J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD

NAAC 'A' Grade Accredited State Govt. University

SCHEME
AND SYLLABUS
FOR
ENTRANCE
EXAM-2021

YMCA MOB GOLDEN JUBILEE GATE
J.C. BOSE UNIVERSITY OF SCIENCE & TECHNOLOGY, YMCA, FARIDABAD

SCHEME AND SYLLABUS FOR ENTRANCE EXAM-2021

MCA

The details and pattern of question paper for entrance test is as mentioned below.

A. SCHEME OF ENTRANCE TEST:

I   Maximum marks : 90

ii   There will be one Question Paper of 90 minutes duration in three parts as under :

Part	Subject	Nos. of Questions	Marks Distribution
Part-I	Mathematical Ability	50 Questions (1-50)	50 Marks
Part-II	Logical and Analytical Ability	20 Questions (51-70)	20 Marks
Part-III	English / Comprehension	20 Questions (71-90)	20 Marks

iii   Only objective type / multiple-choice questions with one correct answer will be asked in the Entrance Test.

iv.   There will "NOT be any Negative marking.

B. SYLLABUS

10+2 Level Mathematics and English / Comprehension. Besides, questions will be asked to test Logical & Analytical Ability

SCHEME AND SYLLABUS FOR ENTRANCE EXAM-2021

MBA

The details and pattern of question paper for entrance test is as mentioned below:

1. Maximum marks: 100
2. The test shall comprise of multiple choice questions
3. The duration of the test shall be one and half hour (90 minutes)
4. There shall be no negative marking

Program	Syllabus / Course content
MBA	The syllabus and pattern of entrance test for admission to MBA entrance test shall be similar to other national level management admission tests such as MAT, CMAT etc. There shall be four sections (parts) of 25 marks each. The test shall include the questions from the following broad areas • Quantitative Techniques and Data Interpretation - 25 marks • Logical Reasoning - 25 marks • General English - 25 marks • General Awareness - 25 marks

SCHEME AND SYLLABUS FOR ENTRANCE EXAM-2021

M.Sc. in
Physics, Mathematics, Chemistry and Environmental Sciences

The details and pattern of question paper for entrance test is as mentioned below.

	Name of the program	Pattern
1.	M.Sc. Physics	The eligible applicants will have to appear in the Online M.Sc. Entrance Test. This test will be of **90 minutes duration having 70 questions of one mark each**. 20 questions will be from **Part-A (General)** and 50 questions will be from **Part –B (Subject specific)** with **no negative marking.**
2.	M.Sc. Mathematics	
3.	M.Sc. Chemistry	
4.	M.Sc. Environmental Sciences	

SYLLABUS FOR ENTRANCE TEST

Part-A

General knowledge and Analytical Skills questions common for all M.Sc. Courses (20 Questions of one mark each)

Questions to test analytical, reasoning capability and English of candidates.

Part - B

Syllabus for M.Sc Physics Entrance Test (50 Questions of one mark each)

1. **Mechanics and Waves**

   Newton's laws of motion and applications, variable mass systems, projectiles. Rotational dynamics-kinetic energy, angular momentum, theorems of moment of inertia. Conservative forces, frictional forces. Gravitational potential and intensity due to spherical objects. Central forces, Kepler's problem, escape velocity and artificial satellites. Streamline motion, viscosity, Applications of Bernoulli's equation and Stokes' law. Simple harmonic motion, Lissajous figures. Damped oscillation, forced oscillation and resonance. Beats, Phase and group velocities. Longitudinal waves in solids. Doppler effect. Ultrasonic and their applications.

2. **Geometrical and Physical Optics**

   Laws of reflection and refraction from Fermat's principle. Matrix method in paraxial optics- thin lens formula, nodal planes, system of two thin lenses. Chromatic and spherical aberrations. Huygens' principle-reflection and refraction of waves. Interference of light-Young's experiment, Newton's rings, interference by thin films, Michelson interferometer. Fraunhoffer diffraction-single slit, double slit, diffraction grating, resolving power. Production and detection of linearly, circularly and elliptically polarised light. Double refraction, quarter-waves plates and half-wave plates. Optical activity and applications. Elements of fibre optics-attenuation, pulse dispersion in step index and parabolic index fibres; material dispersion. Lasers, characteristics of laser light-spatial and temporal coherence.

