.
2. Determination of saponification value and iodine number of fats.
3. Estimation of ascorbic acid.
- 4 Calibration of glass wares - pipettes, burettes and volumetric flasks (demonstration)
5. Preparation of standard sodium oxalate and estimation of potassium permanganate.
6. Preparation of standard Buffer solutions.
7. Preparation of standard buffers and determination of pH.
8. Verification of Beer-Lambert's Law.
9. Estimation of carbohydrate by anthrone method.
10. Demonstration of electrophoresis.
11. Estimation of amino acids by ninhydrin method.
12. Separation of amino acids and sugars using paper and thin layer chromatography

BOOKS FOR REFERENCE

1. Biochemistry – Lehninger – CBS Publishers.
2. Biochemistry – Stryer – W. H. Freeman & Co. – New York.
3. Text Book of Biochemistry – West, Todd, Mason, Bruggen – Amerind Publishing Co. Pvt., Ltd.
4. Chemistry- An Introduction to General, Organic and Biological Chemistry, VII Ed., (1999), Karen C. Timberlake, Benjamin/Cummings
5. Inorganic Biochemistry, G.L. Eichhorn (1973) Elsevier

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Paper III: -CC-B BIOPHYSICAL CHEMISTRY, THERMODYNAMICS & ENZYMOLOGY

UNIT I

Measurement of pH – Glass and reference electrodes

Centrifugation: Principle and applications. Differential and density gradient centrifugation

UNIT II

Chromatography: Principle and applications. Paper chromatography, Thin-layer Chromatography.

Electrophoresis: Principle and applications. Agarose gel Electrophoresis and SDS PAGE.

UNIT III

Beer-Lambert law and its limitations, Light absorption and transmission, Extinction coefficient, Theory and applications of spectrophotometry (UV, visible).

Principle and Use of light microscopy, transmission and scanning electron microscopy

UNIT IV


Thermodynamics and bioenergetics: Laws of thermodynamics first and second law and their application in biochemistry, concept of free energy, standard free energy, Biological oxidation reduction reactions. High energy phosphate compounds. ATP & Phosphoenolpyruvate


UNIT V

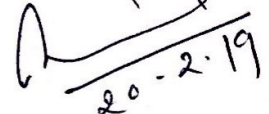
Enzymes: Introductory aspects, Historical Perspective, General characteristics, co-factors, coenzyme and metal ions. Classification of enzymes based on IUB with examples. Enzyme specificity, active site. Definition of IU, Katal, enzyme turn-over, specific activity.

UNIT VI

Enzyme Kinetics: Factors affecting rate of enzyme catalyzed reaction. Effect of substrate, enzyme, product concentration, pH, temperature. Michaelis-Menton equation (Derivation not required). Lineweaver-Burk plot. Competitive, noncompetitive and uncompetitive inhibition. Allosteric enzymes.

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Paper IV: LAB COURSE

1. Preparation of standard buffers and determination of pH.
2. Verification of Beer-Lambert's Law.
3. Estimation of carbohydrate by anthrone method.
4. Demonstration of electrophoresis.
5. Estimation of amino acids by ninhydrin method.
6. Separation of amino acids and sugars using paper and thin layer chromatography
7. Estimation of the achromic point of the enzyme Salivary Amylase
8. Kinetics of the enzyme Salivary Amylase
9. Isolation of milk protein casein using salting in technique and report the yield.
10. To isolate the globulins from egg white using ammonium sulphate precipitation.

BOOKS FOR REFERENCE

1. Inorganic Biochemistry, G.L. Eichhorn (1973) Elsevier
2. Biochemistry – Lehninger – CBS Publishers.
3. Biochemistry – Stryer – W. H. Freeman & Co. – New York.
4. Text Book of Biochemistry – West, Todd, Mason, Bruggen – Amerind Publishing Co. Pvt., Ltd.
5. Biophysical Chemistry, Principles & Techniques – Upadhyay, Upadhyay & Nath – Himalaya Publ. House.
6. A Biologists Guide to Principle & Techniques of Practical Biochemistry – Williams & Wilson – Edward Arnold Publ.
7. The Tools of Biochemistry – T. G. Cooper.
8. Principles & Techniques of Practical Biochemistry – Wilson, Walker-Cambridge Univ. Press.
9. Fundamentals of enzymology – Price & Stevens – Oxford Science Publ.
10. Principals of enzymology for food science – J. R. Whitkar – M. Dekker Pubs.
11. Enzymes – Dixon & Webb – Academic press.

