



POSTGRADUATE TEST SYLLABUS 2017

- › There will be negative marking for all multiple choice questions.
- › **Model Test Papers** will be available on the university's website - sssihl.edu.in - 1 December 2016 onwards

GENERAL ENGLISH

- › Comprehension (Unseen Passage)
- › Vocabulary: Pair of words often confused on word substitutes
- › Grammar: Propositions, tenses, structural items, voices etc., reported speech, phrasal verbs, word formation.
- › Compositions: Expansion of a proverb or paragraph writing (150-200 words).
- › Spelling.

M.A. IN ENGLISH LANGUAGE & LITERATURE

QUESTION PAPER FORMAT

- › Five short answer type: Comprehension of unseen passage, prose, poetry (100 words).
- › Long Answer (essay) type: Testing the knowledge and understanding of literary background (400 words).
- › Set on major literary forms (150 words).
- › Multiple choice type: a) Vocabulary testing b) Common literary terms c) Rewriting a passage: to correct grammatical mistakes - in verbs, spelling or of a similarly type.

PRESCRIBED TEXTS

- › A short history of English Literature by Evans.
- › A background to the study of English Literature - for Indian students by B. Prasad, Macmillan.

M.A. IN ECONOMICS

QUESTION PAPER FORMAT

The question paper is of two hours in duration / 75 marks. It is divided into three sections:

Section A: Objective type questions
Section B: Short answer questions
Section C: One essay type question

TOPICS

Economic Theory

- › Consumer behaviour: preference ordering, utility, budget sets and demand functions; Theory of the firm; Costs, supply and factor demand; Market structure: pricing and production under

perfect and imperfect competition, General equilibrium and welfare; Taxation; Elements of national income accounting; Level of economic activity under classical assumptions; Keynesian theory of effective demand and employment; Monetary and fiscal policies; International trade.

Quantitative Methods

- › Functions of one variable; Linear and quadratic equations; Derivatives and rules of differentiation; Measures of central tendency and dispersion; Correlation and regression with two variables; Index numbers; Elements of probability theory; Random variables and common distributions.

Indian Economy and Development

- › Basic issues and indicators of economic development; Economic growth; Aspects of development policy: Population growth and employment; Strategies and theories of development; Human values and economic development; Structure of the Indian economy; Human resource development; Persistence of poverty and inequality; New economic policy regime; Indian ethos and policies for all round development; Aspects of the International Economy

M.SC. IN MATHEMATICS

QUESTION PAPER FORMAT

The question paper is of two hours in duration / 75 marks. It is divided into three sections:

Section A: 40 multiple choice questions (40 marks)

Section B: Problem-solving type questions - 5 marks each - internal choice (25 marks)

Section C: Short C-Programming Test (10 marks)

Viva voce: Those who pass the English and Written Tests will undergo a technical Viva voce (25 marks)

TOPICS

MATHEMATICS

- › Calculus, Differential Equations,

Probability Theory, Real Analysis, Group Theory, Ring Theory, Linear Algebra, Complex Analysis, Discrete Mathematics, and Numerical Analysis. The detailed syllabus is as follows:

Calculus: Higher Order Partial Derivatives, Differentiability, Gradient, the Chain Rule, Directional Derivative, Total Differential and Approximation, Constrained Extrema and Lagrange Multipliers, Double and Triple Integration.

Differential Equations

- › Classification of Ordinary and Partial Differential Equations, Types of Solutions, Existence and Uniqueness of Solution for an Initial Value Problem, Bernoulli Equation, Exact Differential Equations and Integrating Factors, Cauchy-Euler Equation, Method of Variation Of Parameters, Method of Undetermined Coefficients, Wronskian, Method of Separation of Variables for solving Boundary Value Problems

Probability Theory

- › Conditional Probability-Bayes's Formula, Independent Events, Discrete and Continuous Random variables, Expected Value, Variance, Covariance, Variance of sums and Correlations, Moment generating functions.

Real Analysis

- › Logic, Sets and Relations, Functions, Cardinality, Natural Number and Induction, Ordered Field, Completeness Axiom, Topology of the Reals and Compactness, Convergence, Sequences and Series, Convergence Tests, ϵ - δ definition, Limit theorems, Continuous Function and Uniform continuity, Intermediate Value Theorem, Mean Value Theorem, L'Hospital's rule, Point-wise and Uniform Convergence, Taylor's Theorem, Riemann Integration, Radius and Interval of Convergence for Power Series.

