

PUNJABI UNIVERSITY, PATIALA

**ORDINANCES
AND
OUTLINES OF TESTS,
SYLLABI AND COURSES OF READING
FOR
B.Sc. (Biotechnology) Part - II
2011, 2012 & 2013 Examinations**

**PUBLICATION BUREAU
PUNJABI UNIVERSITY, PATIALA**
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Syllabus
B.Sc. (Biotechnology) Part-II
for
2011, 2012 & 2013 Examinations
Scheme for B.Sc. (Biotechnology) Part-II

Subject: Paper I: English(Common for B.Sc.)
Paper II: Chemistry
Paper III: Biophysics and Biochemistry
Paper IV: Genetics and R.DNA Technology
Paper V: Environment Studies

Note: In addition to above mentioned subjects, there will be a course of Environmental Studies as a qualifying subject.

ENGLISH

PAPER-A

Teaching Hours : Theory : 3 Hrs., Tutorials : 2 Hrs.
Time Allowed : 3 Hrs.

Max. Marks : 75
Pass Marks : 35%

COURSE CONTENT

The course content for Paper-A shall comprise the following books :

1. Perspectives : *Selections from Modern English Prose and Fiction*, edited by S.A. Vasudevan and M. Sathya Babu, Published by Orient Longman.
2. *Six One-Act Plays*, edited by Maurice Stanford. Published by Orient Longman.

TESTING

The paper shall have two sections. Section-A shall comprise testing from *Perspectives* while Section-B from *Six One-Act Plays*.

SECTION-A : PERSPECTIVES

Q. 1. (Based on the section entitled "Prose", comprising chapters I to VI)

- (a) One essay-type question with internal alternative. The answer should not exceed 250 words.
10 Marks
- (b) Five short-answer questions to be attempted out of seven. Each answer should be written in 25 to 30 words.
5×2=10 Marks

Q. 2. (Based on the section entitled "Fiction", comprising chapters VII to IX)

- (a) One essay type question with internal alternative on character/theme and incident/episode. The answer should not exceed 250 words.
10 Marks
- (b) There will be one short answer question from each of the three stories. The candidate shall be required to attempt any two. Each answer should be written in 25 to 30 words.
2×2½=5 Marks

Q. 3. (Based on the section entitled "Biographies", comprising chapters X to XII)

- (a) One essay type question with internal alternative. The answer should not exceed 250 words.
10 Marks
- (b) There will be one short answer question from each chapter. The candidate shall be required to attempt any two. Each answer should be written in 25 to 30 words.
2×2½=5 Marks

SECTION-B : SIX ONE-ACT PLAYS

- Q. 4. (a) One essay type question on character, incident/episode and theme, with internal alternative. The answer should not exceed 250 words. 15 Marks
- (b) Five short-answer questions to be attempted out of seven. Each answer should be written in 25 to 30 words.
5×2=10 Marks

PAPER-B

Teaching Hours : Theory : 3 Hrs., Tutorials : 2 Hrs.
Time Allowed : 3 Hrs.

Max. Marks : 75
Pass Marks : 35%

COURSE CONTENT

The course content for Paper-B shall comprise composition, comprehension, translation and grammar.

TESTING

The paper shall have two sections. Section-A shall test the candidate's skills in composition, comprehension and translation. Section-B shall test his/her skills in grammar.

SECTION-A

- Q. 1. An essay of 300-350 words on a topical or reflective subject (one to be attempted out of the five given). 15 Marks
- Q. 2. Letter-Writing with internal choice between personal and official letters. 10 Marks
- Q. 3. Precis 10 Marks
- Q. 4. Comprehension of an unseen passage 10 Marks
- Q. 5. Translation of a given passage from Punjabi/Hindi into English. 05 Marks

SECTION-B

- Q. 6. (a) Analysis of sentences : Converting simple sentences into complex and compound ones and identifying adverb clause, noun clause and adjective clause in the given sentences. 05 Marks
- (b) Synthesis of sentences : (i) Combining two simple sentences into a single simple sentence by using a participle, an infinitive, a noun or phrase in apposition, too/enough + adjective/adverb+infinitive and the bare infinitive. (ii) Combining simple sentences into complex ones by using a noun clause, adjective clause or an adverb clause. (iii) Combining simple sentences into compound ones by using conjunctions such as 'and', 'as well as', 'not only....but also' or 'either.... or' 'neither.....nor', 'but yet', 'nevertheless', 'so', 'therefore', for etc. 10 Marks
- (c) Transformation of sentences. (i) Transformation of degree, i.e. from positive to comparative degree and positive to superlative degree. (ii) Transformation of kinds of statements, i.e. from rhetorical or interrogative into assertive statements, from affirmative into negative sentences and from statement into exclamatory sentences. (iii) Transformation from active into passive voice and vice-versa and from direct speech into indirect speech and vice-versa. 10 Marks

Note : In part (a) of Q. No. 6, the paper-setter shall set 8 sentences out of which the students shall have to attempt any 5. In part (b) and (c), a total of 15 sentences each shall be set out of which the students shall have to attempt any 10 in each part.