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PAPER V: CC-C: METABOLISM, CELL BIOLOGY AND MEMBRANE BIOCHEMISTRY

UNIT I

General features of the Metabolism, experimental approaches to study metabolism.

Glycolysis, TCA cycle, Gluconeogenesis, glycogenesis and glycogenolysis alcoholic and lactic acid fermentations.

UNIT II

Electron transport chain, sequence of electron carriers, sites of ATP production, inhibitors of electron transport chain, inhibitors and uncouplers of oxidative phosphorylation

Digestion and absorption of proteins, transamination, oxidative deamination and decarboxylation, urea cycle.

UNIT III

Digestion and absorption of fats, hydrolysis of triacylglycerols, transport of fatty acids into mitochondria Beta-oxidation of fatty acids, ATP yields from fatty acid oxidation, ketone bodies.

UNIT IV

Morphology of cell, prokaryotic and eukaryotic cell structure, differences in plant and animal cell, structure and composition of plant and bacterial cell wall. Detailed structure and function of cell organelles i.e. nucleus, mitochondria and chloroplast, ribosomes, endoplasmic reticulum, golgi apparatus, peroxisomes, lysosomes and cytoskeleton.

UNIT V

The Cell Cycle. Overview and control. Cyclins, CDKs and Checkpoints.

UNIT VI

Membrane lipids. Physical properties of lipids, Concept of fluidity and factors causing variations in fluidity. Micelles, liposomes, Lipid rafts. Membrane asymmetry.

Membrane transport: Channels, transporters and pumps (Na^+ K^+). Active and passive transport.

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PAPER VI: LAB COURSE

1. Extraction of Proteins from biological materials
2. Estimation of Proteins by Lowry's method
3. Protein separation methods : Precipitation, chromatographic, electrophoretic
4. Extraction and estimation of RNA
5. Extraction and estimation of DNA

BOOKS FOR REFERENCES

1. Harper's Biochemistry – Murray, Granner, Mayes, Rodwell – Prentice Hall International Inc.
2. Biochemistry – Lehninger – CBS Publishers.
3. Biochemistry – Stryer – W. H. Freeman & Co. New York.
4. Biochemistry – Geoffrey L. Zubay – McGraw Hill.
5. Biochemistry – J. David Rawn – Neil Patterson publs. NC.
6. Molecular Biology of the Cell – Alberts, Bray, Lewis, Raff, Roberts, Watson – Garland Publishers, New York.
7. Biochemistry; Voet, D. and Voet, J.G. [Eds.] (1999) 3 Ed. Jhon Wiley and sons.

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PAPER XII : BCH-CC-D MOLECULAR BIOLOGY AND CLINICAL AND NUTRITIONAL BIOCHEMISTRY

UNIT I

Central dogma of molecular biology. Primary structure of nucleic acids and their properties. Basic concepts of the secondary structure of nucleic acid, 5'→3' direction antiparallel strands, base composition, base equivalence, base pairing and stacking.

UNIT II

DNA replication in prokaryotes – conservative, semiconservative and dispersive types, experimental evidence for semiconservative replication, DNA polymerases, other enzymes and protein factors involved in replication, mechanism of replication, Inhibitors of replication.

UNIT III

Transcription : Prokaryotic transcription, promoters, initiation, elongation and termination
Genetic code – Basic features, biological significance of degeneracy, wobble hypothesis
Translation – Ribosome structure, A and P sites, charged RNA, f-met – tRNA, initiator codon, Shine-Dalgarno consensus sequence, formation of 70 S initiation complex, role of EF-Tu, EF-Ts, EF-G and GTP, non-sense codons and release factors, RF1 and RF2.

UNIT IV

Regulation of gene expression in prokaryotes : operon concept, Lac operon

Mutation – Molecular basis of mutation, types of mutation, e.g. transition, transversion, frame shift, insertion, deletion, suppressor sensitive, germinal and somatic, backward and forward, true reversion and suppression, dominant and recessive mutations, spontaneous and induced mutations.

UNIT V

Introduction and definition of food and nutrition.

Physiological role and nutritional significance of carbohydrates, lipids, vitamins (water and fat soluble) and minerals (calcium, phosphorus, iron and iodine).

Basic food groups, Calorific value of proteins, carbohydrates and fats, RQ of foods. Specific Dynamic action of foods, basal metabolism. Composition of balanced diet. Recommended dietary allowances. Human milk and its virtues.

