University of Rajasthan
Jaipur

SYLLABUS

B.Sc. Part-II

Examination - 2021

Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR

CONTENTS

Dy. Registrar (Academic-I)
University of Rajasthan
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B.Sc. Pt.-II

1. PHYSICS

Scheme : Max. Marks: 100

Min. Pass Marks: 36

Paper I	3 hrs. duration	Max. Marks: 33	Min. Pass marks 12
Paper II	3 hrs. duration	Max. Marks: 33	Min. Pass marks 12
Paper III	3 hrs. duration	Max. Marks: 34	Min. Pass marks 12
Practical	5 hrs. duration	Max. Marks: 50	Min. Pass marks 18

Paper-I : Thermodynamics and Statistical Physics

Work Load: 2 hrs. Lecture /week

Examination Duration: 3 Hrs.

Scheme of Examination: First question will be of nine marks comprising of six parts of short answer type with answer not exceeding half a page. Remaining four questions will be set with one from each of the unit and will be of six marks each. Second to fifth question will have two parts namely (A) and (B) each carrying 3 marks. Part (A) of second to fifth question shall be compulsory and Part (B) of these questions will have internal choice.

Unit-1

Thermal and adiabatic interactions: Thermal interaction; Zeroth law of thermodynamics; System in thermal contact with a heat reservoir (canonical distribution); Energy fluctuations; Entropy of a system in a heat bath; Helmholtz free energy; Adiabatic interaction and enthalpy; General interaction and first law of thermodynamics; Infinitesimal general interaction; Gibb's free energy; Phase transitions, Clausius Clapeyron equation; Vapour pressure curve; Heat engine and efficiency of engine, Carnot's Cycle; Thermodynamic scale as an absolute scale; Maxwell relations and their applications.

Unit-2

Production of law temperatures and applications: Joule Thomson expansion and J T coefficients for ideal as well as Vander Waal's gas, porous plug experiment, temperature inversion, Regenerative cooling, Cooling by adiabatic expansion and demagnetization; Liquid Helium, He I and He II superfludity, Refrigeration through Helium dilution, Quest for absolute zero, Nernst heat theorem

The distribution of molecular velocities: Distribution law of molecular velocities, most probable, average and r.m.s. velocities; Energy distribution function; effusion and molecular beam, Experimental verification of the Maxwell velocity distribution; The principle of equi-partition of energy

Transport phenomena: Mean free path, distribution of free paths, coefficients of viscosity, thermal conductivity, diffusion and their interaction.

Unit-3

Classical Statistics: Validity of Classical approximation; Phase space micro and macro states; Thermodynamic probability, relation between entropy and thermodynamic probability, Monoatomic ideal gas, Barometric equation; Specific heat capacity of diatomic gas, Heat capacity of solids

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Unit-4

Quantum Statistics: Black body radiation and failure of classical statistics. Postulates of quantum statistics, undistinguishibility wave function and exchange degeneracy, a priori-probability, Bose-Einstein statistics and its distribution function; Planck distribution function and radiation formula, Fermi-Dirac statistics and its distribution function, contact potential, thermionic emission. Specific heat anomaly of metals; Nuclear spin statistics (para- and ortho-hydrogen).

Paper- II: Mathematical Physics and Special Theory of Relativity

Work Load: 2 hrs. Lecture /week

Examination Duration: 3 Hrs.

Scheme of Examination: First question will be of nine marks comprising of six parts of short answer type with answer not exceeding half a page. Remaining four questions will be set with one from each of the unit and will be of six marks each. Second to fifth question will have two parts namely (A) and (B) each carrying 3 marks. Part (A) of second to fifth question shall be compulsory and Part (B) of these questions will have internal choice.

UNIT-1

Orthogonal curvilinear coordinate system, scale factors, expression for gradient, divergence, curl and their application to Cartesian, circular cylindrical and spherical polar coordinate.
Coordinate transformation and Jacobian, transformation of covariant, contra-variant and mixed tensor; Addition, multiplication and contraction of tensors; Metric tensor and its use in transformation of tensors.
Dirac delta function and its properties.

UNIT-2

Lorentz transformation, Length Contraction, Time Dilation, Mass variation, rotation in space-time like and space like vector, world line, macro-causality.
Four vector formulation, energy momentum four vector, relativistic equation of motion, invariance of rest mass, orthogonality of four force and four velocity, Lorentz force as an example of four force, transformation of four frequency vector, longitudinal and transverse Doppler's effect.
Transformation between laboratory and center of mass system, four momentum conservation, kinematics of decay products of unstable particles and reaction thresholds; Pair production, inelastic collision of two particles, Compton effect.

UNIT-3

(a) Transformation of electric and magnetic fields between two inertial frames. Electric field measured in moving frames. Electric field of a point charge moving with constant velocity.

(b) The second order linear differential equation with variable coefficient and singular points, series solution method and its application to the Hermite's, Legendre's and Laguerre's differential equations. Basic properties like orthogonality, recurrence relation, graphical representation and generating function of Hermite, Lagendre and Leguerre functions (simple applications).

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UNIT-4

Techniques of separation of variables and its application to following boundary value problems (i) Laplace equation in three dimensional Cartesian coordinate system-line charge between two earthed parallel plates (ii) Helmholtz equation in circular cylindrical coordinates-cylindrical resonant cavity. (iii) Wave equation in spherical polar coordinates the vibrations of a circular membrane. (iv) Diffusion equation in two dimensional Cartesian coordinate system heat conduction in a thin rectangular plate. (v) Laplace equation in spherical coordinate system-electric potential around a spherical surface.

Paper III: Electronics and Solid State Devices

Work Load: 2 hrs. Lecture /week

Examination Duration: 3 Hrs.

Scheme of Examination: First question will be of ten marks comprising of five parts of short answer type with answer not exceeding half a page. Remaining four questions will be set with one from each of the unit and will be of six marks each. Second to fifth question will have two parts namely (A) and (B) each carrying 3 marks. Part (A) of second to fifth question shall be compulsory and Part (B) of these questions will have internal choice.

Unit 1: Circuit analysis and PN junctions

Circuit analysis: Networks- some important definitions, loop and nodal equation based on D.C. and A.C. circuits (Kirchhoffs Laws). Four terminal network: Ampere volt conventions, open, close and hybrid parameters of any four terminal network, Input, output and mutual impendence for an active four terminal network. Various circuit theorems: Superposition, Thevenin, Norton, reciprocity, compensation, maximum power transfer and Miller theorems.
PN junction: Charge densities in N and P materials; Conduction by drift and diffusion of charge carriers, PN diode equation; capacitance effects.

Unit 2: Rectifiers and transistors

Rectifiers: Basic idea of Half-wave, full wave and bridge rectifier: calculation of ripple factor, efficiency and regulation; Filters: series inductor, shunt capacitor, L section and π-section filters. Voltage regulation: Voltage regulation and voltage stabilization by Zener diode, voltage multiplier
Transistors: Notations and volt-ampere characteristics for bipolar Junctions transistor. Concept of load line and operating point Hybrid parameters. CB, CE, CC configurations. Junction field effect transistor (JFET) and metal oxide semiconductor filed effect transistor (MOSFET). Circuit symbols, biasing and volt-ampere characteristics, source follower operation of FET as variable voltage resistor

Unit 3: Transistor biasing and amplifiers

Transistor biasing: Need of bias and stability of Q point, stability factors, and various types of bias circuits for thermal bias stability: fixed bias, collector to base feedback bias and four resistor bias.

