R 361

UNIVERSITY OF POONA

Circular No. 793 of 1990

SUBJECT : Revised syllabus of M.Sc.Chemistry and Biochemistry

In pursuance of the decision taken by the University authorities, it is hereby notified for the information of all concerned that the revised syllabus for M.Sc.Chemistry and Biochemistry is as enclosed herewith in Appendix A (Semester I & II) The said syllabus will be implemented from the year 1989-90.

The Principals of all affiliated Colleges with Post-graduate in Chemistry are requested to bring the contents of this circular to the notice of all concerned teachers and students.

Ganeshkhind, Pune-411007.
Ref.No.CBS/Chem/94 :
Date : 31st January, 1990.

for Registrar

Copy f.w.c. for information to -

1. The Dean, of all faculties
2. The Principals of all affiliated Colleges in Science
3. The members of the Board of Studies in Chemistry
4. The Director, Distance Education Centre
5. The Co-ordinator, Examination Reform Cell
6. The Deputy Registrar (Examinations)
7. The Asstt.Registrar (Exam. Coordination Unit)
8. The Asstt.Registrar (Exam. S & T Unit)
9. The Asstt.Registrar (Records and Meetings)
10. The Asstt.Registrar (Academic)
11. The Public Relation Officer
12. The Law Officer
13. The Statutes Committee Unit (Ref.No.B-24 PA 87/89 A.C. dt.22/23.8.89
14. The Section Officer (External)
15. The P.A. to Registrar.
16. The University Sub-centres at Ahmednagar, Dhule & Nasik.
17. The General Secretary, PUTA/PUCTO.

5490(1989)
Sra/

UNIVERSITY OF POONA

Syllabus of M.Sc. (Chemistry)
(Semester I & II)

1. Each theory course prescribed for M.Sc. should be covered in 4 periods, each of 60 minutes druation per week per course including lectures, tutorials, seminars etc.

2. Each practical course will require 6 hours of laboratory work per week and the course will be extended over two semesters and will be examined at the end of the year.

3. There should not be more than 10 students in a batch for M.Sc. practical course.

Semester - I

CH-110 : Physical Chemistry I
CH-130 : Inorganic Chemistry I
CH-150 : Organic Chemistry I
CH-107* : Physical Chemistry Practicals } at the end of the year
CH-127* : Inorganic Chemistry Practicals }

Semester II

CH-210 : Physical Chemistry II
CH-230 : Inorganic Chemistry II
CH-250 : Organic Chemistry II

CH-290 : General Chemistry (Any two of the following parts)
Part A - Concepts of Analytical Chemistry
Part B - Techniques of Separation
Part C - Instrumental Methods of Anal
Part D - Chemical Mathematics
Part E - Biomolecules - I
Part F - Biomolecules - II

Note : 1. Students of Analytical Chemistry will opt for Parts A & B.
2. Students of Organic, Inorganic and Physical Chemistry will take any two of B, C & D.
3. Students of Organic Chemistry at Ahmednagar College (Autonomous centre) will opt for Parts E & F.

CH-247* : Organic Chemistry Practicals

*These are departmental courses.

Important Note :-

For all theory courses the question paper should include at least 20% weightage for problem solving. Problem solving would include numerical, short answer, long answer questions to test the understanding of the concepts.

It is absolutely essential to have yearly inspection of the laboratories of the Post-graduate centre, where M.Sc.(Chemistry) will be taught as now, the examination of all the practical courses will be assessed by the local staff only.

...2..

This yearly inspection should be done by a Committee appointed by University Authorities. The committee will consist of not less than two members and not more than three members appointed from senior academic staff of the concerned specialization. During the visit to particular post-graduate centre, the committee will take into account equipment in working order, performance of the students in the practicals throughout the year, completion of project given to the students, number of students admitted to that centre, laboratory space for accommodating this number etc.

CH-110 : Physical Chemistry I

1. Recapitulation : First law of thermodynamics, heat, work and the conversion of energy, state function, enthalpies of chemical reactions (Ref.1, Chapters 2,3,4 p. 52-120) (3)

2. Second law of thermodynamics, entropy and entropy changes, Gibbs and Helmholtz functions, other statements of second law, properties of the Gibb's functions, fugacity, open systems and changes of composition (Ref.1, Chapters 5 and 6, p. 121 to 170) (10)

3. Changes of states, partial molar quantites, thermodynamics of mixing, colligative properties, vapour pressure diagrams, real solutions, changes of states : Chemical reactions, equilibrium constants, response of reactions to the conditions (Ref.1, chapters 8 and 9, p.203 to 279).

4. Recapitulation : Empirical chemical kinetics, rates of reactions, rate laws and their determination, integrated equations, half lives (Ref.1, p. 851-863; Ref.2, Chapters 1 and 2; Ref.3, Chapter 2). (3)

5. Accounting of Rate Laws : Simple reactions, temperature dependence of rate, reactions moving towards equilibrium, consecutive reactions, the steady state, first order reactions. Complex reactions : Chain and explosive reactions. Fast reactions - flash photolysis, flow techniques and relaxation methods (Ref.1, p.863-880, 885-898, Ref.2, Chapter 1,2,7; Ref.3, Chapter 2,3,4,9 and 10). (6)

6. Molecular Reaction Dynamics : Collision theory, reaction in the solution, diffusion control, Activated complex theory, reaction co-ordinate and the transition state, formation and decay of activated complex, Eyring question, thermodynamic aspects, reaction in solution, dynamics of molecular collisions-reactive encounters, results of molecular beam studies. (Ref.1, p.897-928; Ref.2, Chapters 3 and 5; Ref.3, Chapters 5 & 8) (10)

For each topic related problems should be solved in the class.

*3a. Elements of statistical thermodynamics : Energy of molecules, Boltzman distribution law, partial function translational, rotational, vibrational and electronic partition fuctions, thermodynamic functions - energy, heat capacity, entropy and free energy from partitions (p. 751-765 from Principles of Physical Chemistry, S.H.Maron and C.F.Prutton, 4th Edn., Collier MacMillan). (8)

...3..

References :

1. Physical Chemistry, P.W. Atkins, (ELBS).
2. Chemical Kinetics, K.J.Laidler, (Tata Mc-Graw Hill)
3. The Foundation of Chemical Kinetics, E.N.Yeremin, (MIR PUBLISHERS).
4. Elements of Chemical Thermodynamics, L.K.Nash, Addison-Wesley 1970.

CH-130 : Inorganic Chemistry I

1. Schrodinger equation (Ref.1, P.26-38; Ref.3, P.570-580, p.601-603; Ref.4, p.1-16) (2)
2. Particle in a box (Ref.1,p. 38-45; Ref.3, p.603-608; Ref.4, p.17-25) (2)
3. The hydrogen atom : derivations of solutions of Θ and Φ parts; solution of R part (no derivation), polar plots, orbitals, orbital angular momentum; many-electron atoms and properties (Ref.1, p.45-66; Ref.3, p.630-643; Ref.4, p.61-80, 88-113) (6)
4. Linear variation method, qualitative MO theory of diatomic molecules (Ref.1, p.128-143, p.152-157, Ref.2, p. 59-111). (5)
5. Electron-pair wavefunctions, hybridization (Ref.1, p.144-152; Ref.2, 112-137 and 198-210). (4)

   For topics 1-5, related problems should be solved in the class.