UNIT VI

Basic concept of clinical biochemistry - Definition and scope of clinical biochemistry in diagnosis.

Clinical Enzymology: Functional plasma enzymes, isozymes and diagnostic tests. Enzyme pattern in health and diseases as is special reference to LDH, SGOT & SGPT

Metabolism and diseases: diabetes inborn errors of amino acid metabolism (alkaptonurea, phenyl ketonuria, albinism, gout).

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PAPER XIII: LAB COURSE

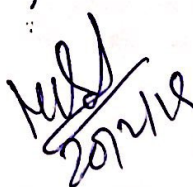
1. Quantification of DNA/ RNA
2. Estimation of calcium and phosphorus in serum and urine
3. Estimation of creatinine in serum and urine.
4. Estimation of bilirubin in serum
5. Estimation of haemoglobin
6. Serum enzyme analysis, amylase, GOT, GPT, acid and alkaline phosphatase

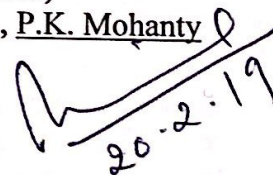
BOOKS FOR REFERENCE

1. Molecular & Cell Biology – Bhamrah – Anmol Publ. Pvt. Ltd., New Delhi.
2. Molecular Biology of the Cell – Alberts, Bray, Lewis, Raff, Roberts, Watson – Garland Publishers, New York.
3. Molecular Biology of the gene – J. D. Watson, NH Hopkins, Roberts, Stertz, Weiner-Freeman.
4. Molecular Biology of the Gene – Watson, Hopkins, Roberts, Steitz, Weiner – Benjamin Cummings Publishing Co.
5. Molecular Cell Biology – Baltimore, Zipursky, Matsudaria, Darnel – W. H. Freeman & Co., New York.
6. Principles of Nutrition by M.S Swaminathan
7. Principles of Nutrition by Dr.C. Gopalan.
8. Human Nutrition and Dietetics by Davidson and Passmore; 8th edition (1986)
9. A Complete Workbook on Clinical Biochemistry (2010) by V.P.Acharya , P.K. Mohanty JPB Publish.



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DISCIPLINE SPECIFIC ELECTIVES

PAPER XIV DSE BASIC MICROBIOLOGY

UNIT I

History of Development of Microbiology, Spontaneous generation vs. biogenesis. Contributions of Anton von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming. Role of microorganisms in fermentation, Germ theory of disease. Binomial Nomenclature, Whittaker's five kingdom and Carl Woese's three kingdom classification systems and their utility. Difference between prokaryotic and eukaryotic microorganisms.

UNIT II

Viruses : An introduction with special reference to Poxvirus, Poliovirus, HIV, T4 and λ phage, lytic and lysogenic cycles.

UNIT III

Bacteria: An account of typical eubacteria, chlamydiae & rickettsiae (obligate intracellular parasites), mycoplasma, and archaeobacteria (extremophiles). Applications of bacteria in industry, environment and food.

UNIT IV

Algae: General characteristics, structure and Applications of Algae in agriculture, industry, environment and food.

UNIT V

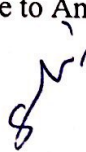
Fungi: General characteristics, fungal cell ultra-structure, thallus organization, asexual reproduction, sexual reproduction, heterokaryosis, heterothallism and parasexual mechanism. Economic Importance of Fungi in Agriculture, environment, Industry, medicine, food, biodeterioration, mycotoxins

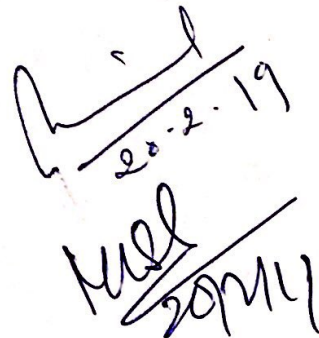
UNIT VI

Protozoa: General characteristics with special reference to Amoeba

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PAPER XIV : LAB COURSE

1. Microbiology Laboratory Practices and Biosafety.
2. To study the principle and applications of important instruments (biological safety cabinets, autoclave, incubator, BOD incubator, hot air oven, light microscope, pH meter)
3. Preparation and sterilization of culture media for bacterial cultivation
4. Study of different shapes of bacteria, fungi, algae, protozoa using permanent slides/pictographs
5. Antibiotic sensitivity of bacterial pure culture.
6. Isolation of pure culture (any one or two bacteria from above sample) by pour plate method.
7. Isolation of pure culture by Streak plate method
8. Isolation of pure culture by spread plate method
9. To study the germicidal effect of UV light on bacterial growth.
10. Demonstration of effectiveness of alcohol as a disinfectant.
11. Staining of bacteria using Gram stain

BOOKS FOR REFERENCE

1. Atlas RM. (1997). Principles of Microbiology. 2nd edition. W M.T.Brown Publishers.
2. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company
3. General Microbiology – Stanier, Adelberg, Ingraham– The Macmillan Press – London.
4. Microbiology – Davis, Dulbacco, Eisen, Ginsberg – Harper International Edition.