Group Theory

- › Groups, Subgroups, Cyclic Groups, Normal and Quotient Subgroups, Permutation Groups, Homomorphism, Automorphism, Cayle's and Sylow's Theorem.

Ring Theory

- › Rings, Integral Domain, Division Rings, Ideals, Quotient Rings, Euclidean Rings, Polynomial Rings, Field of Quotients, Polynomials over Rational Fields.

Linear Algebra:

- › Vector Spaces, Linear Independence and Dependence, Bases and Dimension, Linear Transformations, Systems of Linear Equations, Eigenvalue and Eigenvector Theory.

Complex Analysis

- › Algebra of Complex Numbers, Analyticity - Harmonic Functions, Elementary Functions, Cauchy Integral Formula, Convergence of Sequence and Series, Taylor Series - Laurent Series, Types of Isolated Singularities, Residue Theorems.

Discrete Mathematics

- › Logic, Counting, Graphs and Trees.

Numerical Analysis

- › Bisection Method, Newton Method, Secant Method, Polynomial Interpolation, Simpson Rule, Trapezoidal Rule, LU Factorization, Residual Correction Method, Method of Least Squares, Power Method, Taylor's Method, Euler's Method, Runge-Kutta Method.

COMPUTER SCIENCE

C Language Programming

- › A minimal exposure to programming is expected from the students. Nevertheless, those qualified for the M.Sc. (Mathematics) programme and desirous of opting for computer science specialization will be tested in fundamentals of Computer Science and Programming once they are enrolled for the course.

M.SC. IN PHYSICS

WEIGHTAGE

- › Written Test: 70%
- › Technical Interview: 30% (subject to passing the written test)

QUESTION PAPER FORMAT

The question paper is of two hours in duration / 75 marks.

Section A: Mathematics, Electronics, Chemistry & Computer Science (25 marks)
Section B: Physics (50 marks)

SECTION A

Mathematics

- › Calculus of single and multiple

variables, partial derivatives, Matrices and determinants, Algebra of complex numbers; Taylor expansion, Fourier series; Vector algebra, Vector Calculus, Multiple integrals, Divergence theorem, Green's theorem, Stokes' theorem. First order equations and linear second order differential equations with constant coefficients.

Integral Calculus

- › Integration as the inverse process of differentiation, definite integrals and their properties, Fundamental theorem of integral calculus. Double and triple integrals, change of order of integration. Calculating surface areas and volumes using double integrals and applications. Calculating volumes using triple integrals and applications. Vector Calculus: Scalar and vector fields, gradient, divergence, curl and Laplacian. Scalar line integrals and vector line integrals, scalar surface integrals and vector surface integrals, Green's, Stokes and Gauss theorems and their applications.

Linear Algebra

- › Vector spaces, Linear dependence of vectors, basis, dimension, linear transformations, matrix representation with respect to an ordered basis, Range space and null space, rank-nullity theorem; Rank and inverse of a matrix, determinant, solutions of systems of linear equations, consistency conditions. Eigenvalues and eigenvectors. Cayley-Hamilton theorem. Symmetric, skewsymmetric, hermitian, skew-hermitian, orthogonal and unitary matrices.

Probability

- › Basic concepts of probability theory. Binomial, Poisson & Normal distributions.

Numerical Analysis

- › Solution of non-linear equations using iterative methods. Interpolation Lagrange's formula and Newton's formula for equidistant points). Numerical differentiation and integration Trapezoidal and Simpson's rules.

Electronics

- › Boolean algebra: Binary number systems; conversion from one system to another system; binary addition and subtraction. Logic Gates AND, OR, NOT, NAND, NOR exclusive OR; Truth tables; combination of gates; de Morgan's theorem; Zener diode and its applications, BJT: characteristics in CB, CE, CC modes. Single stage amplifier, two stage R-C coupled amplifiers. Simple Oscillators: OP AMP and applications: Inverting

and non-inverting amplifier. 8085 or 8086 Microprocessor architecture and knowledge of assembly language programming.