RECOMMENDED BOOK

The students are free to use any book. The following book is however recommended :

Current English Grammar and Usage with Composition by R.P. Sinha, Oxford University Press.

CHEMISTRY

PAPER I : INORGANIC CHEMISTRY

Max. Marks : 75

60 Hrs (2 Hrs/week)

3 Periods/week

SECTION-A

(20 hrs.)

I. Chemistry of Elements of First Transition Series

Characteristic properties of d-block elements. Properties of the elements of the first transition series, their simple compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry.

II. Chemistry of Elements of Second and Third Transition Series

General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties & stereochemistry.

SECTION-B

(20 hrs.)

III. Coordination Compounds

Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.

IV. Chemistry of Lanthanide Actinides Elements

Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation of lanthanide compounds.

General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, similarities between the later actinides and the later lanthanides.

SECTION-C

(20 hrs.)

VI. Oxidation and Reduction

Use of redox potential data—analysis of redox cycle, redox stability to water-Frost, Latimer and Pourbaix diagrams. Principles involved in the extraction of the elements.

VII. Acids and Bases

Arrhenius, Bronsted-Lowry, the Lux-Flood solvent system and Lewis concepts of acids and bases.

VIII. Non-aqueous Solvents

Physical properties of a solvent, types of solvents and their general characteristics, reaction in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2 . (20 hrs.)

INSTRUCTIONS FOR PAPER-SETTER AND CANDIDATES

In the case of Chemistry, each theory paper will have three sections A, B, C and an additional section D. The paper-setter will set eight questions from Section A, B and C in such a way that not less than two and not more than three questions are set from any section, Section D will have one question only which will consist of 10 objective/very short answer type parts uniformly covering the whole syllabus. All the questions from sections A, B, C and D will carry the same marks.

Candidates will attempt five questions, selecting at least one but not more than two from each section.

PAPER II : ORGANIC CHEMISTRY

Max. Marks : 75

60 Hrs (2 Hrs/week)

3 Period/week

Section-A

(20 hrs.)

I. Alcohols

Classification and nomenclature.

Monohydric Alcohols—nomenclature, methods of formation by reduction of aldehydes, ketone, carboxylic acids and esters. Hydrogen bonding, Acidic nature, Reactions of alcohols.

Dihydric alcohols—nomenclature, methods of formation, chemical reactions of vicinal glycols—nomenclature, methods of formation, chemical reaction of vicinal glycols, oxidative cleavage with $[\text{Pb}(\text{OAc})_4]$ and $\text{HI}(\text{O})_4$ and Pinacol-Pinacolone rearrangement.

Trihydric alcohol—nomenclature, methods of formation and chemical reactions of glycerol.

II. Phenols

Nomenclature, structure and bonding. Preparation of Phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reaction of phenols—electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement. Gatterman synthesis. Hauben-Hoesch reaction. Lederer-Mianasse reaction and Reimer—Tiemann reaction.

III. Synthetic Dyes

Color and constitution (electronic concept), Classification of dyes, Chemistry and synthesis of Methyl orange. Congo red Malachite green, Crystal violet, Phenolphthalein. Fluoresein, Alizarin and Indigo.

SECTION-B

(20 hrs.)

IV. Aldehydes and Ketones

Nomenclature and structure of the carbonyl group, Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1, 3-

dithianes, synthesis of ketones from nitrites and from carboxylic acids, Physical properties and Mechanism of nucleophilic addition to carbonyl group with particular emphasis of Benzoin, Aldol, Perkin and Knoevenagel condensations, Condensation with ammonia and its derivatives, Wittig reaction, and Mannich reaction.

Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction, MPV, Clemmensen, Wolff-Kishner, LiAlH_4 and NaBH_4 reductions. Halogenation of enolizable ketones.

An Introduction to α , β unsaturated aldehydes and ketones, Michael addition.

Carboxylic Acids

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength, Preparation of carboxylic acids, Reactions of amides, Reactions of carboxylic acids, Mechanism of decarboxylation.