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Amplifiers: Analysis of transistor amplifiers using hybrid parameters and its gain-frequency response. Basic idea of Cascade amplifiers, direct coupled and R C coupled amplifiers. Amplifier with feedback. Concept of feedback, positive and negative feedback, voltage and current feedback circuits. Advantage of negative feedback. Stabilization of gain; effect of negative feedback on output and input resistance, reduction of nonlinear distortion, effect on gain - frequency response

Unit 4: Oscillators and Logic Circuits

Oscillators: criteria for self-excited and self-sustained oscillation, circuit requirement for build-up of oscillation, Basic transistor oscillator circuit and its analysis, Colpitt's and Hartely oscillators, R C Oscillators

Logic circuits: Logic fundamentals: AND, OR, NOT, NOR, NAND, XOR gates, Boolean algebra, De Morgan's theorem, positive and negative logic, logic gates circuit realization using DTL and TTL logic, simplification of Boolean expressions.

Reference Books:-

1. John D. Ryder, Electronic Fundamentals and Application, Prentice Hall of India Pvt. Ltd., New Delhi.
2. John D. Ryder, Engineering Electronics, McGraw Hill Book Company, New Delhi
3. Jacob Millman and Christose Haikias, Integrated Electronics, Analog and Digital Circuits and systems, McGraw- Hill Ltd. (1972).
4. Albert Paul Malvino, Digital Computer Electronics, Tata McGraw- Hill Pub. Co. Ltd., New Delhi (1983).
5. Kumar & Gupta, Hand book of Electronics.
6. G.K. Mithal, Hand Book of Electronics.
7. G.K. Mithal, Electronics Devices and Applications.
8. R.P. Jain, Digital Electronics.

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7. G.K. Mithal, Electronics Devices and Applications.
8. R.P. Jain, Digital Electronics.

PRACTICAL

Teaching : 4 hrs/week
Practical One-Paper
Min Pass Marks : 18

5 hrs. duration
Max. Marks : 50

Note : Total number of experiments to be performed by the students during the session should be 16 selecting any 8 from each section.

Section-A

1. Study of dependence of velocity of wave propagation on line parameter using torsional wave apparatus.
2. Study of variation of reflection coefficient of nature of termination using torsional wave apparatus.
3. Using platinum resistance thermometer find the melting point of agiven substance.
4. Using Newton's rings method find out the wave length of a monochromatic source and find the refractive index of liquid.
5. Using Micheloson's interferometer find out the wavelength of given monochromatic source (Sodium Light)
6. To determine dispersive power of prism.
7. To determine wave length of sodium light using grating.
8. To determine wave length of sodium light using Biprism.
9. Determine the thermodynamic constant $\gamma = \frac{C_p}{C_v}$ using Clement's & Desorme's method.
10. To determine thermal conductivity of a bad conductor by Lee's method.
11. Determination of ballistic constant of a ballistic galvanometer.
12. Study of variation of total thermal radiation with temperature.

Section-B

1. Plot thermo emf versus temperature graph and find the neutral temperature (Use sand bath).
2. Study of power supply using two diodes/bridge rectifier with various filter circuits.

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3. Study of half wave rectifier using single diode and application of L and π section filters.
4. To study characteristics of a given transistor PNP/NPN (common emitter, common base and common collector configurtainos).
5. Determination of band gap using a junction diode.
6. Determination of power factor ($\cos\theta$) of a given coil using CRO.
7. Study of single stage transistor audio amplifier (variation of gain with frequency).
8. To determine e/m by Thomson's method.
9. Determination of velocity of sound in air by standing wave method using speaker, microphone and CRO.
10. Measurement of inductance of a coil by Anderson's bridge.
11. Measurement of capacitance and dielectric constant of a liquid and gang condensor by de-Sauty bridge.

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2. CHEMISTRY

Scheme:
Max Marks: 150

	Duration (hrs.)	Max. Marks	Min. Pass Marks
Paper-I	3	33	
Paper-II	3	33	36
Paper-III	3	34	
Practical	5	50	18

Note: Ten (10) questions are to be set taking two (02) questions from each unit. Candidates have to answer any 5 questions selecting at least one question from each unit.

CH-201 Paper-I: Inorganic Chemistry
(2 hrs or 3 periods/week)

Unit-I

Chemistry of Elements of First Transition Series:
Characteristic properties of d-block elements. Properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation-states, coordination number and geometry.

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 and stereochemistry.

Unit-II

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.

Unit-III

Chemistry of Lanthanide and Actinide Elements:
Electronic structure, oxidation states, ionic radii and lanthanide contraction, complex formation, occurrence and isolation of lanthanide compounds.
General features of chemistry of separation of Np, Pu and Am from U, electronic configuration, oxidation states, magnetic properties, complexation behavior, comparison of Lanthanides and Actinides with d-block elements.

Unit IV

Oxidation and Reduction:
Use of Redox Potential data, analysis of stability of redox stability in water, Frost, Latimer and Pourbaix diagrams, Application of redox principles, extraction of elements.

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Unit-V

Acids and Bases:
Theories - Arrhenius, Bronsted-Lowry, Lux-Flood, Solvent system concept and Lewis concept of acids and bases.

Non-aqueous Solvents:
Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2

CH-202 Paper-II: Organic Chemistry
(2 Hrs. or 3 periods/week)

Unit-I

Electromagnetic Spectrum: An Introduction

Absorption Spectroscopy
Ultraviolet (UV) spectroscopy - Absorption laws (Beer-Lambert Law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of solvents on transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated dienes and enones.

Infrared (IR) spectroscopy - Molecular vibrations, Hook's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristics absorption of various functional groups and interpretation of IR spectra of simple organic compounds.

Unit-II

Alcohols - Classification and nomenclature
Monohydric alcohols - Methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohol with mechanism.
Dihydric alcohols - methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$ and HIO_4] and pinacol-pinacolone rearrangement
Trihydric alcohols - methods of formation, chemical reactions of glycerol.

Phenols
Nomenclature, structure and bonding. Preparation of Phenols. Physical properties and acidic character. Comparative acidic strength of alcohols and phenols. Reactions of phenols- electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gattermann synthesis, Hauben-Hoesch reaction, Lederer Manasse reaction and Reimer-Tiemann reaction.

Ethers and Epoxides
Methods of formation, physical properties, Chemical reactions - cleavage and autooxidation, Zeisel's method.
Synthesis of epoxides, Acid and base catalysed ring opening of epoxides, orientation of epoxide

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reactions of Grignard and organolithium reagents with epoxides

Unit-III

Aldehydes and Ketones

Structure of the carbonyl group. Syntheses of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, syntheses of ketones from nitriles and from carboxylic acids. Physical properties.

Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction, Mannich reaction. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones. Cannizzaro reaction, MPV (Meervein-Pondrof-Verley), Clemmensen, Wolff-Kishner, $LiAlH_4$ and $NaBH_4$ reductions. Halogenation of enolizable ketones. Use of acetals and 1,3-dithiane as protecting group.

Unit-IV

Carboxylic Acids

Structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids, Hell-Volhard-Zelinsky reaction. Reduction of carboxylic acids, mechanism of decarboxylation.

Methods of formation and chemical reactions of halo acids. Hydroxy acids - malic, tartaric and citric acids.

Dicarboxylic acids: methods of formation and effect of heat and dehydrating agents (succinic, glutaric and adipic acids).

Carboxylic Acid Derivatives

Structure, nomenclature and synthesis of acid chlorides, esters, amides and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution.