Chemistry

- › Periodic Table: Periodic classification of elements and periodicity in properties; general methods of isolation and purification of elements. Chemical Bonding and Shapes of Compounds: Types of bonding-Ionic and covalent bonding, M.O. and V.B. approaches for diatomic molecules, VSEPR theory and shape of molecules, hybridisation; Chemical Thermodynamics: Reversible and irreversible processes; First law and its application to ideal and nonideal gases; Thermochemistry; Second law; Entropy and free energy, Criteria for spontaneity. Chemical and Phase Equilibria: Law of mass action; K_p, K_c, K_x and K_n; Effect of temperature on K; Ionic equilibria in solutions; pH and buffer solutions; Chemical Kinetics- Reactions of various order; Basis of Organic Reactions Mechanism: Elementary treatment of SN₁, SN₂, E₁ and E₂ reactions; Acids and Bases: Arrhenius, Lowry -Bronsted concepts of acids and bases - Strengths of acids and bases.

Computer Science

- › Basic knowledge of computer systems, software and programming; Number systems. Basic electronic gates. Algorithmic approach to solve problems. Fundamentals of C language.

SECTION B (PHYSICS)

Mechanics and General Properties of Matter

- › Newton's laws of motion and applications, Velocity and acceleration in Cartesian, polar and cylindrical coordinate systems, uniformly rotating frame, centrifugal and Coriolis forces, Motion under a central force, Kepler's laws, Gravitational Law and field, Conservative and non-conservative forces. System of particles, Centre of mass, equation of motion of the CM, conservation of linear and angular momentum, conservation of energy, variable mass systems. Elastic and inelastic collisions. Rigid body motion, fixed axis rotations, rotation and translation, moments of Inertia and products of Inertia, parallel and perpendicular axes theorem. Principal moments and axes. Kinematics of moving fluids, equation of continuity, Euler's equation, Bernoulli's theorem.

Oscillations, Waves and Optics

- › Differential equation for simple harmonic oscillator and its general solution. Superposition of two or more simple harmonic oscillators. Damped and forced oscillators, resonance. Wave equation, traveling and standing waves in one dimension. Energy density and energy transmission in waves. Group velocity and phase velocity. Sound waves in media. Doppler Effect. Fermat's Principle. General theory of image formation. Thick lens, thin lens and lens combinations. Interference of light, optical path retardation. Fraunhofer diffraction. Rayleigh criterion and resolving power. Diffraction gratings. Polarization: linear, circular and elliptic polarization. Double refraction and optical rotation.

Electricity and Magnetism

- › Coulomb's law, Gauss's law. Electric field and potential. Electrostatic boundary conditions, Solution of Laplace's equation for simple cases. Conductors, capacitors, dielectrics, dielectric polarization, volume and surface charges, electrostatic energy. Biot-Savart law, Ampere's law, Faraday's law of electromagnetic induction, Self and mutual inductance. Alternating currents. Simple DC and AC circuits with R, L and C components. Displacement current, Maxwell's equations and plane electromagnetic waves, Poynting's vector, Lorentz Force and motion of charged particles in electric and magnetic fields.

Kinetic theory, Thermodynamics

- › Elements of Kinetic theory of gases. Velocity distribution and Equipartition of energy. Specific heat of Mono-, di- and tri-atomic gases. Ideal gas, van-der-Waals gas and equation of state. Mean free path. Laws of thermodynamics. Zeroth law and concept of thermal equilibrium. First law and its consequences. Isothermal and adiabatic processes. Reversible, irreversible and quasi-static processes. Second law and entropy. Carnot cycle. Maxwell's thermodynamic relations and simple applications. Thermodynamic potentials and their applications. Phase transitions and Clausius-Clapeyron equation. Ideas of ensembles, Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein distributions.

Modern Physics

- › Inertial frames and Galilean invariance. Postulates of special relativity. Lorentz transformations. Length contraction, time dilation. Relativistic velocity addition theorem, mass energy equivalence. Blackbody radiation, photoelectric effect, Compton effect, Bohr's atomic model,

X-rays. Wave-particle duality, Uncertainty principle, the superposition principle, calculation of expectation values, Schrödinger equation and its solution for one, two and three dimensional boxes. Solution of Schrödinger equation for the one dimensional harmonic oscillator. Reflection and transmission at a step potential, Pauli exclusion principle. Structure of atomic nucleus, mass and binding energy. Radioactivity and its applications. Laws of radioactive decay. Nuclear reactions, Nuclear model- liquid drop model.