Methods of formation and chemical reactions of halo acids. Hydroxyacids, maleic and tartaric acid, citric acids. (Structural Formula only).

Methods of formation and chemical reaction of unsaturated monocarboxylic acids, Dicarboxylic acids, methods of formation and effect of heat and dehydrating agents.

SECTION-C

(20 hrs.)

VI. Carboxylic Acid Derivatives

Structure and nomenclature of acid chlorides, esters, amides and acid anhydrides. Relative stability and reactivity of acyl derivatives.

Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution.

Preparation of carboxylic derivatives, chemical reactions, Mechanism of esterification and hydrolysis (acidic and Basic).

VII. Ethers and Epoxides

Nomenclature of ethers and methods of their formation, physical properties, Chemical reactions—cleavage and autooxidation, Ziesel's method.

Synthesis of epoxide, acid and base catalysed ring opening of epoxide, orientation of ring opening reactions of Grignard and organolithium reagents with epoxide.

VIII. Fats, Oils and Detergents

Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value. Soaps, synthetic detergents, alkyl and aryl sulphates.

IX. Organic Compounds of Nitrogen

Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanism of nucleophilic substitution in nitroarenes and their reactions in acidic, neutral and alkaline media, Picric acid.

Comparative reactivity with halonitroarenes : Structure and nomenclature of amines, physical properties. Stereochemistry of amines, Separation of a mixture secondary and tertiary amines, basicity of amines. Amine salts as phase-transfer catalyst and preparation of alkyl and aryl amines (reduction of nitro compounds and nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel-phthalimide reaction, Hoffmann bromamide reaction. (20 hrs.)

INSTRUCTIONS FOR PAPER-SETTER AND CANDIDATES

In the case of Chemistry each theory paper will have three sections A, B, C and an additional section D. The paper-setter will set eight questions from Section A, B and C in such a way that not less than two and not more than three questions are set from any section, Section D will have one question only which will consist of 8 or 10 objective/very short answer type parts uniformly covering the whole syllabus. All the questions from sections A, B, C and D will carry the same marks.

Candidates will attempt five questions, selecting at least one but not more than two from each section.

PAPER III : PHYSICAL CHEMISTRY

Max. Marks : 75

60 Hrs (2 Hrs/week)

3 Periods/week

SECTION-A

(20 hrs.)

I. Thermodynamics-I

Definition of thermodynamics terms : system, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials, Thermodynamic processes, Concept of heat and work, elementary idea of thermochemistry.

First Law of Thermodynamics : statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law. Joule Thomson coefficient and inversion temperature, Calculation of w , q , dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

II. Thermodynamics-II

Second law of thermodynamics : need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature.

Concept of entropy. entropy as a state function, entropy as a function of V & T , entropy as a function of P & T , entropy change in physical change, Clausius inequality, entropy as a criterion of spontaneity and equilibrium. Entropy change in ideal gases mixing of gases.

SECTION-B

(20 hrs.)

III. Thermodynamics-III

Third law of thermodynamics, Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data, Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities. A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T.

IV. Chemical Equilibrium

Equilibrium constant and free energy, Thermodynamic derivation of law of mass action. Le Chatelier's principle.

Reaction isotherm and reaction isochore—Clapeyron equation and Clausius-Clapeyron equation, applications.

V. Phase Equilibrium

Statement and meaning of the terms—phase, component and degree of freedom, derivation of Gibbs phase rule; phase equilibria of one component system—water and S systems.

Phase equilibria of two component systems—solid-liquid equilibria, simple eutectic, Pb-Ag systems, desilverisation of lead.

Solid Solutions—compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCl-H₂O), (FeCl₃-H₂O) systems. Freezing mixtures, acetone-dry ice.

Liquid—Liquid mixtures-ideal liquid mixtures, Raoult's and Henry's law.

Non-ideal system-azeotropes-HCl-H₂O and ethanol-water systems.

Lower and upper consolute temperature, Effect of impurity on consolute temperature, immiscible liquids, steam distillation.

Nernst distribution law, thermodynamic derivation & applications.

SECTION-C

(20 hrs.)

VI. Electrochemistry-1

Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance with dilution.

Migration of ions and Kohlrausch law. Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method and moving boundary method. Applications of conductance measurements : determination of degree of dissociation, determination of K_a of acids, determination of solubility product of a sparingly soluble salts, conductometric titrations.

VII. Electrochemistry-II

Types of reversible electrodes—gas-metal ion, metal-metal ion, metal-insoluble salt-anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode-reference electrodes-standard electrode potential, sign conventions, electrochemical series and its significance.

Electrolyte and Galvanic cells—reversible and irreversible cells, conventional representation of electrochemical cells.