Preparation of carboxylic acid derivatives, chemical reactions, mechanisms of esterification and hydrolysis (acidic and basic).

Unit-V

Organic Compounds of Nitrogen

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

Amines: Structure, nomenclature and preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds. Physical properties, stereochemistry of amines. Separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase-transfer catalysts. Gabriel phthalimide reaction and Hoffmann bromamide reaction with mechanism.

Reactions of amines, electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid. Diazotisation and mechanism. Synthetic transformations of aryl diazonium salts, azo coupling and its applications.

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CH-203 Paper III : Physical Chemistry

(2 Hrs. or 3 periods/week)

UNIT-I

Thermodynamics - I

Definition of Thermodynamic Terms: System, surroundings, etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process, concept of heat and work.

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.

Thermochemistry : Standard state, standard enthalpy of formation, Hess's law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy. Kirchhoff's equation.

UNIT-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 and entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.

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.

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.

UNIT-III

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, CO_2 and sulphur systems.

Phase equilibria of two component system - solid-liquid equilibria simple eutectic Bi-Cd, Pb-Ag systems, desilverization of lead.

Solid solutions - compound formation with congruent melting point (Mg-Zn) and incongruent melting point ($FeCl_3$-H_2O) System. Freezing mixtures, acetone-dry ice.

Liquid-Liquid mixtures - Ideal liquid mixtures, Raoult's and Henry's law. Non ideal systems, azeotropes - HCl-H_2O and ethanol-water systems. Partially miscible liquids, phenol-water, lower and upper consolute temperature, effect of impurity on consolute temperature. Nernst distribution law, thermodynamic derivation, applications.

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UNIT-IV

Electrochemistry – I

Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific 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 's method and moving boundary method.

Applications of conductivity measurements:

Determination of degree of dissociation, determination of K_a of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

UNIT-V

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.

Electrolytic and Galvanic cells - reversible and irreversible cells, conventional representation of electrochemical cells.

EMF of a cell and its measurements, Computation of cells EMF. Calculation of thermodynamic quantities of cell reactions (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.

Suggested Books:

1. Principles of Physical Chemistry, B. R. Puri, Sharma and M. S. Pathania.
2. A Text Book of Physical Chemistry, A. S. Negi and S. C. Anand.
3. A Text Book of Physical Chemistry, Kundu and Jain.
4. The elements of Physical Chemistry, P. W. Atkins, Oxford.
5. University General Chemistry, C. N. R. Rao, Mac Millan.

CH- 204 Chemistry Practical (Pass course), Laboratory Course-II

(4 hrs or 6 periods / week)

Inorganic Chemistry

(i) Preparation of Standard Solutions

Dilution 0.1 M to 0.001 M solutions

(ii) Volumetric Analysis

(a) Determination of acetic acid in commercial vinegar using NaOH

(b) Determination of alkali content in antacid tablet using HCl

(c) Estimation of calcium content in milk as calcium oxalate by permanganometry

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(d) Estimation of hardness of water by EDTA
(e) Estimation of ferrous and ferric by dichromate method
(f) Estimation of copper using thiosulphate

(iii) Gravimetric Analysis
(a) Cu as CuSCN
(b) Ni as Ni-dimethylglyoxime)

Organic Chemistry

(i) Laboratory Techniques

A. 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, 2-butanone, hexan-2-one and hexan-3-one using toluene and light petroleum (40-60) solvent system.

(c) Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5 : 1.5)

B. Paper Chromatography: Ascending and Circular

Determination of R_f values and identification of organic compounds.

(a) Separation of mixture of phenylalanine and glycine, Alanine and aspartic acid, leucine and glutamic acid. Spray reagent – ninhydrin.

(b) Separation of a mixture of DL – alanine, glycine and L -Leucine using n-butanol: acetic acid: water (4:1:5). Spray reagent-ninhydrin.

(c) Separation of monosaccharides a mixture of D- galactose and D-Fructose Using n- butanol : acetone : water (4:5:1) Spray reagent -aniline hydrogen phthalate.

(ii) Qualitative Analysis

Identification of two organic compounds (one solid and one liquid) through the functional group analysis, determination of melting point, boiling point and preparation of suitable derivatives.

Physical Chemistry

(i) Transition Temperature

a) Determination of the transition temperature of the given substance by thermometric dilatometric method (e.g. $MnCl_2.4H_2O$ / $SrBr_2.2H_2O$).

(ii) Thermochemistry

a) To determine the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process.

b) To determine the enthalpy of neutralization of a weak acid / weak base versus strong base / strong acid and determine the enthalpy of ionization of the weak acid / weak base.

c) To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born-Haber cycle.

(iii)Phase Equilibrium

a) To study the effect of a solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that solute in the given phenol-water system.

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a) To construct the phase diagram of two components (e.g. diphenylamine-benzophenone) system by cooling curve method.

(iv) Distribution law

a) To study the distribution of iodine between water and CCl_4.

b) To studs the distribution of benzoic acid between benzene and water.

(Instructions to the Examiner)
B.Sc. Part II
CH- 204 Chemistry Practical (Pass course)

Max. Marks: 50 Duration of Exam:5 hrs. Minimum Pass Marks:18

Inorganic Chemistry

Ex. 1 Volumetric Analysis
or
Gravimetric Analysis as mentioned in the syllabus 16

Organic Chemistry

Ex. 2 Identification of two organic compounds (one solid and one liquid) through the functional group analysis, determination of melting point, boiling point and preparation of suitable derivatives
or
Perform one experiment out of the experiments on thin layer and paper chromatography given in syllabus 12

Physical Chemistry

Ex. 3 Perform one of the physical chemistry experiments as mentioned in the syllabus. 12

Ex. 4 Viva-voce 5
Ex. 5 Record 5
50

Books Suggested (Theory Course)

1. Basic Inorganic Chemistry F.A. Cotton G. Wilkinson and P.L. Caus Wiley
2. Concise Inorganic Chemistry, J.D. Lee ELBS
3. Concepts of Models of Inorganic Chemistry B. Douglas, D. McDaniel and J. Alexander, John Wiley
4. Inorganic Chemistry, D.F. 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

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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 Heathcock 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. Atkins, Oxford.
20. Physical Chemistry Through problems, S.K. Dogra and S. Dogra, Wiley Eastern Ltd.

Books Suggested (Laboratory Courses)

1. Vogel's Qualitative inorganic Analysis, revised, Svehla, Orient Longman.
2. Vogel's Textbook of Quantitative Inorganic Analysis (revised), J. Bassett, R.C. Deney, G.H. Jeffery and J. Mendham, ELBS.
3. Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.
4. Experimental Inorganic Chemistry, W.G. Palmer, Cambridge.
5. Handbook of preparative Inorganic Chemistry, Vol I & II, Braver, Academic Press.
6. Inorganic Synthesis, McGraw Hill.
7. Experimental Organic Vol I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill
8. Laboratory manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
9. Voge's Textbook of Practical Organic Chemistry, RS. Furniss, Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
10. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal, East-West Press.
11. Experiments in Physical Chemistry, R.C.Das and B. Behra, Tata McGraw Hill
12. Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.
13. Advanced Experimental Chemistry, Vol. 1-Physical, J.N. Gurtu and R. Kapoor, S. Chand & Co.
14. Selected Experiments in Physical Chemistry, N.G. Mukerjee, J.N. Ghjose& Sons.
15. Experiments in Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

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3. ZOOLOGY

B. Sc. Part II - 2020

Scheme:

Min. Marks: 36

Max. Marks: 100

Paper I	**: 3 Hrs duration**	**33 Marks**
Paper II	**: 3 Hrs duration**	**33 Marks**
Paper III	**: 3 Hrs duration**	**34 Marks**
Practical	**: 4 Hrs duration**	**50 Marks**

NOTE:

1. There will be two parts of every theory question paper with a total duration of 3 hours. First part of question paper will comprise of question No. 1 containing 9 (Paper I & II) or 10 (Paper III) very short answer (Maximum 25 words) type questions, each of 1 mark. This part is compulsory to attempt. Questions should be evenly distributed covering entire syllabus.
   Second part of question paper will be of long answer type questions having three sections. There will be total 9 questions (Q. No. 2 to 10) in this part, *i.e.*, three from each unit /section out of which candidate will be required to attempt any 4 questions selecting at least one question from each unit/section. Each question will carry 6 marks.
2. The candidate has to answer all questions in the main answer book only.