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PAPER XV –DSE- ADVANCED CHEMISTRY

UNIT I

Mechanism of organic reactions Homolytic and heterolytic bond breaking, types of reagents- electrophiles and nucleophiles. Types of organic reactions, energy considerations.

Reaction intermediates- carbocations, carbanions, free radicals, carbenes, arynes and nitrenes.

UNIT II

Stereochemistry: Stereoisomerism: types, stereochemical terminology; optical isomerism: Molecular dissymmetry; chirality: glyceraldehyde, lactic acid, tartaric acid; Nomenclature of enantiomers – the RS system and DL notation; diastereoisom, epimers, mutarotation, racemization and resolution; Fischer's projection formulae; Geometrical isomerism: *cis-trans* isomerism in alkenes and ring compounds; (E)-(Z) system of specifying geometrical isomers; significance of chirality in biological system.

UNIT III

Heterocyclic Compounds: Structural and nomenclature of furan, pyran, thiophene, thiazole, pyrrole, imidazole, pyridine, pyrimidine, purine, isoalloxazine and indole; biological compounds containing the above skeletons. reactions of imidazole and pyridine; Aromaticity of furan, thiophene, pyrrole and pyridine.

UNIT IV

Terpenes: Structure and Biological roles of the following: menthol, santonin, juvenile hormone I, abscisic acid, gibberellic acid and lanosterol.

Steroids: basic ring system; structures of cholesterol, steroid hormones (testosterone and oestrogen); structures and biological importance of β -carotene.

UNIT V

Drugs: Classification of drugs; uses of sulphanilamide and pentothal. Antibiotics: Definition; types; sources; structures and antimicrobial spectrum of action of penicillin, chloramphenicol, streptomycin and tetracyclines.

Colloids: Types of colloidal systems, electrical properties of colloids. Emulsions and emulsifiers; Gels; Applications of emulsions in lipid chemistry.

UNIT VI

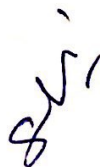
Photochemistry: Laws of Photochemistry; Chemiluminescence; Bioluminescence; Photocatalysis and photochemical reactions.

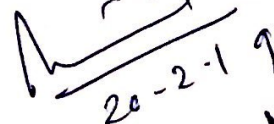
Environmental Toxicology:

Biochemical toxicology- toxicity and detoxification of Pb, Hg, Cd. LD and ED values. Water pollution: Treatment of sewage and industrial effluents (tanning and electroplating); Pesticides hazards. Brief Introduction to Bioremediation and Phytoremediation with applications.



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PAPER XV : LAB COURSE

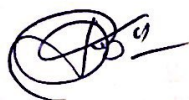
Systematic Qualitative Analysis of organic compounds

The following compounds may be given for systematic qualitative analysis

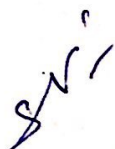
1. Resorcinol
 2. Urea
 3. Glucose
 4. Aniline
 5. Benzoic Acid
 6. Salicylic acid
 7. Phenol
 8. m-Cresol
 9. Benzyl alcohol
 10. Benzaldehyde
 11. Acetophenone
 12. Ethyl benzoate
 13. Toluene
 14. Chlorobenzene
 15. Benzamide
 16. Nitrobenzene
4. Separation of compounds by TLC
 5. Determination of BOD
 6. Determination of COD

BOOKS FOR REFERENCE

1. Stereochemistry of Carbon Compounds, Eliel(1977) Tata-McGrawHill.
2. Chemistry- An Introduction to General, Organic and Biological Chemistry, VII Ed., (1999), Karen C. Timberlake, Benjamin/Cummings
3. Introduction to Ecotoxicology, Ed. D.W. Connell, (2000) Blackwell Scientific



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PAPER XVI -DSE - BIOTECHNOLOGY

UNIT-I

Biotechnology: Definition and scope, types and branches of biotechnology.