6. Coordination Chemistry : M.O.theory and ligand field theory (Ref.7).
7. Chemistry of the S and P block elements (Ref.5 or 6)
   a. Alkali elements (2)
   b. Alkaline earth elements (2)
   c. Al, Ga, In, Tl (3)
   d. Si, Ge, Sn and Pb (4)
   e. P, As, Sb and Bi (4)
   f. S, Se and Te (3)
   g. the halogens (4)
   h. the noble gases (2)

   For topic 7 emphasis be given on txtraction, group trends, intergroup relationships, fundamental properties and applications of typical compounds in industry, biology and agriculture.

References

1. Theoretical Inorganic Chemistry, M.C. Day Jr and J. Selbin, Reinhardt (1967).

...4..

2. Coulson's Valence, R.McWeeny, ELBS (1979)
3. Physical Chemistry, W.J.Moore, Orient Longman (1976)
4. Quantum Chemistry, I. N.Levine, Allyn and Bacon (1974)
5. Inorganic Chemistry, A.G. Sharpe ELBS edition (1984)
6. Concise Inorganic Chemistry, J.D.Lee, 3rd Edition, ELBS(1977)
7. Basic Inorganic Chemistry, F.A.Cotton and G.Wilkinson (Wiely-Eastern)

CH-150 : Organic Chemistry I

1. Inductive Resonance, Effects, Acidity and Basicity, (Recapitulation Ref.1, p.228-238) (4)
2. Nucleophilic substitution (Ref.1, p.265-341; Ref.2, p.183-242, 249-263). (12)
3. Additions and Eliminations (Ref.1,672-684, 895-922; Ref.2, p.265-299) (9)
4. Electrophilic and nucleophilic substitution reactions in aromatic systems (Ref.1, 453-473, 584-595, Ref.2, relevant pages). (9)
5. Stereochemical principles - Enantiometric relationships, diasteromeric relationships, R and S, E and Z nomenclature, dynamic stereochemistry, prochiral relationship. (Ref.2, p.39-70; Ref.3, p.16-28, 92-94 and Ref.1, relevant pages). (5)
6. Conformations of cyclic molecules (Ref.2, p.71-94, 98-125; Ref.3, p.124-139). (5)
7. Shape of six membered rings (Ref.2, p. 204-215) (5)

References

1. Advanced Organic Chemistry, J.March, 2nd Edn. McGraw Hill, 1977.
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sundberg, Part A, Plenum Press (for autonomous centres). centres).
3. Stereochemistry of Carbon Compounds, E.L.Eliel, Tata McGraw Hill Edn.
4. Mechanism and Structure in Organic Chemistry, E.S.Gould, Holt, Rinehart and Winston. (To be used for problem solving of topics 1-4).

...5..

CH - 210 : Physical Chemistry II

Molecular Spectroscopy

1. Basic concepts and Introduction : Characterization of electromagnetic radiation, Regions of the Electromagnetic spectrum; Representation of spectra; Basic elements of practical spectroscopy; Signal-to-noise ratio, width and intensity of spectral lines; Fourier transform spectroscopy, enhancement of spectra (Ref.1, Chapter 1) (2)

2. Microwave Spectroscopy : Rotation of molecules; Rotational spectra of diatomic and polyatomic molecules, intensities of rotational lines, isotope effects, nonrigidity; techniques and instrumentation; applications (Ref.1, Chapter 2) (4)

3. Infrared spectroscopy : Harmonic and anharmonic oscillators; vibrational spectra of di-and polyatomic molecules; vibration-rotation spectra of di- and polyatomic molecules without and with interaction; nuclear spin effect; applications, techniques and instrumentation (Ref.1, Chapter 3) (6)

4. Raman Spectroscopy : The classical and quantum theories of the Raman effect; rotational, vibrational and vibration-rotation Raman spectra of di- and polyatomic molecules; polarization of Raman lines; rule of mutual exclusion, applications, techniques and instrumentation (Ref.1, Chapter 4). (4)

5. Electronic spectroscopy of molecules : Born-Oppenheimer approximation, electronic spectra of di- and polyatomic molecules, vibrational coarse structure rotational fine structure, dissociation energy and dissociation products, electronic structure of diatomic molecules, molecular photoelectron spectroscopy, applications, techniques and instrumentation (Ref.1, Chapter 6). (8)

Nuclear and Radiation Chemistry

6. Radioctivity : Discovery, radioactive elements, general characteristics of radioactive decay, decay kinetics, parent-daughter decay-growth relationships, α-decay, nuclear de excitation (Ref.2, Chapter 4). (6)

7. Detection and measurement of nuclear radiations : Detection of radiation, behaviour of ion-pairs in an electric field, ionization chambers, proportional counter, G.M.Counter, scintillation counter, counting errors (Ref.3, p.198-215) (4)

8. Elements of radiation chemistry : Interaction of radiation with matter, passage of neutrons through matter, units of measuring radiation absorption, radiation dosimetry, radiolysis of water, free radicals in water radiolysis, radiolysis of aqueous solutions, a time scale of radiolytic events (Ref.2, Chapter 9). (6)

...6..

9. Applications of radioactivity : Probing by isotopes, typical reactions involved in the preparation of radioisotopes, radiochemical principles, typical applications of radioisotopes - chemical investigations, physico-chemical, analytical, medical, industrial and agricultural applications, age determinations and prospecting of natural resources (Ref.2, Chapter 8). (8)

10. In all topics related problems should be solved in class.

References :

1. Fundamentals of Molecular Spectroscopy, C.N.Banwell, Tata-McGraw-Hill, Third Edition (1984)

2. Essentials of Nuclear Chemistry, H.J.Arnikar, Wiley-Eastern Ltd.

3. Source Book of Atomic Energy, S.Glasstone, D.van Nostrand and Company, East-West edn.

4. Nuclear and Radiochemistry, G.Friedlander, J.W. Kennedy and S.W. Miller, John-Wiley and Sons.

5. Introduction to Nuclear Physics and Chemistry, B.G.Harvey, Prentice-Hall of India, New Delhi.

CH-230 : Inorganic Chemistry II

1. Symmetry elements, symmetry point groups and space groups, unit cells, Miller indices (Ref.2/) (6)

2. Bravais lattices, hard sphere model and closest packing to be explained with the help of models (Ref.1) (3)

3. Crystal structure determination. Elementary diffraction theory, principles and applications of electron and neutron diffraction (Ref.3) (8)

4. Determination of unit cell lengths of crystal systems such as cubic systems (Ref.1) (4)

   For topics 1-4 relevant problems should be solved in the class.

5. First transition series. (6)

6. Introduction to second and third transition series.

7. Comparison among the same group elements with reference to fundamental properties.

   For topics 5,6 and 7 emphasis be given on their extraction, chemical peculiarities and typical applications in industry, biology and agriculture (Ref.4 or 5)

References :

1. Introduction to Solids, L.V.Azaroff, Tata McGraw Hill.

2. Symmetry in Chemistry, H.H.Jaffe and M.Orchin, Wiley Eastern.

3. Diffraction methods, J.Wormald, Oxford University Press.

...7..