PAPER – I: Z-201
STRUCTURE AND FUNCTION OF INVERTEBRATE TYPES

NOTE:

1. There will be two parts of this theory question paper with a total duration of 3 hours. First part of question paper will comprise of question No. 1 containing 9 very short answer (Maximum 25 words) type questions, each of 1 mark. This part is compulsory to attempt. Questions should be evenly distributed covering entire syllabus.
   Second part of question paper will be of long answer type questions having three sections. There will be total 9 questions (Q. No. 2 to 10) in this part, *i.e.*, three from each unit /section, out of which candidate will be required to attempt any 4 questions selecting at least one question from each unit/section. Each question will carry 6 marks.
2. The candidate has to answer all questions in the main answer book only.

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Section – A

Habit, Habitat,Morphology,Structure, Organs and Systems (Locomotion, Digestive, Circulatory, Respiratory, Excretory, Nervous &Reproductive), Life Cycle,*Affinities and *Adaptations.

Note :* indicates whenever required.

Arthropoda:Palaemon(Indian Fresh water Prawn), Scorpion, Periplaneta,Grasshopper,Apis.
Onychophora :Peripatus.

Section – B

Habit, Habitat,Morphology,Structure, Organs and Systems (Locomotion, Digestive, Circulatory, Respiratory, Excretory, Nervous &Reproductive), Life Cycle,*Affinities and *Adaptations.

Note :* indicates whenever required.

Mollusca: Pila, Unio, Sepia
Echinodermata: Asterias,Echinus, Cucumaria.
Hemichordata: Balanglossus and its phylogenetic significance

Section - C

Invertebrate Adaptations

1. Salient features of Hemichordata.
2. Evolution of canal system of sponges.
3. Parasitic adaptations in Helminthes.
4. Social organization in termites and honey bees.
5. Direct and indirect development in insects.
6. Water vascular system of starfish.
7. Crustacean larvae & mouth parts of insects.
8. Parasitism in Crustacea.

PAPER – II: Z-202
ANIMAL PHYSIOLOGY AND BIOCHEMISTRY

NOTE:

1. There will be two parts of this theory question paper with a total duration of 3 hours. First part of question paper will comprise of question No. 1 containing 9 very short answer (Maximum 25 words) type questions, each of 1 mark. This part is compulsory to attempt. Questions should be evenly distributed covering entire syllabus. Second part of question paper will be of long answer type questions having three sections. There will be total 9 questions (Q. No. 2 to 10) in this part, *i.e.*, three from each unit /section, out of which candidate will be required to attempt any 4 questions selecting at least one question from each unit/section. Each question will carry 6 marks.
2. The candidate has to answer all questions in the main answer book only.

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Section - A

Animal Physiology with special reference to mammals

1. Physiology of digestion: Various types of digestive enzymes and their digestive action in the alimentary canal.
2. Physiology of blood circulation: Composition and functions of blood; mechanism of blood clotting; heart beat; cardiac cycle; blood pressure; body temperature regulation.
3. Physiology of respiration: Mechanism of breathing; exchange of gases: transportation of oxygen and carbon dioxide in blood; regulation of respiration.
4. Physiology of excretion: Kinds of nitrogenous excretory end products (ammonotelic, uricotelic and ureotelic); role of liver in the formation of these end products. Functional architecture of mammalian kidney tubule and formation of urine; hormonal regulation of water and electrolyte balance (Homeostasis).

Section-B

Regulatory aspects of Animal Physiology

1. Physiology of nerve impulse and reflex action: Functional architecture of a neuron, origin and propagation of nerve impulse, synaptic transmission, reflex arc.
2. Physiology of muscle contraction: Functional architecture of skeletal muscles; chemical and biophysical events during contraction and relaxation of muscle fibers.
3. Types of endocrine glands, their secretions and functions: Pituitary, adrenal, thyroid, pancreas, testis and ovary.
4. Physiology of Reproduction: Hormonal control of male and female reproduction, implantation, parturition and lactation in mammals.
5. Preliminary idea of neurosecretion, hypothalamic control of pituitary function.

Section-C

Biochemistry

1. Carbohydrates: Structure, function and significance; oxidation of glucose through glycolysis, Kreb's cycle and oxidative phosphorylation; interconversion of glycogen and glucose in liver; role of insulin and glucagon.
2. Proteins : Structure, function and significance, essential and non-essential amino acids, transformation of amino acids: deamination, transmination, decarboxylation. Synthesis of protein and urea, fate of ammonia (Ornithine cycle), fate of carbon skeleton.
3. Lipids: Structure, function and significance; Beta-oxidative pathway of fatty acids; brief account of biosynthesis of triglycerides. Cholesterol and its metabolism.

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Paper – III: Z-203
Immunology, Microbiology & Biotechnology

NOTE:

1. There will be two parts of this theory question paper with a total duration of 3 hours. First part of question paper will comprise of question No. 1 containing 10 very short answer (Maximum 25 words) type questions, each of 1 mark. This part is compulsory to attempt. Questions should be evenly distributed covering entire syllabus. Second part of question paper will be of long answer type questions having three sections. There will be total 9 questions (Q. No. 2 to 10) in this part, *i.e.*, three from each unit /section, out of which candidate will be required to attempt any 4 questions selecting at least one question from each unit/section. Each question will carry 6 marks.
2. The candidate has to answer all questions in the main answer book only.

Section - A

Immunology

1. Immunology: Definition, types of immunity: innate and acquired; humoral and cell mediated, Organs of immune system.
2. Antigen and antibody: Antigenicity of molecules, haptens, antibody types.
3. Antigen-Antibody reactions: Precipitation reaction, agglutination reaction, neutralizing reaction, complement and lytic reactions and phagocytosis.
4. Immunity Regulating Cells: Macrophages, lymphocytes (B and T-Types) T-helper cells, T-Killer cells, plasma cells and memory cells.
5. Mechanism of humoral or antibody mediated immunity and cell mediated immunity.

Section - B

Microbiology

1. Brief introduction to the History of Microbiology: Work of Anatony Van Leeuwenhoek, theory of spontaneous generation, germ theory of fermentation and disease: Works of Louis Pasteur, John Tyndall, Robert Koch and Edward Jenner.
2. The Prokaryota (Bacteria) : Structural organization:
   (i) Size, shapes and patterns of arrangement.
   (ii) Structural organization: Slime layer (capsule), cell envelopes: cytoplasmic membrane (inner membrane). Cell wall (outer membrane) of Gram- negative and Gram-positive bacteria; mesosmes; cytoplasmic organization; cell projections: flagella and cilia.
3. Genetic material of Bacteria: Chromosome, replication of bacterial DNA.
4. Reproduction in Bacteria: Asexual reproduction, binary fission, budding, endospore formation, exospores and cyst formation; sexual reproduction, conjugation.