Modification and restriction: DNA methylation, restriction endonucleases, Class I, II and III, nomenclature, general properties, mode of action.

UNIT-II

Blotting techniques: Overview, selection and screening of recombinants, genetic, nutritional, immunological blotting. HART and HAT.

UNIT-III

Vectors – Plasmid vectors, Vectors based on the lambda Bacteriophage, Cosmids, M13 vectors, Expression vectors.

UNIT-IV

Amplifying DNA : PCR and Cell based DNA Cloning – The importance of DNA Cloning, PCR : Principle and application
Hybridoma technology, monoclonal antibodies

UNIT-V

Purification and Separation of nucleic acids – Extraction and Purification of nucleic acids, Detection and Quantitation of Nucleic acids, Gel Electrophoresis.

UNIT-VI

Recombinant DNA technology: applications in agriculture, medicine and industry.
Transgenic plant and transgenic animal, Herbicide resistant, stress resistant, pesticide resistant and insect resistant, transgenic plant, transgenic fish and transgenic sheep.

PAPER XVI : LAB COURSE

1. Awareness of microbe handling: Preparation of culture media , Cotton plugging and steriisation, personal hygiene.
2. Use of some laboratory equipments:- Autoclave, hot-air oven, incubator, laminar air flow, Seitz filter.
3. Isolation of microorganisms from water and soil samples (Dilution and pour plate), colony purification.
4. Enumeration of microorganisms by total viable count
5. Characterization of isolated bacteria Gram's staining.
6. Isolation & cultivation of yeast and molds(Penicillium, Aspergillus)
7. Antibiotic sensitivity of microbes, use of antibiotics discs.
8. Alcohol fermentation (ethyl alcohol) (Demonstration)
9. Isolation of plasmid DNA from *e.coli* by alkaline method.
10. Isolation of DNA and RNA from *e. coli*.
11. Quantification of DNA and RNA.

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12. Electrophoresis (agarose) of plasmid DNA/g DNA.
13. Preparation of restriction enzyme digestion of DNA samples and their separation on agarose gel.
14. To amplify DNA using PCR and its analysis by agarose gel electrophoresis.
15. Preparation of competent cells : *E. coli* and transformation.

BOOKS FOR REFERENCE:

- 1) Biochemistry L. Stryer, WH Freeman and Co.
- 2) Molecular biology of the gene, J D Watson, Benjamin/Cummings publ. Co Inc.
- 3) Molecular biology of the cell (1983) B. Alberts, Garland Pub. In., NY
- 4) Genes, B. Lewin, John Wiley and sons, NY.

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PAPER XVII – DSE- PLANT BIOCHEMISTRY

UNIT I

Introduction to Plant cell structure: Plasma membrane, Vacuole and tonoplast membrane, cell wall, plastids and peroxisomes.

UNIT II

Photosynthesis and Carbon assimilation: Structure of PSI and PSII complexes, Light reaction, Cyclic and non cyclic photophosphorylation, Calvin cycle and regulation; C4 cycle and Crassulacean acid metabolism (CAM), Photorespiration.

UNIT III

Respiration: Overview of glycolysis and its regulation, TCA cycle.

UNIT IV

Nitrogen metabolism: Biological Nitrogen fixation by free living and in symbiotic association, structure and function of enzyme Nitrogenase. Nitrate assimilation: Nitrate and Nitrite reductase.

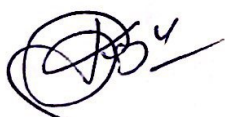
UNIT V

Regulation of plant growth: Introduction to plant hormones and their effect on plant growth and development. Auxin, Gibberellin, Cytokinin, Abscisic acid

UNIT VI

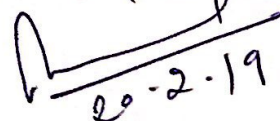
Secondary metabolites

Representatives alkaloid group and their amino acid precursors function of phenolic groups; simple alkaloids, Examples of major phenylpropanoids, Coumarins, Benzoic acid derivatives, flavonoids, tannins and lignin, biological role of plant phenolics, biological functions of terpenoids.