Solid State Physics and Devices

- › Crystal structure, Bravais lattices and basis. Miller indices. X-ray diffraction and Bragg's law; Intrinsic and extrinsic semiconductors, variation of resistivity with temperature. Fermi level. p-n junction diode, I-V characteristics.

Atomic and Molecular Spectroscopy

- › Atomic Spectra: Spin and orbital angular momenta and related quantum numbers, Elements of Molecular Spectroscopy: quantization of energy; representation of spectra; elements of practical spectroscopy.

Lasers

- › Quantum theory of radiation; Einstein A and B coefficients, Essential elements of a laser; laser operation; characteristics of laser light.

M.S.C. IN MATERIALS SCIENCE

QUESTION PAPER FORMAT

The question paper is of two hours in duration / 75 marks.

Section A: Physics, Physics (25 marks each)

Section B: Mathematics (25 marks)

Section C: Chemistry (25 marks)

Mathematics

- › Matrices: Algebra of Matrices, Rank of a Matrix, inverse of a matrix, determinant of a matrix, Solution of Simultaneous Equations, Eigen Values & Eigen Vectors.
- › Differential Calculus: Ordinary Differentiation and Leibnitz's Theorem, Differential Calculus, Partial Differentiation, chain rules, exact differentials, separation of variables, Euler's theorem for homogeneous functions, Total Differentiation, extrema of Function of several variables.
- › Integral Calculus: indefinite and definite integrals, integration using trigonometric identities, integration using substitution and change of variables, integration by

parts.

- › Vectors: unit vectors, Vector Differentiation, scalar and vector products, gradient, divergence and curl.
- › Series and sequences: Convergence test, power series, Taylor and McLaurin series.

Physics

- › Mechanics, Waves and Oscillations: Force, Inertia, Newton's Laws, Kepler's laws, centre of mass, translational motion, rotational motion, angular momentum, conservation laws, transverse and longitudinal waves, Simple Harmonic Motion, forced oscillation and resonance, coupled oscillations.
- › Optics, atomic and molecular physics: Reflection, refraction, dispersion, polarization, interference and diffraction, Bohr model, line spectra, theory of hydrogen atom, Molecular spectra, Zeeman Effect, photoelectric effect, Compton Effect, X-rays, Lasers.
- › Thermodynamics and Statistical physics: Work and heat, transfer of heat by conduction, convection and radiation, Thermodynamic Laws, Heat engines, Refrigerator, Entropy, specific heat, classical and quantum statistics, Maxwell-Boltzmann distribution, Kinetic theory of gasses.
- › Quantum Mechanics: Wave and particle nature, de Broglie relation, wave packets, Uncertainty principle, Schrodinger equations, simple harmonic oscillator.
- › Solid state physics: Ionic and covalent solids, energy bands in solids, semiconductors.
- › Nuclear Physics: Radioactive decay, nuclear size and shape, mass and binding energy, different types of decay

Chemistry

- › Stoichiometry and the Basis of the Atomic Theory; acids and bases; Periodic table-chemical bonding and molecular structure; Molecular Orbital Theory; Periodic Properties; properties of gases; kinetic theory of gases, phase equilibria, properties of ideal and non-ideal solutions; chemical equilibrium, Ionic Equilibria in aqueous solutions; Valence and the Chemical Bond; Oxidation-Reduction Reactions; Chemical Thermodynamics: Thermodynamics of closed systems - 1st law of thermodynamics. Heat and enthalpy: Relation between ΔH and ΔU - Kirchoff's law - Joule-Thomson effect.
- › Work of adiabatic expansion: adiabatic - reversible expansion of a perfect gas
- › Applications of 1st law concepts: Joule-Thomson expansion - characteristics. 2nd law of thermodynamics: Carnot cycle - Clausius inequality; Chemical

Kinetics: Rate expressions, Arrhenius equation - Collision theory, Transition state theory; Electrochemical cells: Galvanic and electrolytic cells; Electrode types; Chemical cell.

- › Organic Chemistry – preparation and reactions of hydrocarbons, functional groups, alcohols, alkenes and aromatic compounds;

M.SC. IN CHEMISTRY

QUESTION PAPER FORMAT

The question paper is of two hours in duration / 75 marks.