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5. Microbial Nutrition : Culture of bacteria
   a. Carbon and energy source
   b. Nitrogen and minerals
   c. Organic growth factors
   d. Environmental factors : Temperature and pH
6. Bacteria of Medical Importance:
   (i) Gram-Positive
      a. Cocci: *Staphylococci, Streptococci*
      b. Bacilli: *Diptheria, Tetanus*.
   (ii) Gram-Negative
      a. Cocci: *Gonnorhea, Meningitis*
      b. Bacilli: Diarrhoea
   (iii) Mycobacteria: Tuberculosis, Leprosy

Section - C

Biotechnology

1. Definition, history, scope and application of biotechnology, major areas of biotechnology (microbial, plant and animal biotechnology).
2. Vectors for gene transfer.
3. Basic concepts of animal cell, tissue, organ and embryo culture.
4. Genetic engineering (outline idea only): Applications of genetic engineering, hazards and regulations.
5. Protoplast fusion in prokaryotes and eukaryotes.
6. Recombinant DNA technology; hybridomas and their applications, PCR. DNA finger printing, DNA foot printing. RFLP, RAPD & AFLP, Human genome project.
7. Monoclonal antibodies and their applications.
8. Brief account of cloning: its advantages and disadvantages.
9. Biotechnology in medicine (outline idea only), antibiotics, vaccines, enzymes, vitamins, artificial blood.
10. Environmental Biotechnology (outline idea only): Metal and petroleum recovery, pest control, waste water treatment.
11. Food, drink and dairy biotechnology (outline idea only): Fermented food production; dairy products, wine, beer, vinegar and food preservation.

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Practical - Zoology

Min. Marks: 18 **4 Hrs. / Week** **Max. Marks: 50**

I. Study of Museum Specimens:

Onychophora	:	*Peripatus*
Arthropoda	:	*Limulus*, Spider, Scorpion, Centipede, Millipede, *Lepas,Balanus*, *Squilla,Eupagurus*, Crab, *Mantis*, Honey-bee, (queen, king, worker) Locust, Silkworm Moth, Beetle, White grub.
Mollusca	:	*Chiton*, *Aplysia*, *Cypraea*, *Mytilus*, Pearl*Oyster*, *Dentalium*, *Loligo*, *Nautilus*.
Echinodermata	:	*Pentaceros*, *Echinus*, *Ophiothrix*, *Cucumaria,Antendon*.
Hemichordata	:	*Balanoglossus*.

II. Study of Microscopic Slides:

Arthropoda	:	V.S. of integument (cuticle): *Pediculus,* Bedbug, Termite and its castes, *Cyclops, Daphnia*, crustacean larvae (Nauplius, Metanauplius, Zoea, Mysis, Megalopa, Phyllosoma), statocyst of prawn.
Mollusca	:	V.S. of shell, T.S. gill of *Pila,* T.S of gill of Unio, Glochidium larva.
Echinodermata	:	Larval forms

III. Anatomy:

Prawn/Squilla	:	External features, appendages, alimentary canal and nervous system; Hastate Plate
Pila	:	External features,pallial organs and nervous system; osphradium, radula.

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IV. Study of the Following Through Permanent Slide Preparation:

(i) Study of different cell types -Blood smear (Wrights or Leishman stain).
(ii) Ospharadium, gill lamella and radula of pila.
(iii) Statocyst and Hastate plate of Prawn/Squilla

V. Microbiology Immunology and Biotechnology:

1. Preparation and use of culture media for microbes.
2. Study of microbes in food materials like curd,etc (Gram +ve& Gram-ve bacteria, Aspergillus, Mucor, Rhizopus, Penicillium, Alternaria and Fusarium).
3. Educational tour to any Microbiology laboratory/ Dairy/ Food processing factory/ Distillery. Collection of material may also be encouraged wherever possible. Candidates are required to submit a detailed report of the visit.
4. Antigen-antibody reactions-precipitation, agglutination.

VI. Animal Physiology:

1. Counting of red and white blood cells in the given blood sample.
2. Estimation of hemoglobin in the given blood sample.
3. Estimation of haematocrit value (PCV) in the given blood sample.
4. Demonstration of enzyme activity (catalase) in liver.
5. Study of salivary digestion of starch and the effect of heat and alcohol on salivary digestion of starch.
6. Study of histological structure of major endocrine glands of mammals.

VII. Biochemistry:

1. Detection of protein, carbohydrate and lipid in the animal tissue/food samples.
2. Identification of different kinds of mono-, di- and poly-saccharides in the given food samples.
3. Circular Paper chromatography of dyes/amino acids.

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B.Sc. Part - II

Scheme of Practical Examination Distribution of Marks

Time: 4 Hrs. **Min. Pass Marks. : 18** **Max. Marks: 50**

		Regular	Ex. /N.C. Students
1.	Anatomy (any system)	6	5
2.	Permanent Preparation	4	6
3.	Exercise in Microbiology/immunology/Biotechnology	4	6
4.	Exercise in Animal Physiology	5	6
5.	Exercise in Biochemistry	5	6
6.	Identification and comments on Spots (1 to 8)	16	16
7.	Viva Voce	5	5
8.	Class Record	5	-
		50	**50**

Notes:

1. Anatomy: Study of systems of the prescribed types with the help of dissection.
2. With reference tomicroscopic slides, in case of non-availability, the exercise should be **substituted with diagrams/ photographs.**
3. Candidates must keep a record of all work done in the practical class and submit the same for inspection at the time of the practical examination.
4. Mounting material for permanent preparations would be as per the syllabus or as available through collection and culture methods.
5. **It should be ensured that animals used in the practical exercises are not covered under the wild life act 1972 and amendments made subsequently.**

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Recommended Books:

1. Barnes R. D: Invertebrate Zoology, W. B. Saunders, 1969.
2. Barrington EJW: Invertebrate Structure and Function. 2nd edition John Wiley & Sons, Inc., 1978.
3. Barrington EJW: The Biology of Hemichordata and Protochordata. Oliver & Boyd, London 1965.
4. Barrett KE, Barman SM, Boctano, S and Brooks HL. Ganongs: Review of Medical Physiology. 24th edition McGraw Hill Education India Pvt. Ltd., 2012.
5. Berril NJ: The Tunicates. The Roy Society, London.
6. Brusca RG and Brusca GJ: Invertebrates. 2nd edition Sinauer/Panima Books, 2003.
7. Cooper GM and Hausman RE: The Cell: A Molecular Approach. 6th edition ASM Press Washington, DC/ Sinauer/Panima Books, 2013.
8. Conn EE, Stumpf PK, Bruening G, Doi, RH: Outline of Biochemistry. 5th edition. John Wiley & Sons, 1987.
9. De Robertis EDP and De RobertisJr EMF: Cell and Molecular Biology. 8th edition Lippincot Williams & Wilkins, 2006.
10. David R, Burggren Wand French K: Eckert Animal Physiology. 5th edition W H Freeman & Company, New York, 2001.
11. Eckert R, Randall D. J. Burggen W, French K: Eckert Animal Physiology and Burggren WW & Co. Ltd., 1997.
12. Fox SI: Human Physiology. 8th edition McGraw Hill Education 2003.
13. Gardner EL, Simmons MJ and Snustad DP: Principles of Genetics 8th edition John Wiley & Sons, Inc., 2006.
14. Giese A. C: Cell Physiology. 4th Edition, Saunders, 1973.
15. Glick BR., Paeternak JJ: Molecular Biotechnology, 4th edition ASM Press, 2010.
16. Goldsby RA, Kindt TJ and Osborne BA: Kuby Immunology. WH Freeman and Co., New York, 2002.
17. Grant: Biology of Developmental System
18. Gupta PK. Genetics: Classical to Modern. Rastogi Publications,2007.
19. Hall JE: Guyton and Hall Textbook of Medical Physiology. 12th edition Saunders Publications, 2010.
20. Hill RW, Wyse GA, Anderson M: Animal Physiology. 3rd edition Sinauer Associates Inc.USA, 2012.
21. Hyman LH: The Invertebrates, Vol. 6, McGraw Hill.
22. Jordan EL and Verma PS: Invertebrate Zoology.S. Chand & Company Ltd., 2012.
23. Karp G: Cell & Molecular Biology: Concepts and Experiments.7th editionJohn Wiley & Sons, Inc., 2013.
24. Kotpal RL: Modern Text Book of Zoology:Invertebrates.Rastogi Publications, 2012.
25. Lal SS: Practical Zoology Invertebrate.11th revised editionRastogi Publications, 2014.
26. Lehninger AL: Biochemistry. 2nd edition Kalyani Publishers, 1991.