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PAPER XVII- LAB COURSE

1. Isolation of starch from potato.
2. Isolation of DNA and RNA from plants
3. Estimation of Tannic acid (Secondary metabolite).
4. Estimation of proteins content in germinating seedlings.
5. Soluble Protein Estimation by Lowry's Method.
5. Fractionation of Cell Organelles.
6. Estimation of Starch.
7. Determination of Polyphenols in Pulse Grains.
8. Assay of Superoxide Dismutase and catalase enzyme activity.
9. Induction of hydrolytic enzymes proteinases /amylases/lipase during germination
10. Extraction and assay of Urease from Jack bean
12. Estimation of carotene/ascorbic acid/phenols/tannins in fruits and vegetables
13. Separation of photosynthetic pigments by TLC

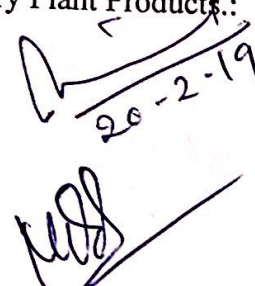
BOOKS FOR REFERENCE:

1. Plant Biochemistry: P.M. Dey and J.B. Harborne. (Editors.) Harcourt Asia PTE Ltd. Academic Press. (Indian Edition, 2000)
2. Biotechnology. Secondary metabolites: K.G. Ramawat and J.M. Merillon.(Editors.) Oxford and IBH Publishing Company Pvt. Ltd., New Delhi and Calcutta. (1999).
3. Plant Metabolism: D.T. Dennis, D.H. Turpin, D.D.Lefebvre and D.B. Layzell (Editors). Addison Wesley Longman Ltd., 2nd Edition, 1997.
4. The Biochemistry of Plants. A Comprehensive Treatise. Vol. 7. Secondary Plant Products. E.E. Conn (Editor) Academic Press (Pub.) (1981).



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PAPER XVIII -DSE - IMMUNOLOGY

UNIT-I

The Immune system: The Cellular and humoral basis of immune response, basic concepts of innate and acquired immunity. lymphoid organs and tissues .T and B lymphocytes; APCs.

UNIT-II

Antigen: Nature of the antigen molecule Antigenicity, Immunogenicity, haptens, B cell and T cell epitopes, Adjuvants

Antibodies: structure and function, Isotypes, Allotypes and Idiotypes. Isotype Monoclonal antibodies and its use in diagnosis and therapy

UNIT-III

Cytokines: general properties and functions of Cytokines, biological role of the complement system; complement components.

MHC molecules - MHC molecules, their structure and role in antigen presentation to T cells.

UNIT-IV

Vaccination; principles of vaccination, vaccines in current use; new vaccines in development; adjuvants.

Allergy and Hypersensitivity Reactions - Allergens, sensitization and production of IgE. Type I, II, III and IV hypersensitivity.


UNIT- V

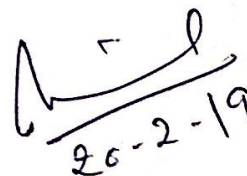
Immunological methods Agglutination; precipitation reactions in gels; immunoelectrophoresis; immunoprecipitation., RIA; ELISA.

UNIT- VI

Immunological diseases : Autoimmune disease: SLA, Rheumatoid Arthritis.

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Suggested Readings:


- (1) Essential Immunology (9th ed. 1997) by Ivan Roitt
Blackwell Science Ltd.
- (2) Immunology (1992) by Janis Kuby W H Freeman
and Co. Ltd. USA.

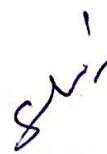
PAPER XVIII : LAB COURSE

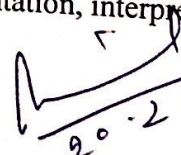

1. Blood groups and Rh.typing - coomb's test.
2. Precipitation reaction in gel. Outchelony - double diffusion, single radial immuno diffusion.
3. Agglutination reactions: Slide and Tube methods RBC agglutination IHA, TPHA Bacterial.
4. Gel electrophoresis of plasma proteins.
5. Hemocytometric analysis-W.B.C. & R.B.C.
6. Estimation of Haemoglobin.
7. Determination of blood sugar, urea, creatine, creatinine.
8. Determination of SGPT and SGOT.
9. Immunofluorescence, (Demonstration only)
10. ELISA (Cytokines).
11. Isolation of Buffy coat, using heparin. lymphocytes (T cells, B cells) enumeration of different cells types,
12. Peripheral blood cell counts, absolute cell counts.

PAPER XX -DSE- DISSERTATION

This paper would focus on the project work / dissertation to be carried out by the students in the supervision of the teachers. The topic of the project would be selected by each student in consultation with the teacher (Advisor). This would train the student to retrieve the literature and collate the information sufficient to make a presentation, the collated literature would also prepare the base for initiating the research. The student would carry out experiments to achieve the planned objectives, collation and analysis of data, presentation of the result in the form of a Dissertation. The grading would be based on continuous evaluation that would include punctuality, hard work, record keeping, intellectual inputs, data presentation, interpretation etc.