4. Inorganic Chemistry, A.G.Dharne, ELBS Edition (1984) aided with sample questions.

5. Concise Inorganic Chemistry, J.D.Lee 3rd Edition, ELBS.

6. Chemical Applications of Group Theory, F.A. Cotton (Wiley Eastern)

CH-250 : Organic Chemistry - II :

1. Oxidation and reductions (Ref. 1, p. 538-564/Ref.2, p. 129-163, 351,-387, 396-407) (9)

2. Rearrangements (Ref. 8, p. 618-660) (8)

3. Organometallic compounds of lithium, magnesium, zinc, copper, thallium and boron (ref.3, p. 341-366, 1225-1232/ Ref. 4, p. 552-557). (9)

4. Phosphorous ylids (Ref.1 and Ref.3 relevant pages) Nitrogen and sulphur ylids (Ref.5, relevant pages) (3)

5. U.V. - application to structural problems (Beg (Ref.6, relevant pages.) (6)

6. Factirs affecting IR group frequency (Ref.7, p. 377-407) (6)

7. Elementary ideas for NMR (Ref.3, relevant pages) (4)

8. Simple Problems in UV, IR and NMR (3)

References :

1. Organic Chemistry, D.J.Cram, G.S.Hammond, 2nd Edn. McGraw Hill (1964).

2. Advanced Organic Chemistry, F.A.Carey and R.J. Sundberg, Part B. (for autonomous centres)

3. Basic Principles of Organic Chemistry, J.D.Roberts and M.C.Caserio Benjamin (1964).

4. Organic Chemistry, T.W.G. Solomon, John Wiley (1976)

5. Advanced Organic Chemistry, J. March, McGraw Hill 2nd Edn. (1977).

6. Spectroscopic Methods in Organic Chemistry, Dudley H. Williams, Ian Fleming, Tata McGarw -Hill Publishing Comp. Ltd. New Delhi Edn. 1988.

7. Infra-Red Spectra of Complex Molecules, L.J. Bellamy 2nd Edn., John Wiley.

8. Mechanism and Structure in Organic Chemistry, E.S.Gould, Holt Tinehart and Winston.

CH-260 : General Chemistry (Any two of the following parts. For topics of each part numerical problems should be solved in the class except for Parts E and F).

... 8 .

Part A : Concepts of Analytical Chemistry (Ref. 1)

1. Methods of Analytical Chemistry - Introduction, general analytical process, methods of analytical determination (4)

2. Errors in chemical analysis - Errors, accuracy and precision classification of errors, determinate and indeterminate errors, determination of accuracy of quantitative analytical methods, accuracy sought. (6)

3. Accuracy and precision : The test of statistics precision, averages, study of an analytical procedure, sampling errors, presentation of results. (6)

4. Principles and methods of sampling : Introduction, theory of sampling, pit falls in sampling, technique of sampling gases, liquids and solids, transmission and storage of samples, sources of specific sampling information. (8)

Part B : Techniques of separation (Ref. 1)

1. Solvent extraction, principles and techniques of solvent extraction, multiple extraction. (4)

2. Chromatography: principles and classification of various techniques. (3)

3. Study of following chromatographic techniques : Column chfomatography, Paper chromatography and electrophoresis, ion exchange chromatography, exclusion chromatography, thin layer chrimatography. (14)

4. Introduction to GLC AND HPLC. (3)

Part C : Instrumental methods of chemical analysis

1. Visible spectrophotometry and colorimetry : Introduction, theory, deviation from Beer's law, instrumentation, applications, spectrophotometrics titrations (Ref.2, chapter 5, Ref. 3, Chapter 3,4) (6)

2. Atomic absorption spectroscopy : Introduction, principle, differences between AAS & FES, advantages of AAS over FES, disadvantages of AAS, instrumentation, sihgle and double bean AAS, detection limit and sensitivity interferences, applications (Ref.2, Chapter 12, Ref.3, Chapter 10). (5)

3. Flame Photometry : Introduction, principle instrumentation applications, interferences, factors affecting the intensity of emitted radiation (Ref.2, Chapter 14) (3)

4. Nephelometry and turbidimetry : Introduction, turbidimetry and colorimetry, nephelometry and flabrimetry, choise, between nephelometry and turbidimetry, theory, instrumentation and applications (ref. 2, Chapter 15) (2)

5. PH Metry : Definition, determination, hydrogen electrode quinhydrone electrode, glass electrode, instrumentation, PH titrations (Ref.2, Chapter 21 Ref.4, Chapter 20)- (3)

.. 9 .

6. Polarography and related techniques : A brief account of polarography, introduction apparatus used for amperometric titrations, techniques and types of amperometric titrations titrations with two indicator electrodes, advantages and disadvantages of amperometric titrations, applications, cyclic volametry, chronopotentiometry (Ref. 2, Chapter 23, 24 Ref . 3 Chapters 22, 25) (5)

Part D : Chemical Mathematics (Ref. 6)

Differential and integral calculus :

Derivative and its physical significance, basic rules for differentiation (without derivation), maxima and minima their applications in chemistry, exact and inexact differentials with specific emphasis on thermodynamic properties, partial differentiation.

Basic rules of integration (without derivation), definite and indefinite integrals, geometrical meaning of integration applications in chemistry.

Differential equations :

Separable variables, homogeneous, exact and linear equations, equations and second order, applications of differential equations in chemistry.

Probability and theory of errors :

Permutations and combinations, probability and probability theorems, probability curves, errors and deviations, thermodynamic probability, distinguishable and indistinguishable particles, methods of averages and least squares.

Part E : Biomolecules I Proteins (Ref.) 7-10)

1. Amino acids : Classification, properties, reactions, rare amino acids, separation techniques.

2. Protein classification : Reactions functions, properties peptide synthesis, solid phase synthesis.

3. Structure : (a) Peptide bond, end group analysis sequencing.
(b) Secondary-alpha-helix, beta-structure, 310 helix, super secondary structire
(c) Tertiary structure : Forces stabilising, unfolding/refolding expt. Prediction of tertiary structure.
(d) Quarternary structure - haemoglobin
(e) Ramachandran plot
(f) Helix coil transitions, Van der Waals electrostatic hydrogen bonding and hydrophobic interactions.
(g) Energy terms in biopolymer conformational calculations.

... 10 .

4. Globular proteins.

5. Protein purification Chromatography, electrophoresis crysrallisation etc. Determinating protein concerntration and molecular weight etc. Criteria of purity of proteins.

6. Fibrous proteins
7. Protein evolution.

Part E : Biomolecules - II - Carbohydrates and lipids (Ref. 11-15)

1. Composition of living matter
2. Properties of water
3. Carbohydrates : Basic chemical structure - hemiacetals and ring forms, anomers, epimers, deoxy sugars, amino sugars and sugar acids- Mono, oligo and polysaccharides. Methylation and periodic oxidations, structure and function of complex carbohydrates, cellulose, chitin, starch, glycogen, muscopolysacchatides and glycoproteins etc.
4. Lipids : Classification, structure and function of major lipid subclasses. Acylglycerols, phosphoglycerides, sphingolipids, waxes, terpenes, steroids and prostaglandins, lipoproteins.
   Circulating lipids :- Chylomicrons, LDL, HDL and VLDL etc. Free fatty acids, pathological changes in lipid levels.
5. Vitamins and co-enzymes.

Note on Options of Course CH-200

1. Students of Analytical Chemistry will opt for Parts A and B.

2. Students of Organic, Inorganic and Physical Chemistry will take any two out of B, C, and D.

3. Students of Organic Chemistry at Ahmednagar College, (Autonomous Centre) will opt for Parts E and F.

References :-

1. Analytical Chemistry, G.D. Christian Wiley, 2nd Edn.

2. Instrumental methods of chemical analysis, G. Chatwal, S. Anand (Himalaya Pub. House).

3. Instrumental methods of analysis, H.H. Willard, L.L.Merritt, J.A. Dean, 5th Edn.

4. Instrumental methods of chemical analysis G.W.Ewing, (McGraw Hill)

5. Introduction to instrumental analysis, R.D.Braun (McGraw - Hill Internationals, 1987)

6. Mathematical preparation for physical chemistry. F. Daniels (McGraw Hill Book Company.)

7. Principles of biochemistry, Lehninger, CBS, Publ.(1982).

8. Biochemistry, L. Stryer, W.H.Freeman, San Francisco

9. Schaum's outline of theory and problems of biochemistry, Philip W.Kuchel and G.B.Ralston, Int.Ed., McGraw Hill Book C Company.