Section A: Objective type – 25 questions (25 marks)

Section B: Short answer type. 6 out of 8 questions - Global choice (6x5=30 marks)

Section C: Essay type – long answer type - One out of two questions (20 marks)

GENERAL CHEMISTRY

- › Electronic structure of atoms: Atomic spectra - H-spectrum.
- › Wave Mechanics: De Broglie matter waves - Heisenberg uncertainty principle, Schrödinger's wave equation. Hydrogen atom - Theories of chemical bonding: Valence bond theory - various types of hybridization and shapes of simple inorganic and organic molecules/ ions - sp^2 , sp^3d , sp^3d^2 , d^2sp^3 and sp^3d^3 ; VSEPR theory – applications to NH_3 , H_3O^+ , SF_4 , ClF_3 , ICl_2^- , H_2O , $SnCl_2$, XeF_2 , XeF_4 , IF_5 ; MO theory - homonuclear and heteronuclear diatomic molecules; – dipole moment - electronegativity - Fajan's rules – Resonance - Delocalized bonding - 1, 3 butadiene and benzene; Electronic displacements: inductive, resonance and hyper conjugative effects. Bonding in metals; Intermolecular forces: Molecular crystals, hydrogen bond; van der Waals forces, Debye, Keesom & London forces.

ANALYTICAL CHEMISTRY

- › Solvents: Non aqueous solvents
- › Solubility of substances: activity, activity coefficients, ionic strength of electrolytes, electrolytic dissociation - acids & bases.
- › Aqueous equilibria: Weak electrolytes -
- › Oswald's law, common ion effect - Neutralization reactions - Sparingly soluble salts - solubility product. Complex ions. Salt hydrolysis & Buffers.
- › Quantitative analysis: Titrimetry - Basic principle, types of reactions - Theoretical principles involved in titrimetric analysis using neutralization and redox reactions - Potentiometric titration curves; Theory of pH indicators; Theory of redox indicators.

INORGANIC CHEMISTRY

- › Group I: General characteristics - Alkali metals in liquid ammonia - alkali metal complexes, crown ethers and cryptands;
- › Group II A: General characteristics - Diagonal relationships - complexes of Be & Ca;
- › Noble gases: Uses, general characteristics - Fluorides of Xenon - Clathrates;
- › Group III A: General properties - Oxidation states and types of bonds - oxygen compounds of boron - Diborane and Boron - Nitrogen compounds;
- › Group IV A: Physical properties, inert pair effect, multiple bonding, graphite compounds Carbides. Classification of silicates: Silicones - preparation and application - hydrides of silicon Carbon allotropes;
- › Group V A: Electronic structure and oxidation states - Oxoacids of nitrogen - Oxoacids of phosphorous;
- › Group VI A: Electronic structure and oxidation states - oxoacids of sulphur;
- › Group VII A: Electronic structure, oxidation states and general characteristics - Oxoacids of halogens - Interhalogen compounds, Polyhalogen compounds - pseudo halogens and pseudo halides.
- › Chemistry of transition elements: General characteristics - periodic trends; Magnetic properties; Metallic nature - oxidation states, catalytic properties, complexes.
- › Coordination chemistry: Werner's theory - Nomenclature of coordination compounds - Isomerism – EAN (effective atomic number) rule - Crystal field theory - Applications of crystal field theory.
- › Periodicity: Basic trends - First and second row anomalies.
- › Nuclear chemistry: Composition of the nucleus - radioactive decay modes - law of radioactivity, natural and artificial disintegration series - Nuclear reactions, Applications of radioisotopes as tracers; Counting statistics - Counting techniques.

ORGANIC CHEMISTRY

- › Aliphatic hydrocarbons: Nomenclature; chain and conformational isomerism; General methods of preparations, reactions of alkanes/alkenes/alkynes; Geometric isomerism in alkenes - sequence rules.
- › Cycloalkanes: Nomenclature - General methods of preparation - Geometrical Isomerism - conformational analysis.
- › Aromatic Hydrocarbons: Chemical criteria for aromaticity - Aromatic sextet – Substitution reactions of Aromatic compounds - Substituent effects - Reactions of Polycyclic benzenoid aromatic hydrocarbons: Naphthalene, Anthracene & Phenanthrene;
- › Stereochemistry: Absolute configuration