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SKILL SPECIFIC ELECTIVES

PAPER VII- SEC- HEALTH AND DISEASES

UNIT I

Introduction to Health and Diseases : Electrolytes and acid-base balance – Regulation of electrolyte content of body fluids and maintenance of pH, reabsorption of electrolytes. Respiratory & renal mechanism, Acidosis & alkalosis. Anti-coagulant and preservatives for blood and urine.

UNIT II

Disorders of Carbohydrate Metabolism: Diabetes melitus, glucose and galactose tolerance tests, sugar levels in blood, renal threshold for glucose, factors influencing blood glucose level.

UNIT III

Disorders of Lipids and Proteins: Plasma lipoproteins, cholesterol, triglycerides & phospholipids in health and disease, hyperlipidemia, hyperlipoproteinemia, Gauchers disease, Tay-Sachs and Niemann-Pick disease. Abnormalities in Nitrogen Metabolism- Uremia, hyperuricemia.

UNIT IV

Disorders of liver and kidney: Jaundice, fatty liver, normal and abnormal functions of liver and kidney, Liver function test, Renal function test. Diagnostic Enzymes – Enzymes in health and diseases. Biochemical diagnosis of diseases by enzyme assays SGOT, SGPT, CPK, Cholinesterase, LDH

UNIT V

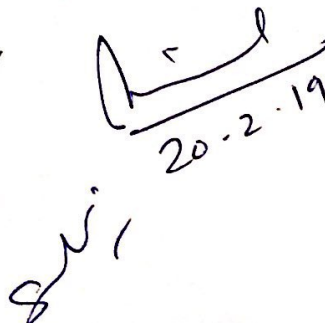
Inborn Errors of Metabolism : Phenylketonuria, alkaptonuria, albinism, tyrosinosis, maple syrup urine disease, Lesch-Nyban syndrome, sickle cell anemia, Histidinemia

BOOKS FOR REFERENCE:

1. Text Book of clinical Biochemistry – Cart A. Burdis and Edward R. Ashwood
2. Text Book of Medical Biochemistry – M.N. Chatterjee and Raneshinde
3. Clinical Biochemistry – Hoffmann
4. Biochemistry with clinical correlation – Devlin
5. Practical Clinical Biochemistry – Harold Varley



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PAPER VIII- SEC- ANIMAL CELL CULTURE: PRINCIPLES AND APPLICATIONS

UNIT-I

Introduction, importance, history of cell culture development, different tissue culture techniques including primary and secondary culture, continuous cell lines, suspension culture, organ culture etc.

UNIT-II

Different type of cell culture media, growth supplements, serum free media, balanced salt solution, other cell culture reagents, culture of different tissues and its application.

UNIT-III

Behavior of cells in culture conditions, division, their growth pattern, metabolism of estimation of cell number.

UNIT-IV

Development of cell lines, characterization and maintenance of cell lines, stem cells, cryopreservation, common cell culture contaminants.

UNIT-V

Application of animal cell culture for in vitro testing of drugs, application of cell culture technology in production of human and animal viral vaccines and pharmaceutical proteins

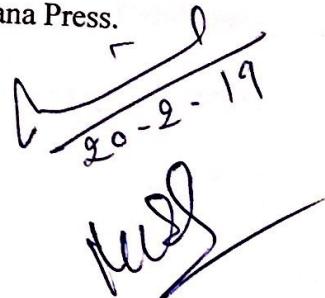
BOOKS FOR REFERENCE:

1. Freshney RI. 2005. Culture of Animal Cells.
2. Wiley Liss. Portner R. 2007. Animal Cell Biotechnology. Humana Press.



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PAPER IX- SEC -INDUSTRIAL BIOTECHNOLOGY

UNIT-I

Introduction, scope and historical development; isolation, screening and genetic improvement of industrially important microorganisms, fermentation: introduction, historical perspective of development of bioprocessing technology.

UNIT-II

Emerging new technologies for processing and production of recombinant products, isolation, preservation. Media designs, sterilization, down stream processing, important fermentation process.

UNIT-III

Immobilization of enzymes and cells, and their application, growth rate analysis, estimation of biomass, batch and plug flow cultures, chemostate cultures. Production of vaccines and diagnostics.

UNIT-IV

Fermented beverages, production of single cell protein, steroid transformation, silage production, waste water treatment.