10. Problem approaches in biochemistry, Wood and Wood.

11. Biochemistry, L. Stryer, W.H.Freeman, San Francisco.

12. Harper's review of biochemistry, Lange Medical Publ. Calif.

13. Biochemistry, Lehninger

14. Schaum's outline series of theory and problems of biochemistry, P.W.Kuchel and B.B.Ralston, Int.Eds., McGraw Hill Book Co.

15. Vitamins and co-enzymes, Wagner and Folker.

CH-107 : Physical Chemistry Practicals

A. Conductometry :

(1) Hydrolysis of NH Cl or CH COONa or aniline hydrichloride.
(2) Solubility of a sparingly soluble salt
(3) Hydrolysis of ethylacetate by NaOH.

B. Potentiometry :

(1) Stability constant of a complex ion.
(2) Solubility of a spatingly souble salt.
(3) Determination of dissociation constant of acetic acid.
(4) Estimation of halide in mixture.

C. pH metry :

(1) Hydrolysis of aniline hydrochloride.

D. Polarography :-

(1) Determination of half wave potential, E1/2 and unknown concentration of an ion.
(2) Amperometric titration of Pb(No3)2 with K2Cr2O7

E. Colorimetry :

(1) pK value of an acid-base indicator.
(2) Analysis of a binary mixture
(3) Copper EDTA photometric titrations.

F. Radioactivity :

(1) Estimation of Mn in tea leaves by NAA
(2) Half-life of a radioactive nuclide.
(3) Determination of Emax of beta radiation and absorption coefficients in Al.
(4) Counting errors.

G. Chemical kinetics :

1. Kinetics of decomposition of diacetone alcohol by dilatometry.

2. Kinetics of hydrolysis of methyl acetate in presence of HCL.

3. Determination of an order of a reaction.

4. Bronsted primary salt effect.

H. Noninstrumental :

1. Transport cumbers by moving boundary method.

2. Freundlich and Langmuir isotherms for adsorption of acetic acid on active charcoal.

3. Statistical treatment of experimental data.
4. Molecular weight by steam distillation.
5. Glycerol radius by viscosity.

Each candidate should perform a minimum of 18 experiments with at least one experiment from each technique.

References :-

1. Practical Physical Chemistry, A. Finday, T.A.Kitchner (Longmans, Green and Co.)

2. Experiments in Physical Chemistry, J.N.Wilson K.T.Newcombe, A.R.Denko, R.M.W. Richett (Pergamon Press)

3. Senior Practical Physical Chemistry, B.D.Khosla and V.S.Garg (R.Chand and Co., Delhi)

CH-127 : Inorganic Chemistry Practicals :

I Ore analysis (at least two of the following)
1. Determination of silica and manganese from pyrolusite
2. Determination of silica and iron from hematite.
3. Determination of silica, copper and iron from chalcopyrite.

II Alloy Analysis (at least two of the following)

1. Determination of tin and lead from solder
2. Determination of chromium and nichel from nichrome
3. Determination of copper and cnickel from constantan.

III Inorganic synthesis and characterization by physical or chemical methods (at least five of the following) :

1. cis-trans Potassium diaque dioxalato chromate (III)
2. Chloropentammino cobalt (III) chloride
3. Nitropentammino cobalt (III) chloride
4. Nitrito pentammino cobalt (III) chloride
5. Bis, 2,4 pentanedionato cobalt (II) and cobalt (III)
6. Potassium trioxalato aluminate
7. Reinecke salt.

...1 3.

IV. Colorimetry (at least two of the following):

1. K_{eq} of M-L systems such as
   (i) Fe(III) salicylic acid
   (ii) Fe(III) Sulphosalicylic acid
   (iii) Fe(III)-R-resorcilic acid
   by Job's method and Mole-ratio method.

2. Determination of
   (i) P_2O_5
   (ii) Vanadium from given unknown soln. by studying Beer's law.
   (iii) Simultaneous determination of
   (a) $Cr^{6+} + Mn^{7+}$
   (b) $Ti^{4+} + V^{5+}$ from the mixture

3. Effect of temp., time, pH on the stability of M-L systems such as (i) Fe-sulphosalicylic (ii) Co-R-nitroso salt.

4. Effect of impurity ion addition on the Beer's law curve of systems.
   (i) Ni^{2+} on Co-R-nitroso salt
   (ii) Fe^{3+} on V^{5+} - H_2O_2
   (iii) Cu^{2+} on Fe^{3+} - sulphosalicylic acid

5. Photometric titration of systems such as
   (i) Cu^{2+} - EDTA
   (ii) Fe^{3+} - sulphosalicylic acid
   (iii) Co^{2+} -R-nitroso salt
   (iv) Ni^{2} - ethylene diamine

V. Thermochemistry (at least one of the following):

1. Lattice energy of binary salts by heat of dissolution; systems such as $CaCl_2$, $MgCl_2$, $CuCl_2$, $MnCl_2$, $CoCl_2$.

2. Thermometric titrimetry of M-L systems such as copper(II) - ammonia, Hg(II)-iodide, nickel(II)-EDTA.

3. Determination of Heat of complexation viz-a-viz, spectrochemical series: systems such as copper (II), nickel(II) or cobalt (II) with conc. HCl, ammonia, ethylenediamine, EDTA, nitrite.

VI. Potentiometry (at least one of the following):

1. Complexometric determination using disodium-EDTA, of (i) Ni^{2+}, (ii) Co^{2+}, (iii) Al^{3+}, (iv) Cu^{2+}
2. Determination of Zn with K_4 $(Fe(CN)_6)$.

...14.

VII. Conductometry

1. Electrolytic nature of transition metal compounds such as $(Co(NH_3)_6)Cl_3$, $K_3[Co(NO_2)_6]$, $K_3[Al(C_2O_4)_3]$.

Reference:

1. A text book of quantitative inorganic analysis, A.I. Vogel (ELBS, 4th Edn.)

CH-247: Organic Chemistry Practicals

1. Techniques : Crystallization, fractional crystallization, fractional distillation, vacuum distillation, sublimation, steam distillation, column chromatography, thin layer chromatography, ion exchange chromatography.
2. Single stage preparations involving different type of reactions (minimum 9 preparations).
3. Two stage preparations (minimum 2 preparations)
4. Three stage preparations (minimum 2 preparations).
5. Derivatives functional groups such as acetyl, benzoyl, 2,4 DNP, oxime, anilide, amide and aryloxy acetic acid (minimum one of each type).

Typical preparations from which the single and two stage preparations can be chosen are :

1. Toluene ---p-nitrotoluene - p-nitrobenzoic acid - p-aminobenzoid acid
2. Benzene - acetophenone - acetophenone oxime - acetanilide.
3. Benzaldehyde - benzoin - benzil - benzilic acid.
4. Nitrobenzene - m - dinitrobenzene - m-nitroaniline - m-nitrophenol.
5. Phthalic acid - phthalic anhydride - phthalimide - anthranilic acid.
6. Anthranilic acid - phenylglycine -o-carboxylic acid - indigo.
7. Acetophenone - benzalacetophenone - epoxide - B -phenyl-a-benzoylacetaldehyde.
8. Cyclohexanone- cyclohexanone oxime - e prolactam.
9. Phthalic anhydride - o-benzoylbenzoic acid- anthraquinone.
10. o-Chlorobenzoic- N-phenylanthranilic acid -, acridone.
11. Chlorobenzene- 2,4-dinitrochlorobenzene- 2,4-dinitrophenol.
12. Bromobenzene- triphenylcarbinol- trityl chloride.
13. Resorcinol - res. cetophenone- 4-ethyl resorcinol.
14. Phenol- allyphenyl ether - o-allylphenol.
15. Phenol- salicylaldehyde - coumarin

.....