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27. Lal SS: Practical Zoology Invertebrate. 11th revised edition, Rastogi Publications, 2014.
28. Lehninger AL: Biochemistry. Kalyani Publisher, 2008.
29. Lodish H, Berk A, Kaiser CA, Krieger M, Bertscher A, Ploegh H, Amon A, Scott M P. Molecular Cell Biology. 7th edition. Mac Millian High Education (International edition) England, 2013.
30. Meyers R. A: Molecular Biology and Biotechnology (A comprehensive Desk References John Wiley & Sons, 1995.
31. Murphy K: Janeway's Immunology. Garland Science; 8th edition, 2011.
32. Nelson DL and Cox MM: .Lehninger Principles of Biochemistry. 5th edition W. H. Freeman, 2008.
33. Nelson DL and Cox MM: Lehninger Principles of Biochemistry. 6th edition W. H. Freeman, 2013.
34. Owen J, Punt J, Stranford S: Kuby Immunology. 7th edition WH Freeman & Co. Ltd., 2013.
35. Old RW and Primrose SB: Principles of Gene Manipulation: An Introduction to Genetic Engineering. University of California, 1980.
36. Sastry KV: Animal Physiology and Biochemistry. 2nd edition Rastogi Publications, 2014-15.
37. Vander AJ, Sheerman J, Liciano D: Human Physiology: The Mechanics of Body Function. McGraw Hill Co., New York, 1998.
38. Verma PS and Jordan EL: Invertebrate Zoology. S Chand &Co. Ltd, New Delhi, 2001.
39. Verma PS, Tyagi BS, Agarwal VK: Animal Physiology. 6th edition S. Chand& Co., 2004.
40. Voet D and Voet JG: Biochemistry. 4th edition, John Wiley & Sons, Inc., 2011.
41. Voet D and Voet JG: Biochemistry. John Wiley & Sons, New York, 1990.
42. Verma PS: A Manual of Practical Zoology: Invertebrates. S.Chand &Co. Ltd.New Delhi, 1971.
43. Voet D and Voet JG: Biochemistry. 4th edition, John Wiley & SonsInc., 2011.
44. Wake MH: Hyman's Comparative Vertebrate Anatomy. 3rdedition University of Chicago Press Ltd., London, 1992.

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4. BOTANY

Scheme

Paper I [illegible] 3 hrs. duration Max Marks: 100
Paper II [illegible] 3 hrs. duration Max. Marks 33
Paper III [illegible] 3 hrs. duration Max. Marks 33
Practical [illegible] Marks: 18 4 hrs. duration Max. Marks 34
Max. Marks 50
3 hours
4 hours

Duration of examination of each theory paper-
Duration of examination of practicals-

Note:

1. There will be 5 questions in each paper. All questions are [illegible] Candidate has to answer all questions in the main answer book only.
2. There will have 18 very short answer type Questions (not more than 20 words) of half [illegible] each covering entire syllabus.
3. The syllabus is divided into four units. There will be one question from each unit. These [illegible] 3 to 5 will have internal choice.

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PAPER-I

Molecular Biology and Biotechnology

(3 hrs/week)

Unit-1

Genetic Material: Biological, chemical and physical nature of heredity material. Structure of DNA and RNAs (mRNA, tRNA and rRNA). Watson and Crick model of DNA. Nucleosome model.

DNA replication: Meselson – Stahl experiment of semiconservative replication of DNA; RNA Primers, Okazaki-fragments, polymerases, DNA-Protein interactions.

Preliminary account of DNA damage and repair.

Unit-2

Central dogma of life. Transcription in eukaryotes: role of promoter, gene, pre mRNA synthesis, pre mRNA processing: capping, splicing and polyadenylation.

Translation: genetic code (codon), initiation, elongation and termination.

Regulation of gene expression in prokaryotes and eukaryotes: Negative and positive control, attenuation and anti-termination. Reverse transcriptase and its application.

Unit-3

Biotechnology: Functional definition. Basic aspects of Plant tissue culture, basal medium, media preparation and aseptic culture technique. Concept of cellular totipotency: Callusing, Differentiation and morphogenesis. Micropropagation; Tissue culture and its applications. Basic concept of Protoplast culture. Anther culture, Embryo culture and their applications.

Unit-4

Recombinant DNA technology: Tools and techniques used in rDNA technology - Restriction enzymes, Vectors for gene transfer: Bacteriophage, plasmids, cosmids and Artificial chromosome, cDNA technology, gene amplification, Polymerase chain reaction, Application of PCR technique, DNA fingerprinting and its uses. Application of Biotechnology and Transgenic plants.

Practicals

1.

2.

3.

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2. *Media preparation*
3. *Inoculation Technique*
4. *Explant culture-shoot tip, nodal segment*
5. *Callus induction from plant parts*
6. *Gel electrophoresis technique*

Suggested Books

1. *Gupta, P.K. (2012) Cell and Molecular Biology* Rastogi Publications, Meerut

2. *Gamborg OL and Philips GC (1995) Plant Cell, Tissue and Organ Culture*

3. Dnyansagar, VR. (1986). Cytology and Genetics. Tata McGraw-Hill Pub. Co. Ltd. New Delhi

4. Verma, PS. and Agarwal, VK. (2012). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand and Co. Ltd. New Delhi.

5. Alberts, B., Bray, DJ, Raff, M., Roberts, K. and Wasson, LD. (2001). Molecular Biology of Cell. Garland Publishing Co., Inc., New York

6. Micklos, DA, Freyer, GA and Crotty, DA. (2003). DNA Science a first course (Second Ed.). Cold Spring Harbor Laboratory Press, NY., USA.

7. Razdan, MK. (1993) An Introduction to Plant Tissue Culture. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.

8. Mascarenhas, AF. (1988). Handbook of Plant tissue culture. Publication & Information Div., ICAR. New Delhi.

9. Purohit, SS. and Mathur, SK. (1996) Biotechnology fundamentals and applications. Agro Botanical Publishers, Bikaner

10. Rana, SVS. (2012) Biotechniques theory & practice (Third Ed.) Rastogi Publications, Meerut

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Paper-II

PLANT PHYSIOLOGY AND BIOCHEMISTRY

(2 hrs /week)

Unit-1

Water: Structure, physical and chemical properties, importance to plant life, concept of water potential. Absorption and transport of water. Ascent of sap. Transpiration, Guttation, stomatal movement, factors affecting transpiration, Guttation.