EMF of a cell and its measurements, Computation of cell EMF. Calculation of thermodynamic quantities of cell reaction (ΔG , ΔH and K), polarization, over potential and hydrogen overvoltage.

Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient potentiometric titrations.

Definition of pH and pK_a, determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods.

Buffers—mechanism of buffer action, Henderson-Hassel equation, Hydrolysis of salts, Corrosion-types, theories and methods of combating it.

INSTRUCTIONS FOR PAPER-SETTER AND CANDIDATES

In the case of Chemistry each theory paper will have three sections A, B, C and an additional section D. The paper-setter will set eight questions from Section A, B and C in such a way that not less than two and not more than three questions are set from any section, Section D will have one question only which will consist of 10 objective/very short answer type parts uniformly covering the whole syllabus. All the questions from sections A, B, C and D will carry the same marks.

Candidates will attempt five questions, selecting at least one but not more than two from each section.

BOOKS SUGGESTED (THEORY COURSES)

1. *Basic Inorganic Chemistry*, F.A. Cotton, G. Wilkinson and P.L. Gaus, Wiley.
2. *Concise Inorganic Chemistry*, J.D. ELBS.
3. *Concepts of Models of Inorganic Chemistry*, B. Douglas, D. McDaniel and J. Alexander, John Wiley.
4. *Inorganic Chemistry*, D.E. Shriver, P.W. Atkins and C.H. Langford, Oxford.
5. *Inorganic Chemistry*, W.W. Porterfield, Addison-Wesley.
6. *Inorganic Chemistry*, A.G. Sharpe, ELBS.
7. *Inorganic Chemistry*, G.L. Miessler and D.A. Tarr, Prentice Hall.
8. *Organic Chemistry Morrison and Boyd*, Prentice Hall.
9. *Organic Chemistry*, L.G. Wade Jr, Prentice Hall.

10. *Fundamentals of Organic Chemistry Solomons*, John Wiley.
11. *Organic Chemistry*, Vol. I, II & III, S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd. (New Age International).
12. *Organic Chemistry*, F.A. Carey, McGraw-Hill, Inc.
13. *Introduction to Organic Chemistry*, Streitwieser Haethcock and Kosover, Macmillan.
14. *Physical Chemistry*, G.M. Barrow, International Student Edition, McGraw Hill.
15. *Basic Programming with Application*, V.K. Jain, Tata McGraw Hill.
16. *Computers and Common Sense*, R. Hunt and Shelly, Prentice Hall.
17. *University General Chemistry*, C.N.R. Rao, Macmillan.
18. *Physical Chemistry*, R.A. Alberty, Wiley Eastern Ltd.
19. *The Elements of Physical Chemistry*, P.W. Alkins, Oxford.
20. *Physical Chemistry—Through Problems*, S.K. Dogra and S. Dogra, Wiley Eastern Ltd.

PRACTICALS

Max. Marks : 75

6 Periods/week

Inorganic Chemistry

Quantitative Analysis

Volumetric Analysis

- (a) Determination of acetic acid in commercial vinegar using NaOH, Alkalinity of water sample.
- (b) Determination of alkali content of antacid.
- (c) Estimation of calcium content in chalk as calcium oxalate by permanganometry.
- (d) Estimation of hardness of water by EDTA.
- (e) Estimation of ferrous and ferric by dichromate method.
- (f) Estimation of copper using sodium thiosulphate.

Gravimetric Analysis

Analysis of Cu as CuSCN and Ni as Ni (dimethylglyoxime)

Organic Chemistry

Laboratory Techniques

Thin Layer Chromatography

Determination of R_f values and identification of organic compounds.

- (a) Separation of green leaf pigments (spinach leaves may be used)
- (b) Preparation and separation of 2, 4-dinitrophenylhydrazones of acetone, benzophenone cyclohexanone using toluene and light petroleum (40 : 60).
- (c) Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5 : 1.5).

Qualitative Analysis

Detection of elements (N, S and halogens) and functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and anilide) in simple organic compounds.

Physical Chemistry

1. To determine the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process.
2. To determine the enthalpy of neutralisation of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.
3. To determine the enthalpy of solution of solid calcium chloride.

PRACTICALS

8 hrs.

(Two session each of four hrs. duration.