UNIVERSITY OF POONA

SYLLABUS OF M.Sc. BIOCHEMISTRY SEMESTER I AND II ONLY.

1. Each theory units prescribed for M.Sc. Biochemistry should be covered in 2 periods each of 60 minutes duration per week per course alongwith tutorials seminars etc.

2. Each practical unit will require 3 hours of laboratory work per week and the course will be extended over two semesters and will be examined at the end of the year.

3. There should not be more than ten students in a batch of M.Sc. practical course.

SEMESTER I

CH-170 : Biomolecules
CH-171 : Biophysical and Bioorganic chemistry
CH-172 : Microbiology and cell Biology
CH-187 : Lab Course I
CH-188 : Lab Course II

SEMESTER II

CH-270 : Metabolism.
CH-271 : Biophysical techniques.
CH-272 : Physiology and plant Biochemistry
CH-273 : Enzymology and genetics
CH-287 : Lab course III

SEMESTER III

CH-370 Molecular Biology of Prokaryotes
CH-371 Medical Biochemistry
CH-372 Biochemistry of Membrances and specialised tissues.
CH-387 Laboratory course IV.

Optional courses:

CH-380 : Advanced Biochemistry
CH-381 : Environmental Biochemistry
CH-382 : Radiation Biology and Human genetics

SEMESTER IV:

CH-470 : Molecular Biology of Eukaryotes
CH-471 : Physiology
CH-487 : Laboratory course V.
CH-488 : Laboratory course VI (Project)

...16.

optional course :

CH-460 : Biotechnology I
CH-461 : Biotechnology II
CH-462 : Biotechnology III
CH-483 : Biotechnology IV

M.Sc. Syllabus for Biochemistry Starting from June 1989

M.Sc. Biochemistry I Year:

Theory units of M.Sc. 1 year:

Course 1. CH-170 : BIOMOLECULES

Unit 1. Biomolecules I : Proteins.
Unit 2. Biomolecules II. Carbohydrates, Lipids etc.

Course 2. CH-171 A : BIOPHYSICAL AND BIOORGANIC CHEMISTRY

Unit 3. Biophysical Chemistry.
Unit 4. Bioorganic Chemistry.

OR

CH-171 B : INORGANICS AND ORGANIC CHEMISTRY

Unit 3A. Thermodynamics.
Unit 4. Bioorganic Chemistry.

Course 3 CH-172 : MICROBIOLOGY AND CELL BIOLOGY

Unit 5. Microbiology and virology.
Unit 6. Cell biology.

Course 4. CH-270 : METABOLISM

Unit 7. Metabolism I : Bioenergetics & Metabolism
Unit 8. Metabolism II: Nitrogen metabolism.

Course 5. CH-271 : BIOPHYSICAL TECHNIQUES

Unit 9. Biophysical Techniques I.
Unit10. Biophysical Techniques II.

Course 6 CH-272 : PHYSIOLOGY & PLANT BIOCHEMISTRY

Unit 11. Physiology
Unit 12. Plant Biochemistry.

...17.

Course 7 CH-273 : ENZYMOLOGY AND GENETICS

Unit 13. Enzymology.
Unit 14. Genetics and Statistics

Practical Units of MSc I year

Course 8 CH-167 : LABORATORY COURSE I

Unit 15. Analysis of food constituents
Unit 16. Microbial Techniques.

Course 9. CH-168 : LABORATORY COURSE II

Unit 17. Proteins and amino acids.
Unit 18. Lipids and carbohydrates.

Course 10. CH-267: LABORATORY COURSE III

Unit 19. Computer.
Unit 20. Experiments in Biophysical chemistry

or

Unit 21. Experiment in Physiological Chemistry
Unit 20. Experiments in Biophysical Chemistry

M.Sc. Biochemistry IInd Year.

Theory Units of M.Sc. IInd Year.

Course 11 CH-370 : MOLECULAR BIOLOGY OF PROKARYOTES

Unit 22. Molecular Biology I: DNA, Synthesis and repair.
Unit 23. Molecular Biology II: Protein Synthesis.

Course 12. CH-371 : MEDICAL BIOCHEMISTRY AND IMMUNOLOGY

Unit 24. Medical Biochemistry.
Unit 25. Immunology.

Course 13. CH-372 : BIOCHEMISTRY OF MEMBRANE AND SPECIALIZED TISSUES

Unit 26. Membrane Biochemistry.
Unit 27. Biochemistry of specialized tissues.

*Course 14. : OPTIONAL COURSES:

CH-360 : ADVANCED BIOCHEMISTRY I Any two of the following units:

Unit 28. Biophysics.
Unit 29. Secondary metabolism.
Unit 30. Neuroscience.

...18.

CH-361 : Environmental Biochemistry :

Unit 31. Environmental Biochemistry.
Unit 32. Biochemical Toxicology.

CH-362 : RADIATION BIOLOGY AND HUMAN GENETICS

Unit 33. Radiation Biology.
Unit 34. Human Genetics.

*ANY TWO OF THE ABOVE UNITS CAN BE COMBINED INTO A COURSE

Course 15. CH-470: MOLECULAR BIOLOGY OF EUKARYOTES

Unit 35. Molecular Biology III: Eutaryotes
Unit 36. Molecular Biology IV: Development and cancer.

Course 16. CH-471. PHYSIOLOGY

Unit 37. Physiological Biochemistry.
Unit 38. Biochemical endocrinology.

*Course 17. OPTIONAL COURSES : BIOTECHNOLOGY

CH-460 : BIOTECHNOLOGY I

Unit 39. Recombinant DNA technology.
Unit 40. Plant Biotechnology.

CH-461 : BIOTECHNOLOGY II

Unit 41. Enzyme Technology.
Unit 42. Fermentation Technology.

CH-462 : BIOTECHNOLOGY III

Unit 43. Tissue culture and vaccine technology.
Unit 44. Forensic Biochemistry.

CH-463 : BIOTECHNOLOGY IV

Unit 45. Food processing and Food Technology.
Unit 46. Sugar processing and sugar Technology.

CH-464 : OPTIONAL COURSE V

Unit 47. Clinical Nutrition
Unit 48. Molecular evolution.

*ANY OF THE ABOVE UNITS MAY BE COMBINED INTO A COURSE

...19.

Practical Units of M.Sc. IInd Year

Course 18: CH-367 : LABORATORY COURSE IV

Unit 49. Molecular Biology and immunology.
Unit 50. Enzymology.

Course 19. CH-467 : LABORATORY COURSE V

Unit 51. Clinical Biochemistry.
Unit 52. Special experiments.

Course 20. CH-468 : LABORATORY COURSE VI

Unit 53 & 54 : PROJECT

Important Note : For all theory courses, question paper should include atleast 30% weightage for problem solving.

jvc.

M. Sc. BIOCHEMISTRY DETAIL SYLLABUS :

Unit 1. Biomolecules I - Proteins.