- assignment of R&S - Optical activity - concept of dissymmetry (chirality) - optical isomers of tartaric acid.
- › Halogen derivatives: Methods of preparation and reactions of alkyl and aryl halides. SN_2 , SN_1 reactions, rearrangements - E1 & E2 reactions.
- › Organometallic compounds: Organomagnesium compounds - Grignard reagents.
- › Alcohols: Nomenclature, physical properties - preparation, and reactions.
- › Phenols: Acidity and structure - Synthesis and Reactions.
- › Ethers: Nomenclature, synthesis and reactions.
- › Carbonyl compounds: Nomenclature - preparation of aldehydes and ketones. General mechanism of nucleophilic addition reactions.
- › Carboxylic acids and their derivatives: General methods of preparation - Mechanism of ester hydrolysis (acid catalyzed and base catalyzed AAC2, BAC2) - Reactions of Carboxylic acids. Dicarboxylic acids: Hydroxy acids (lactic acid and salicylic acid).
- › Reactive methylene compounds: Diethylmalonate and ethylacetoacetate.
- › Organic compounds of nitrogen, Amines: Effect of structure on basicity, preparation and reactions of amines - synthetic applications of azo compounds.

PHYSICAL CHEMISTRY

- › Chemical kinetics: The rate of reactions - rate laws - rate constants - reaction order - Methods of determining reaction orders and rate laws - Radioactive decay - Half life.
- › Complex reactions: Parallel, consecutive and reversible reactions.
- › Theory of chemical kinetics: Arrhenius equation - Collision theory, Transition state theory. Surface Chemistry: Adsorption, physisorption & chemisorptions - adsorption isotherms. Catalysis - heterogeneous catalysis.
- › Chemical thermodynamics: Thermodynamics of closed systems - 1st law of thermodynamics. Heat and enthalpy: Relation between ΔH and ΔU - Kirchoff's law - Joule-Thomson effect. Work of adiabatic expansion: adiabatic - reversible expansion of a perfect gas - Applications of 1st law concepts: Joule-Thomson expansion - characteristics. 2nd law of thermodynamics: Carnot cycle - Clausius inequality - Spontaneous, nonspontaneous changes - Combined equations of I & II laws of thermodynamics - Maxwell relations - Helmholtz and Gibbs energy - Phase transition processes. 3rd law of thermodynamics: Nernst theorem

- Internal pressure - Gibbs - Helmholtz Equation.

- › Electrochemistry- Electrochemical cells: Galvanic and electrolytic cells. Electrode types. Chemical cells: Liquid junction potential-Nernst equation - Application of standard reduction potentials - electrochemical series - potentiometric titrations - Fuel cells.
- › Ionics: Electric properties of ionic solutions, Equivalent conductance - molar conductivity. Strong electrolytes - Kohlrausch's law - applications.
- › Weak electrolytes: Ostwald's dilution law- hydrodynamics, conductivity of H⁺ and OH⁻ ions. Phase rule and phase diagram: Basic concepts - Derivation of Gibbs phase rule - phase diagram of one component system - H₂O and sulphur.

BIOCHEMISTRY

- › Carbohydrates: Introduction, classification, nomenclature, monosaccharides-structure and reactions, disaccharides, oligosaccharides, polysaccharides ; Aminoacids and Proteins.

SPECTROSCOPY

- › UV-Vis spectroscopy: Theory-instrumentation – Woodward-Fieser rules for calculation of λ_{max} of dienes, Fieser-Kuhn rules for determining λ_{max} and λ_{max} of polyenes;
- › Infrared spectroscopy: Theory-instrumentation - Sampling techniques; Analysis of IR spectral data- identification of functional groups.

INDUSTRIAL CHEMISTRY:

- › Surface coatings: Paints and varnishes - Pigments: classification and applications.
- › Petroleum Refining: Occurrence - composition - processing - applications; Fuels from petroleum - raw materials (chemicals) from petroleum for industrial applications.
- › Polymers: Importance of polymers - basic concepts - Types of polymers - Structure and properties. Polymer processing, classification based on methods of preparation.
- › Dyes: Definition - classification based on method of application, color and structure - Classification based on chemical constitution - Methods of application.
- › Fertilizers: Classification - organic fertilizers, inorganic/commercial fertilizers.

M.SC. IN BIOSCIENCES

QUESTION PAPER FORMAT

The question paper is of two hours in duration / 75 marks.