First session in the evening and
second in the Morning of the next day)

INSTRUCTIONS FOR EXAMINERS AND CANDIDATES

On First day, candidates are required to perform practicals from volumetric analysis, gravimetry and TLC and on Second day completion of gravimetry, organic qualitative analysis and physical experiment. Distribution of marks will be as under :

- | | | |
|------------------------------|-------|---|
| (1) Viva-Voce (on both days) | = | 10 (5 each day) |
| (2) Note Books | = | 10 (5 each day) |
| (3) Initial write up | (a) = | 3 (Volumetry; equation, indicator, end point and calculations) |
| | (b) = | 3 (Gravimetry; equation, procedure and calculations) |
| | (c) = | 4 (Physical; theory, procedure and calculations) |
| (4) Volumetry | = | 10 (initial burette reading, final reading, end point and result) |
| | | $1\frac{1}{2}$ $1\frac{1}{2}$ 2 5 |
| (5) Gravimetry | = | 10 (Weighing and result) |
| (6) TLC | = | 5 (Performance and result) |

(7) Organic Qualitative	= 10 (Detection of elements identification and confirmation of functional group by 2 confirmatory tests.)
8. Physical Experiment	= 10 (Performance and result. Full credit up to 10% error)

Total : = 75

BIOPHYSICS & BIOCHEMISTRY PAPER-A

Max. Marks : 75

35% of the Subject

Time Allowed : 3 Hrs.

Theory and Practical Separately lectures to be delivered: 80

INSTRUCTIONS FOR EXAMINEES/ CANDIDATES

The question paper will consist of five sections A, B, C, D, and E. Section-A, B, C and D will have two questions from the respective sections of the syllabus and will carry 15 mark each. Section-E consists of 10 short answer type questions which will cover the entire syllabus uniformly and will carry 15 marks in all. Candidates are required to attempt one question each from sections A, B, C and D of the question paper and the entire Section-E.

SECTION - A

01. Introduction to Biochemistry, water as a biological solvent, dissociation of water, pH, buffer solutions, Handerson Hasselbalch equation.
02. Amino acids, amino acids titration curves, physical & chemical properties of amino acids, peptide bonds, rigid & planar nature of a peptide bond, Ramachandran Plot, folding of peptide chains into regular repeating structure (helix, pleated sheets). β turns in polypeptides, amino acid sequencing of poly peptides.

SECTION - B

03. Proteins: levels of structure in protein architecture, forces stabilizing structure and shape of proteins, native proteins & their conformations, denaturation of proteins, protein folding & design.
04. Carbohydrates: Fisch & Hawarth Structures of Carbohydrates, stereoisomerism & mutarotation, anomeric forms of monosaccharides, reactions of monosaccharides, characteristics of the aldehyde, ketones and hydroxyl groups, glycosidic bonds, amylase, amylopectin, starch., cellulose, chitin, pectins, glycosaminoglycans (mucopolysaccharides).

SECTION - C

05. Structure & functions of lipids, fatty acids, triacylglycerols, glycerophospholipids, sphingmylins, lipoproteins, Liposomes, biological membranes and micelles.
06. Nucleic Acids: Structure & properties of purine and pyrimidine bases. Nucleosides and nucleotides, biological function's of ONA and RNA species. Double helical model of DNA & forces responsible for it. short hand representation of nucleic acid back bone, denaturation of DNA, methods for isolation and purification of nucleic acids.

SECTION - D

07. Introduction to enzymes and coenzymes, units of enzyme activity, enzyme nomenclature and classification. Enzyme Kinetics, effect of substrate concentration on Michaelis - Menten equation, determination of K_m & its significance, effect of pH and temperature on rates of enzymes catalyzed reaction.
08. Enzyme inhibitors and their importance, chemical methods of active site studies, Introduction of multi substrate enzymes, allosteric enzymes and enzyme regulation, isoenzymes, enzyme immobilization.

BOOKS RECOMMENDED

01. Principles of Biochemistry 3rd edition, 2000: Lehninger, Nelson & Cox.
02. Biochemistry, 4th edition, 1995 : Luberts Stryer. W.H. Freeman and company, New York.
03. Text Book of Biochemistry, 3rd Edition. 1986. K. Rangnathan Rao.
04. Fundamentals of Biochemistry 5th Edition, 2000 - J.L. Jain, Chand and Co., New Delhi.

BIOPHYSICS & BIOCHEMISTRY PAPER-B

Max. Marks : 75

35% of the Subject

Time Allowed : 3 Hrs.

Theory and Practical Separately lectures to be delivered: 80

INSTRUCTIONS FOR EXAMINEES/ CANDIDATES

The question paper will consist of five sections A, B, C, D, and E. Section-A, B, C and D will have two questions from the respective sections of the syllabus and will carry 15 mark each. Section-E consists of 10 short answer type questions which will cover the entire syllabus uniformly and will carry 15 marks in all. Candidates are required to attempt one question each from sections A, B, C and D of the question paper and the entire Section-E.