1. Amino-acids , Classification, Properties, reactions, rare amino acids, seperation techniques.
2. Protein classification : Reactions functions, properties peptide synthesis, solid phase synthesis.
3. Structure : a. Peptide bond. and group analysis, sequencing.
   b. Secondary - alpha-helix, beta- structure, 310 helix, super secondary structure.
   c. Tertiary Structure : Forces Stabilising, unfolding/refolding expt. Prediction of tertiany Structure.
   d. quarternary structure-haemoglobin
   e. Ramachandran plot
   f. Helix coil transitions Vander waals electrostatic, hydrogen bonding, and hydrophobic interactions.
   g. Energy terms in Biopolymer conformational calculations.
4. Globular proteins
5. Protein purification : Chromatography, electrophoresis crystallisation etc. Determining protein concentration and molecular weight etc.criteris of purity of proteins.
6. Fibroes proteins.
7. Protein evolution.

BOOKS :

1. Principles of Biochemistry - Lehninger. CBS public(1982)
2. Biochemistry - L. Stryer, W.H. Freeman, San francisco.
3. Senaumes Outline of Theory and Problems of Biochemistry - Philio H. Kuchel and G.B. Ralston. Int.Ed.,McGraw-Hill Book Co.
4. Problem approaches in Biochemistry,Wood and Hood.

Unit 2 : Biomolecules - II.-carbohydrates and lipids

1. Composition of living mattter.
2. Properties of water.
3. Carbohydrates : Basic chemical structure-hemiacetals and ring forms,anomers,epimers, deoxy sugars, amino sugars and sugar acids. Hono. oligo and polysaccharides Methylation and periodic exidations. Structure and function of complex carbohydrates, cellulose, chitin, starch, glycogen, mucopolysaccharides and glycoproteins etc.
4. Lipids : Classification, structure and function of major lipid subclasses, Acylolycerols, phosphoglycerides,sphingo--lipids, waxes, terpenes, steroids and prostaglandins. Lipoproteins, Circulating lipids : Chylomicrons, LDL,HDL and VLDL etc. Free fatty acids, Pathological changes in lipid levels.
5. Vitamines and Co-enzymes.

BOOKS :

1. Biochemistry and Stryer; W.H.Freeman. San francisco.
2. Mangers Review of Biochemistry Lange Medical Publ.Calif.
3. Biochemistry - Lehninger.
4. Schaums outline series of Theory and problems of Biochemistry - P.W. Kuchel and G.B.Relston, Int.Eds.,McGraw-Hill Book Co.

5. Vitamins and Co-enzymes - Wagner and Foller.

Unit 3 : Biophysical Chemistry.

1. Thermodynamics, First and second laws of thermodynamics, Internal energy enthalog, entropy, free energy and work functions, hydrophobic effects, free energy changes in Biological transformations, High energy compounds, redox patentials, effect of temperature and other variables, Thermodynamics of coordinate bond formation, stability of complexes, metal complexes of Biological importance, examples and role of iron in Homoglobin, Mo in oxioases, Co in vitamin B-12, Mo in chlorophyil, Metal enzyme complexes, Protein-metal interactions, Transition state theory, and its importance to Biochemical reactions. Nuclear Radiation Chemistry: Discovery, decay, characterstics, alpha, beta decay and nuclear deoxcitation Detectior of radiations, ionisation chambers, proportional counters, SM Counter, Scientillation counter, Counting errors, Interaction of radiation with matter, passage of neutrons thnough matter interaction of gamma rays with matter, units of measuring radiation absorption, Radiation dosimetry, Radiolysis of water, free radicals in water,

BOOKS

1. Physical Biochemistry : Kensal, Edward Van holde. Prentice Hall (1971).
2. Biochemical Calculations: Segel, John Wiley and Sons (1976)
3. Essentials of Nuclear Chemistry, H.J. Arnikar, Wiely Estern Ltd.

Unit 4 : Bio-organic Chemistry :

Structure of atom : Nuclear isotopes, radioactivity; electronic configuration, atomic and molecular orbitals.

Bond formation, covalent, electrovalent; Weak interactions, van der waal's forces, intermolecular and intramolecular associations; Hydrogen bonds: Hydrophilic and hydrophobic interactions;

Acids and bases inductive, resonance and steric effects; dipolemoment.

Structural isomerism, Geometric isomerism, Optical isomerism, Conformational isomerism.

Asymmetric carbon, R and S configurations, enantiomers, diastereoisomers.

Conformational isomerism in alkanes, cyclohexanes, peptides, hexoses.

Features of organic reaction mechanism; Aliphatic substitution, addition, elimination, aromatic substitution, condensation, rearrangements: Examples from biochemical reactions.

Special characterstics of enzyme catalyzed reactions; Mechanism and functions of important cofactors and coenzymes.

Functional groups in biomolecules: Formation and reactions of alcohols, thiols, amines, vicinal diols; aidehydes and ketones: acids, esters, thiol esters, amides; ethers, sulphides, disulphides. Examples derived from biochemical reactions.

Free radicals in Biochemical reactions.

Heterocycles associated with biomolecules.

Books : Organic chemistry R.T. Morrison and R.N. Royd, Allyn and Bacon Inc.
Biochemistry edited by Zubay : Addison Wesley (1983)

Unit 5 Microbiology and Virology.

1. Historical perspective and Scope of microbiology.
2. Characterizatic s and classificati n of microorganisms.
3. Microscopic observati n of microorganisms. Light Micro-scopy; Ultraviolet and flucrescence microscopy; Electron microscopy.
4. Gram staining of microorganism and other staining methods. Cell well structure of peptidoglycan and other cell wall components.
5. Cultivation of Bacteria, nutrition, physiology and growth of microbiol cells.
6. Reproduction and growth, synchronous growth; continuous culture of microorganisms.
7. Pure cultures and cultural characteristics.
8. Fundamentals of control of microbial growth control by physical agents control by chemical agents.
9. Host-Microbe Interactions. endotoxins, exotoxins, capsular material Enzymatic and other factors; tissue affinity. Resistance and immunity.
10. Microbiology of water air, soil sewage.
11. Etiology and Prophalyxis, Human air born infections. (Baterial and viral). Human food born and waterborn infections. Human cents of diseases; Microbiological standards.
12. Infections diseases of Animals (domestic); Plant (crops).
13. Directing the Chemical Activities of Microorganisms. Biological exidation and the transfer of energy HMP; glycolysis, TCA cycle, glyoxylic acid cycle and metabolism of fats, metabolism of hydrocarbons. Accumulation of Metabolities: Production of organic acids, vitamins and amino acid; Production of nucleotides; Production of antibiotic .
14. Kinetics; Kinetic patterns of various fermentations. Design and applications of a Ciofermentor
15. Microbial leaching of Minerals.

Books 1. Microbiology by M.S. Pelozar. R.D. Reid, E.C.S.Chan Mc Grav Hill (1988) New York.
2. General Microbiology (Fifth edition - 1988) R.Y. Stanier et al, Prentice Hall.
3. Biochemical Engineering by S.Aiba: A.E.Humphrey Nancy F. Mills. (1973) University of Tokyo Press.
4. Introductory Microbiology F.C.Ross.Charles Merril Publication (1983).

UNIT 6 : CELL BIOLOGY

1. Cell classification, cell variability, size shape, complexity. function.
2. Proksryotes, cell structure and components.
3. Eukaryotic cell: structure, subcellular components :Nucleus, Nucleolus, chromosomes, plasma membrane, cell wall, endoplasmic reticulum, lysosomes, peroxisomes, golgi apparatus, mitochondria, chloroplast, cytoskeleton, pili, flagellum, subcellular fractionation, differential and density gradient centrifugation specific staining of organelles or marker enzymes.
4. Animal cell culture techniques, contact inhibition, cell movements and chemotaxis, Embryo and organ culture techniques,
5. Cell division, mitosis and meiosis, cell cycle;
6. Plant cells : Cell wall and its function, xylem, phloem, and epidermal cells, The interaction and communication between the cells [illegible] in plants, role of golgi vesicles in plasma membrane, cell growth and division.
7. Cell -cell adh sion and the extra cellular matrix- species specific cell agregati n in sponges, cell junction, extracellular matrix, collages elastin, fibronectin.