Section A: Objective type – 25 questions (25 marks)

Section B: Short answer type. 6 out of 8 questions- Global choice (6x5=30 marks)

Section C: Essay type – long answer type- One out of two questions (20 marks)

BOTANY

› Cryptogams and Phanerogams:

Important features (habit, morphology and reproduction); General classification of Virus, Bacteria, Algae and Fungi; Common Viral, fungal and Bacterial diseases in Plants, Animals and Man; Economic importance of Bacteria, Algae and Fungi and their applications; Evolutionary trends among Bryophytes, Pteridophytes and Gymnosperms; Binomial nomenclature and modern trend in taxonomy; Economic importance of Brassicaceae, Melliaceae, Leguminaceae, Solanaceae and Poaceae.

› Plant Anatomy:

Types of meristematic and other tissue systems in Plants; Anatomy of root, stem and leaf in Dicots; Micro and Macro Sporogenesis; Endosperm: Formation and Types; Polyembryony: Embryogenesis in Morocots and Dicots: Types and examples.

Plant Physiology:

- › Osmosis - Principle, Mechanism and factors affecting osmosis; Active Transport - Principle and mechanism; Physiology of Photosynthesis - Introduction, PSI & PSII systems, Mechanism of Photosynthesis - Light and Dark reaction; Respiration - Kinds of respiration, aerobic and anaerobic respiration, mechanism of aerobic respiration: Glycolysis, Krebs cycle; Transpiration: Kinds of transpiration, guttation and exudation; Translocation: Mechanism of ascent of sap, path of translocation, structure of xylem and phloem; Flowering Photoperiodism, classification of plants according to flowering, vernalization; Growth: growth regulators/hormones; Dormancy: Kinds, factors causing dormancy, mechanism; Mineral nutrition in plants: essential and non-essential elements, major and minor elements and their role.

ZOOLOGY

- › Non-Chordates & Chordates: Classification of Non-Chordates,

Prochordates and non-Chordates; Locomotion and reproduction in Protozoa, Protozoan and Helminthes Parasites of Man; Comparative anatomy of Chordates, flight adaptations and migration in Birds; Poisonous and Non-Poisonous snakes of India; Dentition in Mammals; Apiculture, Sericulture, Pearl, Prawn and Fish culture techniques.

› Animal Histology & Physiology:

Epithelial, Connective, Muscular and Nervous tissues; Physiology of Digestion, Osmoregulation, Respiration, Circulation, Excretion and Reproduction in mammals, Muscle contraction Impulse conduction; Blood composition, Blood groups, Endocrine glands and Hormonal action; Thermoregulation in Animals.

CELL BIOLOGY, GENETICS & EVOLUTION

- › Structure of cell -- Cell organelles, Types of Chromosomes Mitosis and Meiosis, Gametogenesis, mechanism of fertilization, cleavage patterns, Gastrulation; Placentation and Menstruation in Mammals, Extra foeta membranes; Mendel's laws of inheritance, Multiple alleles, linkage - Sutton's and Morgan's views, kinds of linkage; Crossing over -- somatic and germinal crossing over, mechanism of meiotic crossing over; Sex determination -- Sex chromosome mechanisms, types of sex chromosomal mechanism of sex determination; Mutation -- kinds of mutation, classification of mutation based on various types; Operon concept -- basic concept and types; Eugenics - basics, pedigree analysis, positive and negative eugenics; Genetic code -- basics of cryptoanalysis, methods of cryptoanalysis of genetic code; Principles of plant and animal breeding; Evidences of evolution -- Darwin's and Lamarkian Theories; Darwin's and Lamarkian theories of evolution origin and evolution of man, isolation and speculation.

ENVIRONMENTAL BIOLOGY

- › Biotic and Abiotic factors of environment; Biogeochemical cycles -- types, general process, climax concept; examples of succession; trends of succession; Ecological Succession -- types, general process, climax, concept, examples of succession, trends of succession; Ecosystem, Population ecology; Arboreal, Volany1, Deepsea, Xerophytic, Hydrophilic and epiphytic adaptations; Environmental pollutions -- origin, types, kinds and sources, remedial measures;

MICROBIOLOGY

- › Classification and characteristics of microorganisms, Physiology and

Cultivation of microbes. Microbes in water, soil, air food and sewage; Air, Water, Soil, food and Vector borne diseases prophylactic measures Antigen, Antibody reactions and Principles of immunization.