3. **Heat and Thermodynamics**

   Thermal equilibrium and temperature, Thezeroth law of thermodynamics, Heat and first law of thermodynamics. Efficiency of Carnot engines, Entropy and the second law of thermodynamics. Kinetic theory and the equation of state of an ideal gas, Mean free path, distribution of molecular speeds and energies. Transport phenomena. Andrew's experiments-van der Waals equation and applications, Joule-Kelvin effect and applications. Brownian motion. Thermodynamic potentials-Maxwell relations. Phase transitions. Kirchhoff's laws. Black-body radiation-Stefan-Boltzmann law, spectral radiancy, Wien displacement law, application to the cosmic microwave background radiation, Planck's radiation law.

4. **Electricity and Magnetism**

   Electric charge, Coulomb's law, Electric field, Gauss' law. Electric potential, Van de Graff accelerator. Capacitors, dielectrics and polarization. Ohm's law, Kirchhoff's first and second rules, resistors in series and parallel, applications to two-loop circuits. Magnetic field-Gauss's law for magnetism, Atomic and nuclear magnetism, magnetic susceptibility, classification of magnetic materials. Circulating charges, cyclotronand synchrotron. Hall Effect. Biot-Savart law, Ampere's law, Faraday's law of induction, Lenz's law, Inductance. Alternating current circuits-RC, LR, single-loop LRC circuits, impedance, resonance, power in AC circuits. Displacement current, Maxwell's equations.

5. **Atomic, Quantum and Nuclear Physics**
Photoelectric effect, Einstein's photon theory. Bohr's theory of hydrogen atom. Stern-Gerlach experiment, quantisation of angular momentum, electron spin. Pauli Exclusion Principle and applications. Zeeman Effect. X-ray spectrum. Compton Effect, Compton wavelength. Wave nature of matter, de Broglie wavelength, wave-particle duality. Heisenberg's uncertainty relationships. Schrodinger's equation-Eigen values and Eigen functions of (i) particle in a box, (ii) simple harmonic oscillator and (iii) hydrogen atom. Natural and artificial radioactivity. Binding energy of nuclei, nuclear fission and fusion. Classification of elementary particles.

6. **Solid State Physics**
Crystal structure, X-ray diffraction, Bragg's law, Bonding, covalent, ionic, metallic, Van der Walls bonding, Magnetism, Dia, Para and Ferromagnetism, Hysteresis. Thermal properties, lattice vibrations, Debye model. Band structure, energy band, energy gap, metals, insulators and semiconductors.

7. **Electronics**
Diodes in half-waves and full-wave rectification, qualitative ideas of semiconductors, p type and n type semiconductors, junction diode, Zener diode, transistors, Field Effect transistor. Binary numbers, Logic gates and truth table.   Two junction devices p-n-p and n-p-n transistors Amplifiers-only bipolar junction transistor, CB, CE and CC configurations. Single stage CE amplifiers Class B push-pull amplifier. Feed back in amplifiers. Operational Amplifiers.

8. **Mathematical Physics**
Addition, subtraction and product of two vectors. Polar and axial vectors. Triple and quadruple product. Scalar and vector fields, differentiation of a vector w. r. t. a scalar. Unit tangent vector and unit normal vector. Directional derivatives, gradient, divergence, curl and Laplacian operations. Line, surface and volume integrals. Gauss's, Stokes and Green's theorems. Orthogonal curvilinear coordinates. Derivation of gradient, divergence, Curl and Laplacian in Cartesian, spherical and cylindrical coordinate systems. Change of variables and Jacobian transformations. Evaluation of line, surface and volume integrals. Calculus of Variations. Constrained maxima and minima. Method of Lagrange undetermined multipliers. Euler-Lagrange Equation

9. **Theory of Relativity**
Michelson-Morley experiment and its outcome. Postulates of special theory of relativity. Lorentz transformations. Simultaneity and order of events. Lorentz contraction and time dilation. Relativistic transformation of velocity. Velocity dependence of mass and equivalence of mass and energy. Relativistic Doppler Effect. Relativistic kinematics. Transformation of energy and momentum.

Part –B
Syllabus for M.Sc. Mathematics Entrance Test (50 Questions of one mark each)

1. **Algebra**

   Rank of matrices. Inverse of a matrix. Linear dependence and independence of rows and columns of matrices. Eigen values and Eigen vectors and characteristics of equation. Minimal polynomial of a matrix. Cayley Hamilton theorem and its use in finding the inverse of a matrix. Nature of the roots of an equation Descartes' rule of signs. Solutions of cubic equations (Cardon's method). Biquadratic equations and their solutions. Relations between the roots and coefficients of general polynomial equation in one variable. Solutions of polynomial equations having conditions on roots. Common roots and multiple roots. Transformation of equations.

2. **Calculus**

   ε -δ definition of the limit of a function. Basic properties of limits, Continuous functions and classification of discontinuities. Differentiability, Successive differentiation. Leibnitz theorem. Maclaurin and Taylor series expansions. Limit continuity and Differentiability of real valued functions of two variables. Partial differentiation. Total Differentials. Composite functions & implicit functions. Change of variables. Homogenous functions & Euler's theorem on homogeneous functions. Taylor's theorem for functions of two variables. Schwarz and Young's theorem. Implicit function theorem. Maxima, Minima and saddle points of two variables. Lagrange's method of multipliers.

3. **Trigonometry**

   De Moivre's Theorem and its Applications. Expansion of trignometrical functions. Direct circular and hyperbolic functions and their properties. Inverse circular and hyperbolic functions and their properties. Logarithm of a complex quantity. Gregory's series. Summation of Trigonometry series.

4. **Real Analysis**

   Sequence & Series, Boundedness of the set of real numbers; least upper bound, greatest lower bound of a set, neighbourhoods, interior points, isolated points, limit points, open sets, closed set, interior of a set, closure of a set in real numbers and their properties. Bolzano-Weiestrass theorem, Open covers, Compact sets and Heine-Borel Theorem., Riemann integral, Integrabililty of continuous and monotonic functions, The Fundamental theorem of integral calculus. Mean value theorems of integral calculus. Improper integrals and their convergence, Comparison tests, Abel's and Dirichlet's tests, Frullani's integral, Integral as a function of a parameter. Continuity, Differentiability and integrability of an integral of a function of a parameter. Definition and examples of metric spaces, neighbourhoods, limit points, interior points, open and closed sets, closure and interior, boundary points, subspace of a metric space, equivalent metrics, Cauchy sequences, completeness, Cantor's intersection theorem, Baire's category theorem, Contraction Principle.

5. **Groups and Rings**

   Groups, Subgroups and Quotient groups with example and their properties , Normal subgroups, Homoomorphisms, isomophisms, automorphisms and inner automorphisms of a group. Automorphisms of cyclic groups, Permutations groups. Even and odd permutations. Alternating groups, Cayley's theorem, Center of a group and derived group of a group. Introduction to rings, subrings, integral domains and fields, Characteristics of a ring. Ring homomorphisms, ideals (principle, prime and Maximal) and Quotient rings, Field of quotients of an integral domain.

6. **Complex Analysis**

Extended Complex Plane, Stereographic projection of complex numbers, continuity and differentiability of complex functions, Analytic functions, Cauchy-Riemann equations. Harmonic functions. Mappings by elementary functions: Translation, rotation, Magnification and Inversion. Conformal Mappings. Mobius transformations. Fixed pints, Cross ratio, Inverse Points and critical mappings.

7. **Linear Algebra**

Vector spaces, subspaces, and their properties Quotient space., Linear transformations and linear forms on vector spaces, Vector space of all the linear transformations Dual Spaces, Bidual spaces, annihilator of subspaces of finite dimensional vector spaces, Null Space, Range space of a linear transformation, Rank and Nullity Theorem, Algebra of Linear Transformation, Minimal Polynomial of a linear transformation, Singular and non-singular linear transformations, Matrix of a linear Transformation, Change of basis, Eigen values and Eigen vectors of linear transformations.

8. **Solid Geometry Sphere**

Plane section of a sphere. Sphere through a given circle. Intersection of two spheres, radical plane of two spheres. Co-axial system of spheres Cones.: Right circular cone, enveloping cone and reciprocal cone. Cylinder: Right circular cylinder and enveloping cylinder. Paraboloids: Circular section, Plane sections of conicoids. Generating lines. Confocal conicoid. Reduction of second degree equations.

9. **Ordinary and Partial Differential Equations**

Ordinary simultaneous differential equations. Solution of simultaneous differential equations involving operators $x \, (d/dx)$ or $t \, (d/dt)$ etc. Simultaneous equation of the form $dx/P = dy/Q = dz/R$. Total differential equations. Condition for $Pdx + Qdy + Rdz = 0$ to be exact. General method of solving $Pdx + Qdy + Rdz = 0$ by taking one variable constant. Method of auxiliary equations. Linear differential equations of second order: Reduction to normal form. Transformation of the equation by changing the dependent variable/ the independent variable. Solution by operators of non-homogeneous linear differential equations. Reduction of order of a differential equation. Method of variations of parameters. Method of undetermined coefficients. Partial differential equations: Formation, order and degree, Linear and Non-Linear Partial differential equations of the first order: Complete solution, Singular solution, General solution, Solution of Lagrange's linear equations, Charpit's general method of solution. Compatible systems of first order equations, Jacobi's method. Classification of linear partial differential equations of second order. Method of separation of variables: Solution of Laplace's equation, Wave equation, Diffusion (Heat) equation.

10. **Vector Calculus**

Scalar and vector product of three vectors, product of four vectors. Reciprocal vectors. Vector differentiation Scalar Valued point functions, vector valued point functions, derivative along a curve, directional derivatives. Vector integration; Line integral, Surface integral, Volume integral Theorems of Gauss, Green & Stokes and problems based on these theorems.

11. **Fourier Transform and Laplace Transforms**

Fourier transforms: Linearity property, Shifting, Modulation, Convolution Theorem, Fourier Transform of Derivatives, Relations between Fourier transform and Laplace transform, Parseval's identity for Fourier transforms, solution of differential Equations using Fourier Transforms. Existence theorem for Laplace transforms, Linearity of the Laplace transforms, Shifting theorems, Laplace transforms of derivatives and integrals, Differentiation and integration of Laplace transforms, Convolution theorem, Inverse Laplace transforms, convolution theorem, Inverse Laplace transforms of derivatives and integrals, solution of ordinary differential equations using Laplace transform.

12. **Numerical Analysis**

Finite Differences operators and their relations. Interpolation with equal intervals and unequal intervals: Newton's divided difference, Lagrange's Interpolation formulae, Hermite Formula. Central Differences: Gauss forward and Gauss's backward interpolation formulae, Sterling, Bessel Formula. Numerical Integration: Newton-Cote's Quadrature formula, Chebychev formula, Gauss Quadrature formula. Numerical solution of ordinary differential equation of Runge-Kutta Methods. Multiple step methods; Predictor-corrector method, Modified Euler's method, Milne-Simpson's method. Solution of Algebraic and Transcendental equations: Bisection method, Regula-Falsi method, Secant method, Newton- Raphson's method. Newton's iterative method for finding pth root of a number, Order of convergence of above methods. Simultaneous linear algebraic equations: Gauss-elimination method, Gauss-Jordan method, Triangularization method (LU decomposition method). Crout's method, Cholesky Decomposition method. Iterative method, Jacobi's method, Gauss-Seidal's method, Relaxation method.

13. **Dynamics & Statics**

Composition and resolution of forces. Parallel forces. Moments and Couples. Analytical conditions of equilibrium of coplanar forces. Friction. Centre of Gravity. Velocity and acceleration along radial, transverse, tangential and normal directions. Relative velocity and acceleration. Simple harmonic motion. Elastic strings. Mass, Momentum and Force. Newton's laws of motion. Work, Power and Energy. Definitions of Conservative forces and Impulsive forces. Motion on smooth and rough plane curves. Projectile motion of a particle in a plane. Vector angular velocity. General motion of a rigid body. Central Orbits, Kepler laws of motion. Motion of a particle in three dimensions. Acceleration in terms of different co-ordinate system.

Part - B
Syllabus for M.Sc. Chemistry Entrance Test (50 Questions of one mark each)

Entrance examination will consist of questions based on Chemistry up to graduation level, covering following topics

1. **Inorganic Chemistry**
   - ❖ Atomic Structure
   - ❖ Periodic Table and Periodic Properties
   - ❖ Metallic Bond and Semiconductors
   - ❖ Chemistry of s, p, d and f block Elements
   - ❖ Chemistry of Coordination Compounds
   - ❖ Non-aqueous Solvents
   - ❖ Theory of Qualitative and Quantitative Inorganic Analysis
   - ❖ Metal-ligand Bonding in Transition Metal Complexes: CFT
   - ❖ Thermodynamic and Kinetic Aspects of Metal Complexes
   - ❖ Magnetic Properties of Transition Metal Complexes
   - ❖ Electron Spectra of Transition Metal Complexes
   - ❖ Organometallic Chemistry
   - ❖ Acid-Base concepts
   - ❖ Bioinorganic Chemistry

2. **Physical Chemistry**
   - ❖ Theory of Gases and related Critical Phenomenon
   - ❖ Theory of Liquid States
   - ❖ Solid State
   - ❖ Chemical Kinetics
   - ❖ Electrochemistry
   - ❖ Thermodynamics
   - ❖ Chemical Equilibrium
   - ❖ Distribution Law
   - ❖ Quantum Mechanics
   - ❖ Physical Properties and Molecular Structure: Optical properties, dipole moment and magnetic properties
   - ❖ Spectroscopy: Introduction, Rotational Spectrum, Vibrational spectrum, Raman Spectrum &Electronic Spectrum
   - ❖ Photochemistry
   - ❖ Solutions: Dilute Solutions and Colligative Properties
   - ❖ Phase Equilibrium

3. **Organic Chemistry**
   - ❖ Structure and Bonding:
     Localized and delocalized chemical bond, van der Waals interactions, resonance, hyperconjugation, inductive effect, Electromeric effect & their comparison.
   - ❖ Stereochemistry of Organic Compounds
     Mechanism of Organic Reactions: Homolytic and Heterolytic bond breaking, types of reagents electrophiles and nucleophiles, types of organic reactions, energy considerations, reactive intermediates

- ❖ Structure, classification, properties, Reaction Mechanism and Synthetic Applications : Alkanes and Cycloalkanes Alkenes, Arenes and Aromaticity, Dienes, Alkynes, Alkyl and Aryl Halides, Alcohols, Phenols, Aldehydes and Ketones, Carboxylic Acids & Acid Derivatives, Epoxides, Amines, Diazonium Salts, Nitro Compounds
- ❖ Specroscopic techniques: Ultraviolet (UV) absorption spectroscopy, Infrared (IR) absorption spectroscopy, NMR Spectroscopy
- ❖ Chemistry of Natural Products: Carbohydrates, Amino Acids, Peptides & Proteins
- ❖ Heterocyclic Compounds
- ❖ Organosulphur Compounds
- ❖ Polymers

Part - B
Syllabus for M.Sc. (Environmental Sciences) Entrance Test
(50 Questions of one mark each)

1. **LIFE SCIENCES:**   **(25 Questions)**
   (For Biological Background Students)

Plant and Animal kingdom-classification, characteristics of various groups, morphology, anatomy, adaptations. Cell biology, Structure and functions of biomolecules, Genetics.

Physiology and biochemical processes - Photosynthesis, respiration, nitrogen metabolism, protein synthesis, growth hormones, enzymes.

Structural and functional aspects of digestive, respiratory, circulatory, muscular, excretory, reproductive, endocrine and nervous system of animals. Economic botany and plant diseases.

Biofuel, Agriculture, Agroforestry. Environmental Biotechnology.

OR

PHYSICAL SCIENCES (PHYSICS AND MATHEMATICS): (25 Questions)
(For Non- biological Background students)

Fundamental forces in Nature, Nature of Physical laws, Motion, Heat and Thermodynamics, Sound, Radiations.

Sets and their Representations, Trignometric Functions, Bionomial Theorem, Sequence and Series, Integrals, Differential Equations.

2. **CHEMISTRY :**   **(15Questions)**
   Matter in our surroundings, Atoms and Molecules, Metals and Non-metals, Carbon and its compounds, Classification of elements and periodicity, States of Matter.
   Acids, Bases and Salts; Biomolecules and Polymers; Chemicals in Food; Cleansing Agents.

3. **GENERAL ENVIRONMENT:**   **(10 Questions)**
   Components of Environment, Concept of biomes and biosphere, Natural resources- water, soil, food, energy, forests, minerals; Biodiversity and its conservation, Ecosystem: Structure and Functions, Water pollution, Air Pollution, Soil Pollution, greenhouse effect and global warming, acid rain, ozone layer depletion, social issues related to environment.

SCHEME AND SYLLABUS FOR ENTRANCE EXAM-2021

M.Sc. in
Botany, Zoology, Microbiology & Biotechnology

The details and pattern of question paper for entrance test is as mentioned below.

Name of the program	Pattern
M.Sc. in Botany, Zoology, Microbiology & Biotechnology	The eligible applicants will have to appear in the Online M.Sc. Entrance Test. This test will be of **90 minutes duration having 70 questions of one mark each**. 20 questions will be from **Part-A (General)** and 50 questions will be from **Part –B (Subject specific)** with **no negative marking.**

SYLLABUS FOR ENTRANCE TEST

Part-A

General knowledge and Analytical Skills questions common for all M.Sc. Courses (20 Questions of one mark each)
Questions to test analytical, reasoning capability and English of candidates.

Part - B

Syllabus for M.Sc Botany Entrance Test (50 Questions of one mark each)

1. **Viruses:** Discovery, general structure, replication, DNA virus (T-phage); lytic and lysogenic cycle, RNA virus (TMV); Bacteria: General characteristics and cell structure; reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction); economic importance.

2. **Fungi:** General characteristics, classification (Alexopolous, Mims & Blackwell), cell wall composition, nutrition and reproduction; life cycle of Rhizopus (Zygomycota), Venturia (Ascomycota), Agaricus (Basidiomycota). Fungi, bacteria, MLO'S and RLO'S. Major diseases, disease symptoms and management practices in apple, pear and apricot. Symptoms, causal organism, disease cycle and control of plant diseases: Late blight of Potato, Paddy blast, Alternaria leaf blight of apple, bacterial blight of rice. Symbiotic associations: Lichens and Mycorrhiza - general account and significance

3. **Algae:** General characteristics, classification of Algae (Round 1965), criteria for algal classification; range of thallus organization; morphology, reproduction and life cycle of Nostoc, Chlamydomonas, Oedogonium, Vaucheria, Ectocarpus, Batrachospermum; economic importance of algae. Archegoniate – General characteristics, adaptations to land habit.

4. **Bryophytes -** General characteristics, Proskauer's classification (upto family); morphology, anatomy and reproduction (excluding developmental details) of Marchantia and Funaria; Evolution of sporophyte; apogamy and apospory; alternation of generation; economic importance of bryophytes.

    Pteridophytes - General characteristics; classification of Pteridophytes (Sporne 1965); Early land plants (Rhynia); morphology, anatomy and reproduction (excluding developmental details) of Selaginella, Equisetum and Dryopteris; heterospory and origin of seed habit; evolution of stellar systems in pteridophytes. Gymnosperms - General characteristics, classification – Christenhusz et al. 2011 (upto family); morphology, anatomy and reproduction (excluding developmental details) of Cycas and Pinus; economic importance of gymnosperms.

5. **Introduction to Plant taxonomy; types of classification** - artificial, natural and evolutionary; classification systems - Bentham and Hooker (upto series), Angiosperm Phylogeny Group (AGP) (upto order level). Numerical taxonomy - OTUs, character weighing and coding, cluster analysis; phenograms and cladograms (definitions and differences).

6. **Meristematic and permanent tissues:** Simple and Complex tissue (Types and Functions); Organization of root and shoot apical meristem- Histogen theory; Tunica and corpus theory. Plant organs: Structure of a typical dicot and monocot root, stem and leaf. Secondary growth : Cambium- types, structure and function, Secondary growth in typical dicot root and stem (Helianthus, Sunflower) ; General account of wood structure (Heart wood and Sap wood);

Adaptations: General structure and function of cuticle, epidermis and stomata; General account of adaptations in xerophytes and hydrophytes.

7. **Structural organization of flower:** Development and structure of anther and pollen; Structure and types of ovules; Types of embryo sacs; Structure of a typical embryo sac. Pollination and fertilization: Types of pollination –Floral modifications favoring self and cross pollination; Double fertilization; Seed dispersal mechanism. Embryo and Endosperm: Endosperm development, structure and functions; Structure and development of dicot and monocot embryo (Capsella-bursa pestoris; maize). Apomixis and Embryogeny: Definition, types and practical applications of apomixis and polyembryony.

8. **Plant Water Relations:** Water potential and its components; Transpiration and its significance; Factors affecting transpiration; Ascent of Sap, Pressure flow model; Phloem loading and unloading. Mineral nutrition: Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements; Transport of ions across cell membrane, active and passive transport. Photosynthesis: Photosynthetic Pigments (Chl-a, Chl-b, xanthophylls, carotene); light harvest complexes, Photosystem I and II, Electron transport and mechanism of ATP synthesis; C3, C4 and CAM pathways of carbon fixation; Photorespiration.

9. **Respiration:** Glycolysis, anaerobic respiration, TCA cycle; Pentose Phosphate Pathway, Electron Transport system and Oxidative phosphorylation. Enzymes: Structure, Classification and properties; Mechanism of enzyme action and enzyme inhibition. Nitrogen metabolism: concept of symbiotic and asymbiotic associations, Biological nitrogen fixation; Nitrate and ammonia assimilation. Plant growth regulators: Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA and ethylene. Plant response to light and temperature: Photoperiodism (SDPs, LDPs, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Vernalization.

10. **Mendelian principles of inheritance; modified Mendelian ratios:** 2:1- lethal Genes; 1:2:1- Co- dominance, incomplete dominance; 9:7; 9:4:3; 13:3; 12:3:1 and 15:1. Multiple allelism and pleiotropy.. Linkage: concept; complete & incomplete linkage, Bridges experiment. Crossing over: concept and significance. Numerical and Structural changes in chromosomes.

11. **The cell theory; structure of prokaryotic and eukaryotic cells**; structure and function of biomembranes; fluid mosaic concept, Cell wall-structure and functions. Structure and functions of ribosomes, centrioles, basal bodies, endoplasmic reticulum, golgi bodies, lysosomes, peroxisomes and glyoxisomes, mitochondria, chloroplast and nucleus.

    Euchromatin and heterochromatin; mitosis and meiosis; DNA- structure, types and replication-Watson and Crick's model, Griffith's and Avery's transformation experiments. Types of RNA (mRNA, tRNA, rRNA), Transcription and translation in prokaryotes, genetic code. Gene regulation in Prokaryotes: Lac operon and Tryptophan operon.

12. **Introduction to ecology**; soil - origin, formation and composition, soil profile; water - states of water in the environment, precipitation types; light and temperature as ecological factors; adaptation of hydrophytes and xerophytes, Plant communities - characteristics; ecotone and edge effect; succession - processes and types. Ecosystem: Structure; energy flow; trophic organization; food chains and food webs; ecological pyramids, primary productivity; biogeochemical cycling of carbon, nitrogen and Phosphorous. Phytogeography - biogeographical zones of India, concept of endemism.

13. **Concept of centers of origin, crop domestication**; importance of germplasm diversity Origin, morphology and uses of Wheat and Rice. Introduction, systematic position, morphological features and uses of Crocus sativus and Curcuma domestica, extraction methods of essential oils; systematic position and uses of Brassica and Coconut. Classification of fibres (based on origin). Morphology, extraction & uses of Cotton. Chemical constituents and uses of Saussurea costus and Papaver somniferum.

Part - B

Syllabus for M.Sc Zoology Entrance Test (50 Questions of one mark each)

1. **Animal Diversity-** Classification of Invertebrate phyla up to Class level and characteristics of classes. Vertebrates' classification and characteristics

2. **System Physiology (Animal)**- Cardiovascular system, Endocrine System, Reproductive system, Digestive system, Excretory system, Respiratory system, Muscle contraction. Nervous system.

3. **Developmental Biology-** Potency, commitment, specification, determination and differentiation; Gametogenesis, fertilization and early development. Zygote formation, cleavage, blastula formation, gastrulation and formation of germ layers in animals; embryogenesis, Prevention of poly spermy in sea urchin and mammals. Sex determination inDrosophila, Vulva formation in *C.elegans*

4. **Immunology -** Cells of immune system and organs (primary and secondary lymphoid organs) of the immune system. Haematopoiesis. Antigens, haptens and adjuvants. Antibodies-classes and function. Various types of hypersensitivities, Autoimmunity and immunodeficiency. Vaccines-and types.

5. **Molecular Biology:** Nucleic acid – replication, transcription, RNA processing, translation and their regulatory mechanisms, Genetic code, DNA damage and repair. Different types of RNA. Gene Regulation

6. **Inheritance Biology-** Mendelian inheritance, Gene interaction; Complementation, Linkage, recombination and chromosome mapping, Extra chromosomal inheritance, Microbial genetics – transformation, transduction and conjugation, probability and pedigree analysis. Human genetic disorders.

7. **Recombinant DNA Technology**-Restriction enzymes, restriction modification systems, restriction digestion, Vectors, Polymerase chain reaction–methods and applications. DNA sequencing. application of recombinant DNA technology; genetically modified organisms. DNA libraries. Electrophoresis, Chromatography, Centrifugation, Spectroscopy. Immuno-techniques, blotting techniques etc.

8. **Biochemistry and metabolism-** Carbohydrates; Proteins; Lipids; Nucleic acids; Enzymes; Vitamins; Hormones; Metabolism – Glycolysis, TCA cycle, Oxidative Phosphorylation;

9. **1Cell Biology:** Prokaryotic and eukaryotic cell structure, Cellular organelles; Cell cycle, Cell signaling and its types, cancer Biology.

10. **Evolution-** The evolutionary time scale; Eras, periods and epoch; Major events in the evolutionary time scale. Lamarck; Darwin–concepts of variation, adaptation, struggle, fitness and natural selection. Population genetics, Gene pool, Gene frequency; Hardy-Weinberg Law.

Part - B

Syllabus for M.Sc Microbiology Entrance Test (50 Questions of one mark each)

Unit 1: **Microbial world:** Introduction to microbial world, Systems of classification Binomial Nomenclature, Whittaker's five kingdom and Carl Woese's three kingdom classification system, Difference between prokaryotic and eukaryotic microorganisms, General characteristics of different groups: Acellular microorganisms (Viruses, Viroids, Prions) and Cellular microorganisms (Bacteria, Algae, Fungi and Protozoa) with emphasis on distribution and occurrence, morphology, mode of reproduction and economic importance. General characteristics, phylogenetic overview of archaebacteria. Gram positive and Gram-negative bacteria. General features of Bacteria, Algae, Fungi, protozoa, viruses. Diseases related to humans, animals and plants caused by different microbes.

Unit2: Environmental and Food Microbiology: Carbon cycle, nitrogen cycle, rhizobia legume association, Phosphorus cycle, Sulphur cycle and other elemental cycles: Iron and manganese with reference to microbes, Microbe interactions: Mutualism, synergism, commensalism, competition, amensalism, parasitism, predation, solid and liquid waste management. Food borne diseases and intoxication.

Unit 2: Metabolism: Growth and Nutritional requirements of microbes, Central metabolic pathways, Glycolysis, Gluconeogenesis, TCA and related metabolic pathways for metabolism of carbohydrates, fats, proteins, lipids and amino acids, Vitamins and related disorders.

Unit 4: Biotechniques: Spectrophotometry, Preparative and analytical centrifugation, Principle and applications of native polyacrylamide gel electrophoresis, Brightfield and darkfield microscopy, Fluorescence Microscopy, Phase contrast Microscopy, Electron Microscopy

Unit 5: Biomolecules: Carbohydrates, Proteins**:** Functions of proteins, Primary structures of proteins: Amino acids, the building blocks of proteins. General formula of amino acid and concept of zwitterion, Structure of enzyme: Apoenzyme and cofactors, Tertiary and Quaternary structures of proteins, Lipids, enzymes, detail of DNA and RNA in terms of structure, function, properties.

Unit 6: Immunology: Introduction to basic concepts in immunology, components of immune system, principles of innate and adaptive immune system, Antibodies, Structure, classes and function of antibodies, monoclonal antibodies, Various types of hypersensitivities, Concepts of autoimmunity and immunodeficiency. Vaccines. Concept of MHC.

Unit 7: Plant – Pathogen Interaction: Concepts and physiology of plant diseases, Biochemical basis of plant diseases, Disease forecasting

Unit 8: Molecular biology and Cell biology: Structure of cell and cell organelles, nucleus, cell cycle, cell sorting, cell death, cell signalling**.** concept of prokaryotic DNA, RNA, replication, transcription, translation, post translational modifications, mutations and types, transposable elements.

Part - B

Syllabus for M.Sc Biotechnology Entrance Test (50 Questions of one mark each)

1. **Recombinant DNA Technology**-Restriction enzymes, Restriction sites, restriction modification systems, various enzymes used in recombinant DNA technology, restriction maps and mapping techniques Cloning Vectors, Expression vectors. Nucleic acid probes, Blotting techniques, Polymerase chain reaction–methods and applications. DNA sequencing. application of Recombinant DNA technology, genetically modified organisms, DNA libraries.

   Plant tissue culture and animal tissue culture.

2. **Biochemistry and Metabolism-** Carbohydrates, Proteins, Lipids, Nucleic acids, Enzymes, Vitamins, Metabolism – Glycolysis, TCA cycle, Oxidative Phosphorylation, Photosynthesis.

3. **Cell Biology:** Prokaryotic and eukaryotic cell structure, Cellular organelles and their important function. Cell cycle, Cell signaling and its types, cancer Biology.

4. **Molecular Biology:** Concept of genes and chromosomes, Mutations Regulation of gene expression; Nucleic acid – replication, transcription, RNA processing, translation and their regulatory mechanisms, Genetic code DNA damage and repair. Different types of RNA.

5. **Inheritance Biology-** Mendelian inheritance; Gene interaction; Complementation; Linkage, recombination and chromosome mapping; Extra chromosomal inheritance; Microbial genetics – transformation, transduction and conjugation, probability and pedigree analysis.

6. **Immunology and Physiology**- Concept of Blood composition, Antigen, antibody, Heptane's, Hypersensitivity, Vaccine and its application. Autoimmune disorders. Cardiac output, cardiac cycle, Endocrine System, reproductive system, Digestive system.

7. **Basic Techniques in modern biology**- Electrophoresis, Chromatography, Centrifugation, Spectroscopy. Immuno-techniques Polymerase chain reaction (PCR), RTPCR, DNA Fingerprinting, DNase Foot printing.

8. **Evolution-** The evolutionary time scale; Eras, periods and epoch; Major events in the evolutionary time scale. Lamarck; Darwin–concepts of variation, adaptation, struggle, fitness and natural selection. Population genetics, Gene pool, Gene frequency; Hardy-Weinberg Law.

J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD

NAAC 'A' Grade Accredited State Govt. University

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NH- 2, SECTOR-6, MATHURA ROAD, FARIDABAD, HARYANA-121006