Mineral Nutrition: Essential micro and macro nutrients; their uptake, hydroponics-and nutrient requirement, deficiency and toxicity symptoms.

Transport of organic substances: Mechanisms of phloem transport, factors regulating the translocations of nutrients

Unit-2

Photosynthesis: Pigments, Photosynthetic apparatus, light reaction, photo system I & II, Z scheme, photophosphorylation, C_3 (Calvin cycle), C_4 cycle, and factors affecting the photosynthesis.

Respiration: Aerobic and anaerobic respiration; RQ (Respiratory Quotient), Kreb's cycle, electron transport system, oxidative phosphorylation, and factors affecting the process. Fermentation

Unit-3

Carbohydrates: Introduction, importance, nomenclature, classification, molecular structure & function of mono, oligo and polysaccharides, their properties, glycosidic linkages and glycoprotein.

Amino acids & proteins: Amino acids-structure, electrochemical properties, peptide bonds, chemical bonds and nomenclature, structure and classification of proteins, physical and chemical properties

Enzymes: Structure, nomenclature & classification of enzyme, Characteristics of enzymes, mechanism of action, multi-enzyme system, regulation of enzyme activity.

Lipids: Occurrence of fatty acids (saturated and unsaturated), Alpha and Beta oxidation.

Secondary metabolites: Introduction and application of secondary metabolites

Unit-4

Processes of growth and development: Seed dormancy and germination, plant movement, Biological clock, Plant growth regulatory factors

Photoperiodism: Action, location of photoreceptors, mechanism of action, concept of florigen and Vernalization

Plant growth regulators: Auxins, gibberellins, cytokinins, ethylene and ABA, discovery & physiological effects

Suggested Readings

2. Bajpai, A. N. and Bhatia, K. N.: Plant physiology. Trueman Book Company, 1985.
3. Jain, V. K. Fundamentals of plant physiology. S. Chand & Company Ltd.
4. Sinha, S. K. and Verma, M. A textbook of plant physiology, biochemistry and biotechnology. S. Chand Ltd., 2000.
5. Verma, V. Textbook of plant physiology. ANE Books India, 2007.
6. Malik, C. P. and Srivastava, A. K. Textbook of plant physiology. Kalyani publication, 1982.

Practical Exercises:

1. To determine the osmotic potential of vacuolar sap by plasmolytic method.
2. To study the permeability of plasma membrane using different concentrations of organic solvents.
3. To study the effect of temperature of permeability of plasma membrane.
4. To separate chloroplast pigments by solvent method
5. To separate chloroplast pigments using paper chromatography.
6. To separate amino acids in a mixture by paper chromatography.
7. To prepare the standard curve of protein.
8. To demonstrate the tests for proteins in the unknown samples.
9. To demonstrate the enzyme activity - Catalase, peroxidase and amylase.
10. To demonstrate the tests for different types of carbohydrates and lipids.
11. Bioassay of growth hormone (auxin, cytokinin, gibberellin).
12. Demonstration of phenomenon of osmosis by use of potato osmometer
13. To demonstrate root pressure
14. To demonstrate rate of transpiration by use of potometers
15. Photosynthesis by inverted funnel method, Moll's experiment
16. To demonstrate anaerobic and aerobic respiration
17. R.Q. by Ganong's respirometer
18. Measurement of growth using auxanometer

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Paper III

Pteridophytes, Gymnosperms & Palaeobotany

(2 hrs. week)

Unit-1

[illegible] characters of Pteridophytes. Classification (G.M. Smith). Distribution and alternation of generations. Stelar system in Pteridophytes. Eusporangiate and leptosporangiate development of sporangia. Morphology of sporophyte. Economic importance of Pteridophytes.

Unit-2

Morphology, anatomy and reproduction of *Psilotum, Selaginella, Equisetum* and *Marsilea*.

Characteristics of Gymnosperms, distribution and classification (K.R.Sporne).

Unit-3

Morphology, anatomy, reproduction and life cycle of *Cycas, Pinus* and *Ephedra*. Economic importance of Gymnosperms.

Unit-4

Process of fossilization, types of fossils & Techniques of study of fossils. Geological time scale. Fossil land plant *Rhynia*, fossil Pteridophytes, reconstructed plants-Lepidodendron and Calamites. Fossil Gymnosperms *Williamsonia*.

Suggested Laboratory Exercises:

1. Study of external morphology, anatomy of vegetative and reproductive parts of *Psilotum Selaginella, Equisetum* and *Marsilea*
2. Study of external morphology, anatomy of vegetative and reproductive parts of *Cycas Pinus* and *Ephedra*
3. Study of fossils and slides of fossils
4. Preparation of charts of Geological time scale

Suggested Readings

[illegible] Morphology of Plant and Fungi (5th [illegible]

[illegible] Vascular Plants, Vol. I

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Sharma, O.P. Pteridophytes. 2000. Today's & Tomorrow's Publications

Sarabhai, R.C. and Saxena, R.C.1990. A Text book of Botany. Rastogi Publications, Meerut.

Sporne, K.R. 2002. The Morphology of Gymnosperms. B.I. Pub. Pvt. Ltd., Mumbai, Kolkata. Delhi.

Vasishta, P.C. 2003. Pteridophytes. S. Chand & Co.New Delhi

Wilson, N.S. and Rothwell, G.W. 1993. Palaeobotany and Evolution of Plants. (2nd Ed.). Cambridge University Press. U.K.

Singh, V., Pandey, P.C. & Jain, D.K.2013. A Text book of Botany (IV Ed). Rastogi Publications. Meerut

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BOTANY PRACTICAL EXAMINATION B. Sc PART-II

SKELETON PAPER

M.M. 50

TIME: 4 Hours

S. No.	Practical	Regular	Ex NC
1(a)	Comment on the Tissue culture or Biotechnology technique	5	5
1(b)	Exercise based on molecular biology	5	5
2	Perform the given physiological experiment and write the principle, procedure, results based on observations and precautions involved.	7	-
3	Perform the bio-chemical test of the given sample and discuss the observation giving reasons.	3	3
4	Make a suitable preparation of material "A" (Pteridophyte) (vegetative/reproductive part). Draw a labelled sketch. Identify giving reasons.	5	5
5	Make a suitable preparation of material "B"(Gymnosperm) (vegetative/reproductive part). Draw a labelled skeich. Identify giving reasons.	5	5
6	Comment upon spots (1-5)	10	15
7	Viva-Voce	5	5
8	Practical record	5	-
	TOTAL	50	50

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6. MATHEMATICS

B.Sc. Part-II 2020

Teaching : 3 Hours per Week per Theory Paper.
2 Hours per Week per Batch for Practical

Examination Scheme:

	Min.Pass Marks		Max. Marks
	Science – 54		150
	Arts – 72		200
		Duration	Max. Marks
Paper – I	Real Analysis	3 hrs.	40 (Science) 53 (Arts)
Paper – II	Differential Equations	3 hrs.	40 (Science) 53 (Arts)
Paper – III	Numerical Analysis	3 hrs.	40 (Science) 54 (Arts)
Practical		2 hrs.	30 (Science) 40 (Arts)

Note:

1. Common paper will be set for both the Faculties of Social Science and Science. However, the marks obtained by the candidate in the case of Faculty of Social Science will be converted according to the ratio of the maximum marks of the papers in the two Faculties.
2. Each candidate is required to appear in the Practical examination to be conducted by internal and external examiners. External examiner will be appointed by the University and internal examiner will be appointed by the Principal in consultation with Local Head/Head, Department of Mathematics in the college.
3. An Internal/external examiner can conduct Practical Examination of not more than **100 (Hundred)** Candidates.
4. Each candidate has to pass in Theory and Practical examinations separately.