UNIT V

Industrial application of Nanobiotechnology. Computer simulations, energy requirement and product formation in microbial culture, fed-batch and mixed cultures, scale-up principles.

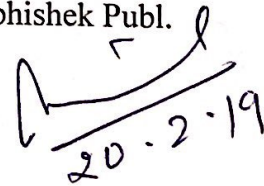
BOOKS FOR REFERENCE:

1. Alberghina L. 2000. Protein Engineering for Industrial Biotechnology. Routledge.
2. Kun LY. 2006. Microbial Biotechnology. World Scientific.
3. Singh, R & Ghosh SK. 2004. Industrial Biotechnology. Global Vision Publ. House.
4. Thomson J. 2006. Your Guide to Industrial Biotechnology. Abhishek Publ.



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PAPER X - SEC - BASICS OF PLANT TISSUE CULTURE

UNIT-I

History of Tissue Culture technique. Requirements for a Cell Tissue Culture lab like Laminar Air Flow device, sterilisation scheme for culture chamber. Totipotency of plant cells- dedifferentiation and dedifferentiation.

UNIT II

Nutrient media: Composition of commonly used nutrient culture media with respect to their contents like inorganic chemicals, organic constituents, vitamins, amino acids etc. Sterilisation of the media and appliances by autoclaving.

UNIT III

Culture of plant materials- explants selection and technique of culturing the same. Growth conditions. Methods of sub culturing and transfer of regenerated plants to the field.

UNIT IV

Micro propagation: Proliferation of axillary buds, induction of adventitious buds and bulbs, callus regeneration, somatic embryogenesis, continuous culture, immobilized cultures, estimation of growth and artificial seeds.

UNIT V

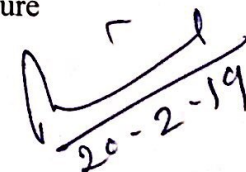
Cloning: Isolation of single cells, culturing of single cell- different methods, culture cell viability test. Cryopreservation and slow growth cultures, Freezing and storage, thawing, reculture.

BOOKS FOR REFERENCE:

1. Hudson T Hartmann : Plant Propagation-Principle and Practices
2. Chopra V L, Sharma R P & Swaminathan M S : Agricultural Biotechnology
3. Kalyan Kumar D : An introduction to Plant Tissue Culture
4. Hamish A, Collin & Sue Edwards : Plant Cell Culture
5. Razdan M K : An Introduction to Plant Tissue Culture
6. Guptha P K : Elements of Biotechnology



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PAPER XI- SEC -TOOLS AND TECHNIQUES IN BIOCHEMISTRY

UNIT I

Biochemical reagents and solutions: Safety practices in the laboratory. Preparation and storage of solutions. Concepts of solution concentration and storing solutions. Quantitative transfer of liquids. Concept of a buffer, Henderson-Hasselbach equation, working of a pH meter.

UNIT II

Spectrophotometric techniques: Principle and instrumentation of UV-visible and fluorescence spectroscopy. Beer-Lambert's law,

UNIT III

Chromatography – Principles and applications of paper, thin layer, ion exchange, affinity, gel permeation, adsorption and partition chromatography and HPLC.

UNIT IV

Centrifugation – Principle of centrifugation, concepts of RCF, different types of instruments and rotors, preparative, differential and density gradient centrifugation, analytical ultra-centrifugation.

UNIT V

Electrophoretic techniques – Principles of electrophoretic separation. Types of electrophoresis including paper and gel (Agarose & SDS PAGE) electrophoresis.

UNIT VI

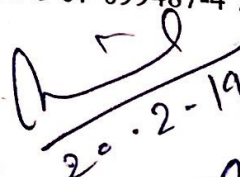
Electron microscopy – Transmission and scanning electron microscopy.

BOOKS FOR REFERENCE:

1. Physical Biochemistry: Principles and Applications (2010) 2nd ed., Sheehan, D., Wiley Blackwell (West Sussex), ISBN:978-0-470-85602-4 / ISBN:978-0-470-85603-1.
2. Physical Biochemistry: Applications to Biochemistry and Molecular Biology (1982) 2nd ed., Freifelder, D., W.H. Freeman and Company (New York), ISBN:0-7167-1315-2 / ISBN:0-7167-1444-2.
3. An Introduction to Practical Biochemistry (1998) 3rd ed., Plummer D. T., Tata McGraw Hill Education Pvt. Ltd. (New Delhi), ISBN:13: 978-0-07-099487-4 / ISBN:10: 0-07-099487-0.



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