SECTION - A

01. Bioenergetics: Biological systems and general laws of thermodynamics, concept of entropy, high energy bonds, biological oxidation and redox potentials mitochondrial electron transport chain & oxidative phosphorylation.
02. Metabolic pathways: Basic concept & design, glycolysis, TCA cycle, Pentosephosphate pathway, gluconeogenesis & glycogen metabolism.

SECTION - B

03. β -Oxidation of fatty acids, formation of Ketone bodies, Biosynthesis & Catabolism of triglycerides, phosphoglycerides & sphingolipids, synthesis of Cholesterol and fatty acids.
04. Deamination, Transamination, decarboxylation reaction, hormones and vitamins, Urea cycle, Biosynthesis & degradation of purines and pyrimidines.

SECTION - C

05. Spectroscopic techniques: - Beer's Lambert Law, U.V. visible spectrophotometry, IR spectroscopy and spectro fluorimetry: principle & biological applications.
06. ORD & CD spectroscopy, NMR & mass spectrometry Principle & Biological applications.

SECTION - D

07. Electrophoretic techniques: Principles and applications of Electrophoretic techniques in purification and characterization of biomolecules isoelectric focusing, & immunoelectrophoresis, SDS - PAGE & agarose gel electrophoresis.
08. Chromatographic techniques : General principle of chromatography and applications of adsorption, partition and thin layer chromatography, gas chromatography, HPLC, Ion exchange, exclusion and affinity chromatography.

BOOKS RECOMMENDED

01. Principles of Biochemistry, 3rd Edition, 2000: Lehninger, Nelson & Cox.
02. Biochemistry, 4th ed., 1995 : Lubert Streyer.
03. Text book of Biochemistry, 3rd Edition, 1986 : K. Rangnathan Rao.
04. Fundamentals of Biochemistry, 5th Edition, 2000 - J.L. Jain Chand and Co., New Delhi.
05. Biophysical Chemistry - Principles and Techniques. Upadhyay, Upadhyay and Nath, 3rd Edition, 2002. Himalaya Publishing House.
06. Physical Chemistry with application to Biological systems: Raymond Chang, 2nd Edition, 1989, MacMillan Publishing Co. 2 No. New York.

PRACTICALS

Guidelines pattern for the conduct of Practical Examinations.

M.M. : 50

Practical Records	:	5 M
Viva-Voce	:	5 M
Report on Industrial Visit:		5 M
Practical	:	25 M
Internal Assessment	:	10 M

01. Protein estimation by Biuret reagent & Lowry method.
02. Carbohydrates - Anthrone and DNS Method.
03. α amylase, Acetylcholine esterase: enzyme activity & Kinetics.
04. TLC of fatty acids.
05. SDS - PAGE for Protein.

06. Agarose - Gel electrophoresis for Nucleic acids.
07. Isolation & Purification of DNA and RNA.
08. Gel-permeation & Ion exchange chromatography.
09. λ max of Proteins & Nucleic acids by U-V spectrophotometry.
10. Immobilization of enzyme in Calcium alginate beads.

BOOKS RECOMMENDED

01. A Introduction to Practical Biochemistry, 3rd edition, Tata McGraw Hill. 1988, David T. Plummer.
02. Biochemical Methods, 2nd edition, New Age International Publishers edn. 1996, S.S. Sadasivan and A Mamekam.
03. A Brologists Guide to Principles and techniques of practical biochemistry Wilson and Goulding, ELBS Publishers, Britain.

GENETICS AND R-DNA TECHNOLOGY

PAPER-A

Max. Marks : 75

35% of the Subject

Time Allowed : 3 Hrs.

Theory and Practical Separately lectures to be delivered: 80

INSTRUCTIONS FOR EXAMINEES/ CANDIDATES

The question paper will consist of five sections A, B, C, D, and E. Section-A, B, C and D will have two questions from the respective sections of the syllabus and will carry 15 mark each. Section-E consists of 10 short answer type questions which will cover the entire syllabus uniformly and will carry 15 marks in all. Candidates are required to attempt one question each from sections A, B, C and D of the question paper and the entire Section-E.