Raj / Jan

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University of Rajasthan
Jaipur

Paper – I: Real Analysis

Teaching : 3 Hours per Week

Duration of Examination : 3 Hours **Max. Marks:** **40 (Science)**
53 (Arts)

Note: This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Real numbers as complete ordered field, Limit point, Bolzano-Weierstrass theorem, closed and Open sets. Concept of compactness and connectedness. Heine-Borel theorem. Holder inequality & Minkowski inequality, Metric space – Definition and examples, Open and Closed sets, Interior and Closure of a set, Limit point of a set in metric space.

Unit 2: Real sequences- Limit and Convergence of a sequence, Monotonic sequences. Cauchy's sequences, Subsequences, Cauchy's general principle of convergence. Properties of continuous functions on closed intervals.

Unit 3: Properties of derivable functions, Darboux's and Rolle's theorem. Notion of limit, continuity and differentiability for functions of several variables. The directional derivative, the total derivative, expression of total derivative in terms of partial derivatives.

Unit 4: Riemann integration – Lower and Upper Riemann integrals, Riemann integrability, Mean value theorem of integral calculus, Fundamental theorem of integral calculus. Functions of bounded variations. Introduction, properties of functions of bounded variations, total variation.

Unit 5: Sequence and series of functions – Pointwise and Uniform convergence, Cauchy's criterion, Weierstrass M-test, Abel's test, Dirichlet's test for uniform convergence of series of functions, Uniform convergence and Continuity of series of functions, Term by term differentiation and integration.

Reference Books :

1. K.A. Ross, Elementary Analysis: The Theory of Calculus, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.
2. R.G. Bartle D.R. Sherbert, Introduction to Real Analysis (3rd edition), John Wiley and Sons (Asia) Pvt. Ltd.., Singapore, 2002.
3. Charles G. Denlinger, Elements of Real Analysis, Jones and Bartlett (Student Edition),2011.
4. S. Kumaresan, Topology of Metric Spaces, Narosa Publishing House, Second Edition 2011.
5. G. F. Simmons, Introduction to Topology and Modern Analysis, Mcgraw-Hill, Edition 2004.

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Paper – II: Differential Equations

Teaching : 3 Hours per Week

Duration of Examination : 3 Hours **Max. Marks:** **40 (Science)**
53 (Arts)

Note: This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Degree and order of a differential equation. Equations of first order and first degree. Equations in which the variables are separable. Homogeneous equations and equations reducible to homogeneous form. Linear equations and equations reducible to linear form. Exact differential equations and equations which can be made exact.

Unit 2: First order but higher degree differential equations solvable for x,y and p. Clairaut's form and singular solutions with Extraneous Loci. Linear differential equations with constant coefficients, Complimentary function and Particular integral.

Unit 3: Homogeneous linear differential equations, Simultaneous differential equations. Exact linear differential equations of nth order. Existence and uniqueness theorem.

Unit 4 : Linear differential equations of second order. Linear independence of solutions. Solution by transformation of the equation by changing the dependent variable/the independent variable, Factorization of operators, Method of variation of parameters, Method of undetermined coefficients.

Unit 5: Partial differential equations of the first order. Lagrange's linear equation. Charpit's general method of solution. Homogeneous and non-homogeneous linear partial differential equations with constant coefficients. Equations reducible to equations with constant coefficients.

Reference Books :

1. R.S. Senger, Ordinary Differential Equations with Integration, Prayal Publ. 2000.
2. D.A. Murray, Introductory Course in Differential Equations, Orient Longman (India), 1967.
3. E.A. Codington, An Introduction to Ordinary Differential Equations, Prentice Hall of India, 1961.

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Paper – III: Numerical Analysis and Vector Calculus

Teaching : 3 Hours per Week

Duration of Examination : 3 Hours **Max. Marks:** **40 (Science)**
54 (Arts)

Note: (i) This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.
(ii) Non-Programmable Scientific Calculators are allowed.

Unit 1: Differences. Relation between differences and derivatives. Differences of a polynomial. Newton's formulae for forward and backward interpolation. Divided differences. Newton's divided difference, Lagrange's interpolation formula.

Unit 2: Central differences.Gauss's, Stirling's and Bessel's interpolation formulae. Numerical Differentiation. Derivatives from interpolation formulae. Numerical integration, Derivations of general quadrature formulas, Trapazoidal rule. Simpson's one-third, Simpson's three-eighth and Gauss's quadrature formulae.

Unit 3: Relation between the roots and coefficients of general polynomial equation in one variable, transformation of equations, Descarte's rule of signs, solution of cubic equations by Cardon's method, biquadratic equations by Ferari's method.
Numerical solution of Algebraic and Transcendental equations, Bisection method, Secant method, Regula-Falsi method, Iteration method, Newton- Raphson Method (derivation of formulae and rate of convergence only).

Unit 4: Gauss elimination and Iterative methods (Jacobi and Gauss Seidal) for solving system of linear algebraic equations. Partial Pivoting method, ill conditioned systems, Numerical solutions of ordinary differential equations of first order with initial condition using Picard's, Euler and modified Euler's method.

Unit 5: Scalar and Vector point functions. Differentiation and integration of vector point functions. Directional derivative. Differential operators. Gradient, Divergence and Curl. Theorems of Gauss, Green, Stokes (without proof) and problems based on these theorems.

Reference Books :

1. B. Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
2. C. F. Gerald and P. O. Wheatley, App;ied Numerical Analysis, Pearson Education, India,7th edition, 2008.
3. C.F. Gerald, P.O. Wheatley, Applied Numerical Analysis, Addison-Wesley, 1998.

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Practical

Teaching: 2 hours per week per batch not more than 20 students.

Examination Scheme: **Duration: 2 Hours**

	Science	Arts
Max.Marks	30	40
Min.Pass Marks	11	15

Distribution of Marks:

Two Practicals one from each group

10 Marks each	=	20 Marks (13 Marks each)	26
Practical Record	=	05 Marks	07
Viva-voce	=	05 Marks	07
Total Marks	=	30 Marks	40

The paper will contain TWO practical. The candidates are required to attempt both practical.

Practicals with Computer Programming in C Language.

Programming languages and problem solving on computers, Algorithm, Flow chart, Programming in C- Constants, Variables, Arithmetic and logical expressions, Input-Output, Conditional statements, Implementing loops in Programs, Defining and manipulation arrays and functions.

Group A:

1. Printing n terms of Fibonacci sequence.
2. Finding $n!$, $\sum n, \sum n^2$ etc.
3. Defining a function and finding sum of n terms of a series/sequence whose general term is given (e.g. $a_n = \frac{n^2+3}{n+1}$).
4. Printing Pascal's triangle.
5. Finding gcd and lcm of two numbers by Euclid's algorithm.
6. Checking prime/composite number.
7. Finding number of primes less than n, $n \in Z$.
8. Finding mean, standard deviation and ${}^nP_r$, ${}^nC_r$ for different n and r.

Group B:

1. Numerical integration using Trapezoidal, Simpson's 1/3, 3/8 and Waddle rules.

Note:

1. Each Candidate (Regular/non-Collegiate) has to prepare his/her practical record.
2. Each Candidate has to pass in Practical and Theory examinations separately.

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