...23

8. Germ cells and fertilization, cell differentiation, organogenesis, functional and biochemical maturation of tissues, Placentation, Amniocentesis, Teratogenesis,
9. Differentiated cells and maintainance of tissues, Tissue with permanent cells : Lense, photoreceptor cells of the retina, rod cells and cone cells : Liver cells, endothelial cells of the blood vessels, stem cells, lumen of gut, epidermal cells, blood cell formation, osteoblasts certilage,
10. Types of ecosystem, marine, fresh water and terrestrial,
11. Cell aging and senscence.

BOOKS:

1. Molecular Biology of the Cell Bruce Alberts (J.D.Watson) et al Barland publishing Inc.N.Y. (1983).
2. Cell Biology C.J.Avers, Addison Wesley Co (1986)
3. Biology, M.Curtis, Worth Publ (1986)
4. Molecular cell Biology,: James Darnell (D. Baltimore) W.H. Freeman (1986).
5. Cell and Molecular Biology, DeRobertis and Saunders(1980).

UNIT 7. METABOLISM 1 : BIOENERGITICS AND METABOLISM

1. Survey of metabolism - carbon, oxygen, nitrogen cycle catabolism, use of mutants and istopes in the study of metabolism, compartmentalization. Food chain and energy flow,
2. Cell bioenergetics - concept of free energy, standard free energy change of a chemical reaction, ATP and high energy phosphate compounds.
3. Glycolysis - anaerobic pathway of glucose metabolism. Two phases of glycolysis, Detailed study of all the reactions, entry of other carbohydrates in glycolytic pathway, energy balance sheet, Regulation of glycolytic sequence by enzymes and hormones, alcoholic fermentation.
4. Citric acid cycle - aerobic pathway of glucose metabolism, historical background details of the cycle, use of isotope for study of citric acid cycle, energatics of the cycle.
5. Alternate pathways of carbohydrate metabolism, Pentose phosphate pathway, glyoxalate cycle, glucuronic acid cycle interconversion of hexoses, Pasteur effect.
6. Lipid metabolism. Fatty acid metabolism - Beta oxidation of unsaturated fatty acids. The phases of fatty acid oxidation, energetics of Beta oxidation, oxidation of fatty acids with odd no of carbon atoms. formation of ketone bodies. Other types of fatty acids oxidation.
7. Integration of lipid and carbohydrate metabolism.
8. Biosynthesis of lipids - requirement of CO_2 and citrate for biosyethesis, fatty acid synthetase complex, regulation of fatty acid biosynthesis. Biosynthesis of triglycerides.
9. Electron transport chain and oxidative phosphorylation.

:BOOKS: Same as in unit 8.

Unit 8 : Metabolism III Nitrogen Metabolism.

1. Oxidative degradation of amino acids : Proteolysis Transamination, Oxidative deamination, acetyl CoA Alpha ketoglutarate, acetoactyl CoA, succinate, fumarate and oxaloacetate pathway, decarboxylation, area cycle, Ammonia excretion.
2. Biosynthesis of amino acids : Amino acid biosynthesis, Precursor functions of amino acids, Biosynthesis of aromatic amino acids, Histidine, One carbon atom transfer by folic acid (Biosynthesis of glycine, serine cysteine, methionine, threonine,)

3. Peptides, polyamines, Porphynins, gamma glutamyl cycle, glutathione Biosyathesis. Nonribasomal Protein Biosyathesis.
4. Purine oynimidine degradation.
5. Biosynthesis of Purine and pyrimidine nucleotides. Regulation. Biosynthesis of nucleotide coenzymes.
6. Inborn errors of nitrogen metabolism.
7. Gluconeogenesis.
8. Cholesterol Biosynthesis.

BOOKS : 1. Biochemistry - Lehninger,
Z. Mitabolic Pathways - Greenberg,
S. Biochemistry B. Zubay Addison Wesley Publ (1983).

UNIT 9 : BIOPHYSICAL TECHNIQUE 1

1. Theory, phase contrast microscopy, fluorescence microscopy,
2. Electron microscopy : Theory, specimen preparation freeze etching, freeze fracture, shadow casting, electron microscopy of nucleic acids, TEM, SEM,
3. Measurement of pH : pH. glass electrofe, pH meter, buffers, electrodes sensitive to other ions,
4. Absorption Spectroscopy: Theory, visible, and UV spectrophotometer, Factors effecting absorption, Chemical analysis, Structural studies of DNA, and proteins. reporter groups, infrared spectroscopy, Technique information in spectra, Raman spectroscopy, Fluorescence spectroscopy, ORD, CD, NMR, ESR.
5. Membrane filter and dialysis : Nitrocellulose, fiber glass, polycarbonate, Dialysis and concentration.
6. Chromotography : partition- paper TLC, GLC, adsorption, Gel chromatography theory materials, advantages, molecular weight determination, and other applications, Ion exchange cahromatography, properties of ion exchangers, choice, technique, HPLC, affinity chromatography, Hydrophobic chromato-graphy, DNA-celluloss, MAK, Hydroxyapetite,
7. Electrophoresis : Theory, Types. zone, paper, cellulose-acetate, Gel electrophoresis, Disc, PAGE, parameters, DNA agarose, electrophoresis, Mol wt Shape, Gyrase assay, Souther, Northern, Western transfers, DNA sequencing, Gradient electrophoresis, Isoelectrofocussing, Fingerprinting, Homothromategrphy,

BOOKS : As in Unit No. 10

UNIT 10 : BIOPHYSICAL TECHNIQUES II

1. Sedimentation : Theory, Preparatory and analytical ultracentrifuges, facotrs affecting sedimentation velocity, sedimentation coefficient, measurement of S. Zonal centrifugation, DNA analysis, Determination of molecular weight by

sedimentation diffusion and sedimentation equilibrium methods, specific examples of applications.

2. Partial specific volume, and the diffusion coefficient Measurement of partial specific volume, and diffusion coefficients.

3. Viscocity Theory, effect of macromolecules on the viscocity of a solution, measurement molecular weight determination.

4. Isotope tracer technique types of radiations measurement Scintillation and gamma counters, Back ground noise quenching, Applications,

5. Autoradiography.

6. Lignc Sonication,

7. Freeze drying

8. Warburg constant volume respirometer and oxygraphs,

9. Scattering 10. X-ray diffraction.

BOOKS:

1. Biophysical Techniques. Friefelder

Unit-11: Physiology

1 Food utilization: Ingestion, digestion, absorption, transport storage and disposal of food nutrients (proteins, carbonyrates, fats, vitamins and minerals)

2. Energymetabolism-Factory affecting requirement, measurement, BMR and relation of temperature regulation to basal metabolism,

3. Role of food nutrients-Requirements and allowances. Proteins as building material, amino-acid inter relationship, protein quality and metabolism. Factors affecting metabolism. Biochemical basis of causation and detection of anaemias.