BIOCHEMISTRY & BIOTECHNOLOGY

- › Classification of enzymes, coenzymes and vitamins, structure and function of carbohydrates, proteins and lipids and their energy metabolism.
- › Plant and Animal tissue culture techniques, Micro-Propagation, Monoclonal Antibodies, Protoplast culture, DNA sequencing, Recombinant DNA, Applied aspects of Biotechnology in Agriculture, Animal Husbandry, Medicine, disease, diagnosis and Therapy.

M.SC. IN FOOD & NUTRITIONAL SCIENCES

QUESTION PAPER FORMAT

The two-part question paper is of two hours in duration / 75 marks.

Part I (30 min): Subject based test for all the streams Objective type (25x1=25 Marks) Twenty-five out of thirty questions with global choice

Part II (90 min): Subject based test for all the streams Descriptive type (10x5 = 50 Marks). Ten out of fifteen questions with global choice.

The question paper will contain questions on the following topics carrying equal marks. There will be balanced distribution of questions from each of the topics listed below to enable the students from various streams get an opportunity to score in the test.

Food Science and Nutrition

- › Food as a source of nutrients, composition, properties, characteristics, and nutritive value of different foods (cereal grains, millets, pulses, nuts and oil seeds, fruits and vegetables, milk and milk products, meat, egg, poultry, fish, spices and condiments).
- › Energy requirement: Basal metabolism, Energy requirement for different age groups.
- › Study of Nutrients: (a) Carbohydrates, proteins and fats – chemistry and nutritional aspects such as digestion, absorption, metabolism, functions, sources, deficiency and requirements (b) Vitamins and minerals - functions, sources, requirements, and deficiencies (c) Water balance.

Dietetics and Public Health Nutrition

- › Principles involved in adoption of normal diet for formulating therapeutic diet - use of food exchange groups.
- › Diet during pregnancy, lactation, infancy, school age, adolescent, adulthood and old age.
- › Nutritional deficiency diseases.
- › Dietary management in diseases (metabolic disorders, febrile conditions, surgical & other stress conditions) - causes, symptoms, physiological changes and diet.
- › National and international agencies and intervention programmes in the betterment of nutritional status.
- › Methods of assessing the nutritional status.

Microbiology, Food safety and Quality control

- › Historical development and scope of microbiology; General characteristics, morphology, growth and reproduction of bacteria, fungi and algae. Pure culture techniques; Stains and staining techniques.
- › Causes of food spoilage; Principles of food safety and preservation; Methods of food preservation.
- › Food contamination and adulteration: Types and detection methods of adulterants.
- › Food safety evaluation and quality control assurance systems.
- › Food laws and standards; Subjective and objective methods of evaluating food acceptability.

Biochemistry and Physiology

- › Chemistry and metabolism of carbohydrates, lipids, proteins and nucleic acids.
- › Enzymes, coenzymes and cofactors; Hormones.
- › Structure and functions of the following - Cell, Skeletal system, Blood and Circulatory system, Gastro-intestinal system, Excretory system, Respiratory system, Endocrine system, Reproductive system, Immune system and Sense organs.

Chemistry and Physics

- › Chemistry: The gas laws, properties of gases, electrolytes, thermo-chemistry, chemical equilibrium, chemical kinetics, concept of pH and buffer, molecular orbital theory, chemical bonds and the forces involved therein; periodic table; Aliphatic and aromatic hydrocarbons. Organic substitution reactions, electrophilic and nucleophilic reactions; Isomerism; structural and optical isomers. Solubility and concentration (molar, normal and molal) of solutions.

- › Food Chemistry: Water activity in foods; Carbohydrates: Mono, di-saccharides (reducing and non-reducing sugars) and polysaccharides (starch, cellulose, pectins) - sources and properties; Proteins: Primary, secondary and tertiary structure of proteins- Protein denaturation, peptide bonds, amino acids; Fats and oils: Properties and modification of fats; Colloids and emulsions; Plant acids and pigments.
- › Physics: Elements of mechanics, colligative properties, Laws of Thermodynamics: Mode of heat transfer; Electrostatics, magnetism and electrodynamics; Outlines in optics and sound; Electro-magnetic radiation; Radioactivity and elements in quantum physics; Physico – chemical properties: Vapour pressure, boiling point, freezing point, viscosity, interfacial and surface tension and specific gravity.

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