SECTION - A

01. Genetic Material
- Evidence of DNA as Genetic Material.
 - Griffith's Transformation experiments Hershey and Chase Experiment.
 - Structure of DNA : Watson
 - Crick Model Structure of RNA : Clover leaf structure of-RNA eukaryotic mRNA-Capping, poly adenylation.
02. Geome Concept
- Chromosome structure:
Pro karyotic and Eukaruotic chromosome nucleosome structure.
 - Chromosome morphology: Position of Centromere Banding Pattern, Telomeres.
Nucleolar Organizer Region (NOR)
 - Heterochromatin and Euchromatin.
Chromosome Number: Aneuploidy and Polyploidy, Trisomy 21, Down's syndrome.
03. Mechanisms of Inheritance Mendel's Laws :-
- Principle of Segregation
 - principle of Independent assortment.
- Mode of Inheritance
- Recessive, Dominant, Sex Linked etc.
- Extra chromosomal
- Mitochondrial, Chloroplast and Plasmid inheritance DNA.

SECTION - B

04. Mutations
- Spontaneous (Basic mechanism) and induced Mutagens.
 - Chemical Base analogs, Base Modifiers, Intercalating agents.
 - Physical: Ionizing and non-Ionizing radiations.
05. DNA replication
- Phtoreactivation. Excision Repair.
 - Mismatch repair
 - SOS repair.
06. DNA replication
- Bacterial DNA replication DNA replication in Eukaryotes.
 - Reverse Transcription in retrovirus.

SECTION - C

07. Gene Transcription: Characteristics of Genetic Code, RNA Polymerase.
Transcription in Prokaryote's: Initiation, Elongation Termination.
Transcription in Eukaryotes: RNA Polymerare, I, II, and III.
Transcription factors, promoters and initiation complex.
08. Regulation of Gene Expression in Prokaryotes
Organization of E.Coli genes, Operon hypothesis.
Lac Operon, Catabolite repression.
trp operon, Attenuation.
09. Regulations of Gene Expression in Eukaryotes:
Promoters Enhancers, Response

Elements motifs: Zinc finger, Helix turn Helix.
Transcription factors, Hormones, Cytokines

SECTION - D

10. Translation
 - Charging of RNA Initiation, Elongation Termination.
 - Post translational modifications.
11. Population Genetics
 - Genetics in Population: Lardy-Weinberg Equilibrium.
 - Factors distorting equilibrium selection Mutation, Migration
 - Chi-Square test.
12. Genetic Diversity and Evolution:
 - Source of Variation,
 - Mutation Vs Selection, Heterozygote advantage, Drift and founder effect.
 - Chromosomal Changes: Karyotype & Banding pattern, chromosomal rearrangement.
 - Deletion, Duplication, Translocation Inversion, Sex Chromosome anomalies, Evolutionary effects.
 - Molecular Clocks
 - Phylogenetic Trees.

List of Books:

01. Genetics by Gardner.
02. Freifelder, D. (2000) Microbial Genetics, Narosa Publishing House.

MOLECULAR GENETICS AND R-DNA TECHNOLOGY

PAPER-B

Max. Marks : 75

35% of the Subject

Time Allowed : 3 Hrs.

Theory and Practical Separately lectures to be delivered: 80

INSTRUCTIONS FOR EXAMINEES/ CANDIDATES

The question paper will consist of five sections A, B, C, D, and E. Section-A, B, C and D will have two questions from the respective sections of the syllabus and will carry 15 mark each. Section-E consists of 10 short answer type questions which will cover the entire syllabus uniformly and will carry 15 marks in all. Candidates are required to attempt one question each from sections A, B, C and D of the question paper and the entire Section-E.

SECTION - A

01. Introduction to R-DNA technology
02. Tools of R-DNA technology:
 - DNA Cutting Tool, Restriction Enzymes
 - DNA end Modifying Tools
 - 3' Nucleotidyl Transferase
 - 5 Nucleotidyl kinase
 - Alkaline Phosphates
 - T4 DNA Ligase
 - Joining DNA Fragments
 - Nucleic acid Probes.
03. Techniques for Genetic Engineering:
 - Southern Blotting, Northern Blotting, Western Blotting
 - DNA Sequencing: Maxam - Gilbert Technique Sanger's Dideoxy Chain Termination
 - Polymerase chain Reaction
 - Agarose gel electrophoresis

SECTION - B

04. Introduction to Cloning Genes:
Cloning by direct cDNA cloning.
05. Vectors: Plasmids, Bacteriophages, Shuttle Vectors, Retro Viruses.
06. Transformation Techniques: Competent E. Coli Cells, Yeast Spheroplasts, bacillus Protoplast.
 - CaCl₂ Method, Biolistic gun.
 - Electroporation, Phage transfection.

SECTION - C

07. Cloning in E. Coli Selection of Transformants.
08. Cloning in Yeast: Selection of Transformants.
09. Cloning in Plant Cells: Selection of Transformants.