4. Minerals and trace elements homeregulation,

5. Primary Nutritional Diseases: PEM, Starvation-obesity, and vitamin deficiency disorders.

6. Conditioned nutritional diseases:

1 Anaemias Diet and allergy, Gastrointestinal Tract disorders, Liver, Biliary tract and Pancreatic disorders.

BOOKS:

1. Roses: Foundations of Nutritions.
2. Human Nutrition and dietics; Davidson R.Passmore J.F.Brock & A.S.Truswell.
3. Human Nutrition-Benjamin T.Burtrum.
4. An Integrated approach to nutrition. Pyke and Brown.

UNIT 12: PLANT BIOCHEMISTRY

1. Special features of plant biochemistry.
2. Photosynthesis: Intracellular organisation of photosynthetic systems, fundamental reactions of photosynthesis, light and dark reactions, photosynthetic pigments Role of light, reaction and its significance, photophosphorylation, light reactions cyclic and noncyclic photoinduced electron flow, energetics of photosynthesis, photosynthetic posphorylation, photospiration, dark phase of photosynthesis, Calvin cycle, C_4 pathway. Bacterial photosynthesis.
3. Nitrogen fixation: historical background, nitrogen cycle in nature, symbiotic nitrogen fixation, nitrogese system, nitrate reductase,

4. Plant nutrition, fertilizers
5. Plant diseases, pesticides and insecticides,
6. Plant hormones auxins, gibberellic acids, cytokinins, etc.
7. Biochemistry of seed germination, seed storage proteins,
8. Gums, pectins, alkaloids, rubber, anthocyanins etc,
9. Bioluminescence,
10. Principles of plant breeding(Conventional and nonconventional) polyploidy
11. Plant tissue culture and plant Biotechnology, Haploidy, Somatic hybridisation, protoplast fusion, cybrids, Transgenesis, Allophony
12. Phytochrome action and circadian rytm.

BOOKS:

1. Biochemistry of Green Plants, David Krogmann, Prentice Hall India(1977)
2. Plant Physiology, Dieter Hess, Springer International Student Edition (1981)

UNIT 13 ENZYMOLOGY:

1. Historical perspectives,
2. Isolation purification criteria of purity, classification, nomenclature, specificity, active site,
3. Enzyme kinetics One substrate reactions, Km, competitive, non competitive, uncompetitive inhibition, effect of pH, temperature, two substrate reactions, Theory, ordered, random, pingpong mechanisms, Kinetic analysis, Isotope exchange analysis, Stopped flow technique Relaxation methods,
4. Mechanism of enzyme actions,: Orientation effect, acid base catalysis, microenvironment, experimental approaches to study mechanisms of enzym reactions- kinetic studies, detection of intermediates X-ray crystallographic studies, chemical modification, affinity labelling, Examples of chymotrypsin, triose phosphate isomerases, aldolase etc. active site studies
5. Control of enzyme activity inhibitors, availability of substrates, co factors, product inhibition,
   a) Changes in covalent structure-Zymogen activation, phosphorylation
   b) Ligand induced changes: Allosteric enzymes, Theoretical models, Hill equation, N.W.C. and M.W.F. models, Negativ cooperativity, significance.
   c) Control of metabolic pathway signal amplification by substrate cycles, and interconvertible enzyme cycles, examples
6. Multienzyme complex properties, pyruvate dehydrogenase system, Tryptophan synthetase, fatty acid synthase, glycogen particles
7. Enzyme turn over: Mechanism, [illegible] function.
   synthesis degredation, significance.
8. Clinical aspects of enzymology: LDH isozymes, SGOT, SGPT, creatin kinase, alpha amylase, phosphatase, inborn errors.
9. Enzyme technology Immobilized enzymes, Enzyme electrodes, ELISA therapy.

BOOKS

1. Enzymes, Gordon B.Hammez, Academic Press(1982)
2. Biochemical Calculation 2nd Edition Irwin Segal, John Wiley and Sons, New York (1976).

...27

3. Proteins and Enzymes T.Bell and E.T.Bell Pentice Hall Inc(1988)

UNIT 14: Genetics and Statistics

1. Nucleic acids: Nuclesin, Nucleotides, Nucleotide chain, double helix, chromosomes, UV absorption, lampbrush chromosomes, Griffith transformation experiment, Wermsley chase experiment, Gierer Schramm experiment, Central dogma, Beadle and Tatum experiment,

2. Replication Semiconservative mechanism, Meselson and Stahl experiment. Cairns experiment, Kornberg enzyme Nearest neighbour analysis, RNA replication. Chemical Synthesis of Oligonucleotides.

3. Mendelian Principles Mendel's experiments segregation, Independent assortment, Tetrad analysis. Principles and theories of graphic evolution and speciation.

4. Probability and Statistical testing probability rules, Chisquare, binomial expansion, coincidence limits, poisson distribution.

5. Dominance relations incomplete dominance vs codominance, multiple alleles blood group RH and A,B,O incompatibilities. Histocompatibility genes.

6. Sex determination sex chromosomes, Y-chromosome, sex determination, meiotic behaviour of sex chromosomes, nondisjunction, detection of sex linked diseases, sex ratio.

7. Cytoplasmic heridity maternal effect, chloroplast, streptomycin resistance in chlamydomonas, petite mutants of yeast, cytoplasmic DNA, extrachromosomal inheritance, infective heridity in and drosophila,

8. Linkage and recombination Linkage groups, complete linkage, Recombination, crossing over, Detection of linkage, Recombination frequencies linkage maps, crossing over.

9. Gene mapping Recombination frequencies, Linkage maps, crossing over, Transduction, conjugation, episomes, plasmids, Host restriction and modifications.

10. Chromosome aberrations.
11. Congenital diseases and genetic counselling.
12. Genetic toxicity testing, population genetics.

BOOKS:

1. Genetics, Strickberger M.W.Macmillan Publ Inc(1976)
2. 36 Lectures in Biology, S.E.Luria, M.I.T.Press Cambridge(1975)

...28

MSC I Year Laboratory Courses:

Unit 15: 1 ANALYSIS OF FOOD FOR VARIOUS CONSTITUENTS

1. Protein by Bowry
2. Protein by UV.
3. Protein by Kjeldhal and NPN
4. Protein and free amino acids by Ninhydrin
5. Carbohydrate(Total)
6. Sugar estimations
7. Estimation and iodine value
8. BOD
9. COD
10. Preparation of Egg albumin
11. Preparation of Milk Caseins
12. Electrophoretic Analysis of proteins
13. Starch preparation.
14. Alpha and Beta amylolysis
15. Cholesterol and lecithin from egg.
16. Vitamins-A,B,C, - colorimetrically.
17. Moisture.
18. Ash
19. Fibre
20. Mineral determination-Mg,Cu, P, Fe etc.
21. Food Toxins-1. Trypsin Inhibitors
    2. Aflatoxins
22. Animal Experiments.

BOOKS:

1. Hawk's Physiological Chemistry, Tata McGRaw Hill Book Co Bombay (1981)

UNIT 16; MICROBIAL TECHNIQUE:

Introduction to microbial techniques, sterilization, incubation aeration, glass apparatus:

1. Media preparation and pour plating, Methods of sterilisations, aseptic transfer techniques,
2. Preservations of bacterial cultures,
3. Growth curve of E.coli,
4. Growth curve of yeast,
5. Serial, pour plate techniques to count viable cells;
7. Introduction to microbial techniqrs,
8. Ultraviolet irradiation and survival curve
9. Isolation of auxotrophic mutants.
10. Microscopic examination of micro organisms-staining and motility tests.
11. Alcohol Fermentation,
12. Methenogenesis
13. Microbial assay of vitamins

BOOKS

1. Microbial methods J.C Collins
2. Medical Microbiology Vol.Cruickshank

...29