

EXAM FOR THE POST OF MUSEUM CURATOR

Exam will consists of one Multiple Choice Questions (MCQs) type Paper.
Question paper will have questions as per following scheme:

S. No.	Details	Number of Questions	Maximum Marks	Duration
1.	Botany	60	60	90 Minutes
2.	Hindi (Basic Knowledge)	10	10	
3.	English(Basic Knowledge)	10	10	
4.	General intelligence and reasoning	5	5	
5.	Quantitative aptitude (Basic arithmetic skill)	5	5	
6.	General Knowledge and current affairs	5	5	
7.	Computer (Basic knowledge)	5	5	

Total number of questions will be one hundred.

1. BOTANY

UNIT 1. MICROBIOLOGY

Topic 1: Microbes

Viruses – Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance;

Bacteria – Discovery, General characteristics and cell structure; Reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance.

Topic 2: Gymnosperms

General characteristics, classification. Classification (up to family), morphology, anatomy and reproduction of *Cycas* and *Pinus*. Ecological and economical importance.

UNIT 2. PLANT ECOLOGY AND TAXONOMY

Topic 1: Ecological factors

Soil: Origin, formation, composition, soil profile.

Water: States of water in the environment, precipitation types.

Light and temperature: Variation Optimal and limiting factors; Shelford law of tolerance. Adaptation of hydrophytes and xerophytes.

Topic 2: Ecosystem

Structure; energy flow trophic organisation; Food chains and food webs, Ecological pyramids production and productivity; Biogeochemical cycling; Cycling of carbon, nitrogen and Phosphorous

Topic 3: Phytogeography

Principle biogeographical zones; Endemism

Topic 4: Introduction to plant taxonomy

Identification, Classification, Nomenclature.

Topic 5: Identification

Functions of Herbarium, important herbaria and botanical gardens of the world and India; Documentation: Flora, Keys: single access and multi-access

Topic 6 : Taxonomic hierarchy

Ranks, categories and taxonomic groups

Topic 7: Botanical nomenclature

Principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations.

Topic 8: Classification

Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (uptoserries), Engler and Prantl (upto series).

UNIT 3. PLANT ANATOMY AND EMBRYOLOGY

Topic 1: Meristematic and permanent tissues

Root and shoot apical meristems; Simple and complex tissues.

Topic 2: Organs

Structure of dicot and monocot root stem and leaf.

Topic 3: Secondary Growth

Vascular cambium – structure and function, seasonal activity. Secondary growth in root and stem, Wood (heartwood and sapwood).

Topic 4: Adaptive and protective systems

Epidermis, cuticle, stomata; General account of adaptations in xerophytes and hydrophytes.

Topic 5: Structural organization of flower

Structure of anther and pollen; Structure and types of ovules; Types of embryo sacs, organization and ultrastructure of mature embryo sac.

Topic 6: Pollination and fertilization

Pollination mechanisms and adaptations; Double fertilization; Seed-structure appendages and dispersal mechanisms.

Topic 7: Embryo and endosperm

Endosperm types, structure and functions; Dicot and monocot embryo; Embryoendosperm relationship.

Topic 8: Apomixis and polyembryony

Definition, types and practical applications.

UNIT 4. PLANT PHYSIOLOGY AND METABOLISM

Topic 1: Plant-water relations

Importance of water, water potential and its components; Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation.

Topic 2: 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, carriers, channels and pumps.

Topic 3: Translocation in phloem

Composition of phloem sap, girdling experiment; Pressure flow model; Phloem loading and unloading.

Topic 4: Photosynthesis

Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C₃, C₄ and CAM pathways of carbon fixation; Photorespiration.

Topic 5: Respiration

Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Glyoxylate, Oxidative Pentose Phosphate Pathway.

Topic 6: Enzymes

Structure and properties; Mechanism of enzyme catalysis and enzyme inhibition.

Topic 7: Nitrogen metabolism

Biological nitrogen fixation; Nitrate and ammonia assimilation.

Topic 8: Plant growth regulators

Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.

Topic 9: Plant response to light and temperature

Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Vernalization.

UNIT 5. CELL AND MOLECULAR BIOLOGY

Topic 1: Techniques in Biology Principles of microscopy; Light Microscopy; Phase contrast microscopy; Fluorescence microscopy; Confocal microscopy; Sample Preparation for light microscopy; Electron microscopy (EM)- Scanning EM and Scanning Transmission EM (STEM); Sample Preparation for electron microscopy; X-ray diffraction analysis.

Topic 2: Cell as a unit of Life; The Cell Theory; Prokaryotic and eukaryotic cells; Cell size and shape; Eukaryotic Cell components.

Topic 3: Cell Organelles; Mitochondria:_ Structure, marker enzymes, composition; Semiautonomous nature; Symbiont hypothesis; Proteins synthesized within mitochondria; mitochondrial DNA; Chloroplast_ Structure, marker enzymes, composition; semiautonomous nature, chloroplast DNA; ER, Golgi body & Lysosomes: _Structures and roles; Peroxisomes and Glyoxisomes:_Structures, composition, functions in animals and plants and biogenesis; Nucleus:_Nuclear Envelope- structure of nuclear pore complex; chromatin; molecular organization, DNA packaging in eukaryotes, euchromatin and heterochromatin, nucleolus and ribosome structure (brief).

Topic 4: Cell Membrane and Cell Wall; The functions of membranes; Models of membrane structure; The fluidity of membranes; Membrane proteins and their functions; Carbohydrates in the membrane; Faces of the membranes; Selective permeability of the membranes; Cell wall.

Topic 5: Cell Cycle; Overview of Cell cycle, Mitosis and Meiosis; Molecular controls.

Topic 6: Genetic material; DNA: Miescher to Watson and Crick- historic perspective, Griffith's and Avery's transformation experiments, Hershey-Chase bacteriophage experiment, DNA structure, types of DNA, types of genetic material; DNA replication (Prokaryotes and eukaryotes): bidirectional replication, semi-conservative, semi discontinuous RNA priming, θ (theta) mode of replication, replication of linear, ds-DNA, replicating the 5' end of linear chromosome including replication enzymes.

Topic 7: Transcription (Prokaryotes and Eukaryotes) ; Types of structures of RNA (mRNA, tRNA, rRNA), RNA polymerase- various types; Translation (Prokaryotes and eukaryotes), genetic code.

Topic 8: Regulation of gene expression; Prokaryotes:Lac operon and Tryptophan operon ; and in Eukaryotes.

UNIT 6. BIOTECHNOLOGY

Topic 1: Plant tissue culture

Micropropagation ; haploid production through androgenesis and gynogenesis; brief account of embryo & endosperm culture with their applications

Topic 2 : Recombinant DNA Techniques

Blotting techniques: Northern, Southern and Western Blotting, DNA Fingerprinting;

Molecular DNA markers i.e. RAPD, RFLP, SNPs; DNA sequencing, PCR and Reverse

Transcriptase-PCR. Hybridoma and monoclonal antibodies, ELISA and Immunodetection.

Molecular diagnosis of human disease, Human gene Therapy.

UNIT 7. ANALYTICAL TECHNIQUES IN PLANT SCIENCES

Topic 1: Imaging and related techniques

Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Use of fluorochromes: (a) Flow cytometry (FACS); (b) Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.

Topic 2: Cell fractionation

Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, CsCl₂ gradient, analytical centrifugation, ultracentrifugation, marker enzymes.

Topic 3: Radioisotopes

Use in biological research, auto-radiography, pulse chase experiment.

Topic 4: Spectrophotometry

Principle and its application in biological research.

Topic 5: Chromatography

Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ion exchange chromatography; Molecular sieve chromatography; Affinity chromatography.

Topic 6: Characterization of proteins and nucleic acids

Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids; Electrophoresis: AGE, PAGE, SDS-PAGE

UNIT 8. RESEARCH METHODOLOGY

Topic 1: General laboratory practices

Common calculations in botany laboratories. Understanding the details on the label of reagent bottles. Molarity and normality of common acids and bases. Preparation of solutions. Dilutions. Percentage solutions. Molar, molal and normal solutions. Technique of handling micropipettes; Knowledge about common toxic chemicals and safety measures in their handling.

Topic 2: Data collection and documentation of observations

Maintaining a laboratory record; Tabulation and generation of graphs. Imaging of Tissue specimens and application of scale bars. The art of field photography.

Topic 3: Methods to study plant cell/tissue structure

Whole mounts, peel mounts, squash preparations, clearing, maceration and sectioning; Tissue preparation: living vs fixed, physical vs chemical fixation, coagulating fixatives, noncoagulant fixatives; tissue dehydration using graded solvent series; Paraffin and plastic infiltration; Preparation of thin and ultrathin sections.

Topic 4: Plant microtechniques

Staining procedures, classification and chemistry of stains. Staining equipment. Reactive dyes and fluorochromes (including genetically engineered protein labeling with GFP and other tags). Cytogenetic techniques with squashed plant materials.

Hindi Language

- काल, संज्ञा, सर्वनाम, विशेषण, क्रिया, अलंकार, क्रियाविशेषण, लिंग, वचन (एकवचन और बहुवचन), त्रुटि का पता लगाना, खाली स्थान भरना, समानार्थक/समानार्थी शब्द, विलोम शब्द, वर्तनी / गलत वर्तनी शब्द का पता लगाना, मुहावरे और वाक्यांश, एक शब्द प्रतिस्थापन, वाक्य सुधार, कारक, समास, लोकोक्तियाँ, विराम चिह्न, सन्धि, प्रत्यय, उपसर्ग, भाषा और बोली, वाक्य प्रकरण, शब्द ज्ञान, वाच्य, अंग्रेजी के पारिभाषिक (तकनीकी) शब्दों के समानार्थक हिन्दी शब्दों का ज्ञान।

English Language

- Tenses, Nouns, Pronouns, Adjectives, Verbs, Articles, Figures of speech, Proverbs, Adverbs, Genders, Numbers (Singular & Plurals), Prepositions, Conjunctions, Word meanings, Spot the Error, Fill in the Blanks, Synonyms, Homonyms, Antonyms, Spellings/ Detecting misspell words, Idioms & Phrases, One word substitution, Improvement of Sentences, Active/ Passive Voice of Verbs, Conversion into Direct/ Indirect narration.

General Intelligence and reasoning

- It would include questions of both verbal and non-verbal type. The test will include questions on Semantic Analogy, Symbolic operations, Symbolic/ Number Analogy, Trends, Figural Analogy, Space Orientation, Semantic Classification, Venn Diagrams, Symbolic/ Number Classification, Drawing inferences, Figural Classification, Punched hole/ pattern-folding & unfolding, Semantic Series, Figural Pattern – folding and completion, Number Series, Embedded figures, Figural Series, Critical Thinking, Problem Solving, Emotional Intelligence, Word Building, Social Intelligence, Coding and de-coding, Directions, Calendar, Clock, Alphabet series test, Ranking test, Sitting arrangement, Puzzle test.

Quantitative Aptitude:

- **Arithmetic:** Number Systems: Computation of Whole Number, Decimal and Fractions, Relationship between numbers, Fundamental arithmetical operations: Percentages, Ratio and Proportion, Square roots, Averages, Interest (Simple and Compound), Profit and Loss, Discount, Partnership Business, Time and distance, Time and work. Algebra: Basic algebraic identities of School Algebra and Elementary surds (simple problems) and Graphs of Linear Equations.
- **Geometry:** Familiarity with elementary geometric figures and facts: Triangle and its various kinds of centres, Congruence and similarity of triangles, Circle and its chords, tangents, angles subtended by chords of a circle, common tangents to two or more circles.
- **Mensuration:** Triangle, Quadrilaterals, Regular Polygons, Circle, Right Prism, Right Circular Cone, Right Circular Cylinder, Sphere, Hemispheres, Regular Right Pyramid with triangular or square Base Trigonometry: Trigonometry, Trigonometric ratios, Complementary angles, Height and distances (simple problems only) Standard Identities like $\sin^2 + \cos^2 = 1$ etc.,
- **Data Handling:** Mean, Median, Mode, Chance and Probability.

General Knowledge and Current Affairs

- Questions will test the candidate's general awareness of the environment around him and its application to society. Questions will also test knowledge of current events and of such matters of everyday observation and experience in their scientific aspect as may be expected of an educated person. The test will also include questions relating to India and its neighboring countries especially pertaining to Sports, History, Culture, Geography, Economic Scene, General policy and scientific research.

Computer

- **Knowing computer** : What is Computer, Basic Applications of Computer; Components of Computer System, Central Processing Unit (CPU), VDU, Keyboard and Mouse, Other input/output Devices, Computer Memory, Concepts of Hardware and Software; Concept of Computing, Data and Information; Applications of IECT; Connecting keyboard, mouse, monitor and printer to CPU and checking power supply.
- **Operating Computer using GUI Based Operating System**: What is an Operating System; Basics of Popular Operating Systems; The User Interface, Using Mouse; Using right Button of the Mouse and Moving Icons on the screen, Use of Common Icons, Status Bar, Using Menu and Menu-selection, Running an Application, Viewing of File, Folders and Directories, Creating and Renaming of files and folders, Opening and closing of different Windows; Using help; Creating Short cuts, Basics of O.S Setup; Common utilities.
- **Understanding Word Processing and M. S. Office**: Word Processing Basics; Opening and Closing of documents; Text creation and Manipulation; Formatting of text; Table handling; Spell check, language setting and thesaurus; Printing of word document. Understanding of components of M.S. Office, M.S. word, M.S. excel sheets, M.S. power point etc.
- **Using Spread Sheet**: Basics of Spreadsheet; Manipulation of cells; Formulas and Functions; Editing of Spread Sheet, printing of Spread Sheet.
- **Introduction to Internet, WWW and Web Browsers**: Basic of Computer networks; LAN, WAN; Concept of Internet; Applications of Internet; connecting to internet; What is ISP; Knowing the Internet; Basics of internet connectivity related troubleshooting, World Wide Web; Web Browsing softwares, Search Engines; Understanding URL; Domain name; IP Address; Using e-governance website
- **Communications and collaboration**: Basics of electronic mail; Getting an email account; Sending and receiving emails; Accessing sent emails; Using Emails; Document collaboration; Instant Messaging; Netiquettes.
- **Making Small Presentation**: Basics of presentation software; Creating Presentation; Preparation and Presentation of Slides; Slide Show; Taking printouts of presentation / handouts.