SECTION - D

10. Application of R-DNA Technology in Agriculture.
11. Application of R-DNA Technology in Medicine, RFLP and Prenatal diagnosis.
12. Application of R-DNA Technology in Industry.

BOOKS SUGGESTED

01. Molecular Biology and Biotechnology: Smith and Wood, Chapman & Hall Ltd., 1991.
02. Recombinant DNA: A Short Course: J.A. Watson, J. Tooze and D.T. Durtz, Scientific American Books, 1983.
03. Gene Manipulation: Old and primrose, 2000.

PRACTICALS

Guidelines pattern for the conduct of Practical Examinations.

M.M. : 50

Practical Records : 5 M
Viva-Voce : 5 M
Report on Industrial Visit: 5 M
Practical : 25 M
Internal Assessment : 10 M

01. Demonstration of Law of segregation and independent assortment (use of coloured beads capsules etc.) Numericals for Segregation and independent assortment. Use of χ^2 for prediction of phenotype genotype frequencies of parents from progeny and vice-versa. Emphasis.
02. Comparison of variance in respect of pod length and no of seeds pod.
03. Pedigree analyze.
04. Detection of Blood groups A, B, O and Rh factors.
05. Dermatographies Palm print taking and finger tip patterns.
06. Demonstration of sex chromatin from baccal methylem.
07. Isolation of Plasmids from alkaline method.
08. Agarose Gel Electrophoresis.
09. Polyacrylamide Gel Electrophoresis.
10. Transformation of E. Coli by CaCl_2

Note: The awards in Internal Assessment for each practical paper must reach Controller of Examination, Punjabi University, Patiala within one week of the start of the Theory Examination.

PAPER V: ENVIRONMENTAL STUDIES

Time Allowed : 3 hours

Total lectures: 50
Total Marks : 100
Pass marks: 35
Written paper: 75 marks
Field work: 25 marks

INSTRUCTIONS

The written paper will have two parts. Part first will be of 25 marks it will contain ten questions, the students will attempt five questions of five marks out of this part. The answer to these questions should not exceed 50 words each. Part second of the paper will be of 50 marks and will contain ten essay type questions. The candidates will attempt five questions out of this part. The answer to each question should not exceed 500 words. Each question will carry ten marks. Field work will be evaluated at the college level.

Unit 1: The Multidisciplinary nature of environmental studies

Definition, scope and importance
Need for public awareness.

Unit 2 : Natural Resources:

Renewable and non-renewable resources:

- Natural resources and associated problems.

- a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- c) Mineral resources; Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problem, water logging, salinity, case studies.
- e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, Case studies.
- f) Land resources; Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
 - Role of an individual in conservation of natural resources.
 - Equitable use of resources for sustainable lifestyles.

Unit 3 : Ecosystems.

- Concepts of an ecosystem.
- Structure and function of an ecosystem.
- Producers, consumers and decomposers.
- Energy flow in the ecosystem.
- Ecological succession.
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structures and function of the following ecosystem:-
 - a) Forest ecosystem
 - b) Grassland ecosystem
 - c) Desert ecosystem
 - d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit 4 : Biodiversity and its Conservation

- Introduction- Definition: genetic, species and ecosystem diversity.
- Biogeographical classification of India.
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.

- Biodiversity of global, National and local levels.
- India as a mega-diversity nation.
- Hot-spots of biodiversity.
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India.
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit 5 : Environmental Pollution

Definition

- Causes, effects and control measures of:-
 - a) Air Pollution
 - b) Water Pollution
 - c) Soil Pollution
 - d) Marine Pollution
 - e) Noise pollution
 - f) Thermal pollution
 - g) Nuclear hazard
- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution.
- Pollution case studies.
- Disaster management : floods, earthquake, cyclone and landslides.

Unit 6 : Social Issues and the Environment

- From Unsustainable to Sustainable development.
- Urban problems related to energy.
- Water conservation, rain water harvesting, watershed management.
- Resettlement and rehabilitation of people; its problems and concerns. Case studies.
- Environmental ethics: Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.
- Wasteland reclamation.
- Consumerism and waste products.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Public awareness.

Unit 7: Human Population and the Environment

- Population growth, variation among nations.
- Population explosion- Family Welfare Programme.
- Environment and human health.
- Human Rights
- Value Education.
- HIV/AIDS.
- Women and Child Welfare.
- Role of information Technology in Environment and human health.
- Case Studies.

Unit 8 : Field Work

- Visit to a local area to document environmental assets- river/forest/grassland/hill/mountain.
- Visit to a local polluted site- Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours).