Syllabus for Forest Ranger under Environment, Forests & Climate Change Department, 2019

The examination will comprise of the following papers:

(1)	General English Paper - I	:	100 Marks
(2)	General English Paper - II	:	100 Marks
(3)	General Science Paper - I	:	200 Marks
(4)	General Science Paper - II	:	200 Marks
(5)	General Science Paper - III	:	200 Marks
	Total	:	800 Marks

DETAILS OF SYLLABUS :

(1) General English Paper - I
ESSAY TYPE : 100 Marks

(a)	Essay Writing	:	25 Marks
(b)	Précis Writing	:	15 Marks
(c)	Letter Writing	:	15 Marks
(d)	Idioms & Phrases	:	14 Marks
(e)	Expansion of passages	:	15 Marks
(f)	Comprehension of given passages	:	16 Marks

(2) General English Paper – II
MCQ/OBJECTIVE TYPE: 100 Marks

(a) Grammar : Parts of Speech, Nouns, Adjective, Verb, Adverb, Preposition, Etc. : 40 Marks

(b) Compositions : 30 Marks

i) Analysis of complex and compound sentences.
ii) Transformation of sentences.
iii) Synthesis of sentences.

(d) Correct usage and vocabularies. : 30 Marks

(3) General Science PAPER – I
BASIC SCIENCE
Objective Type - 200 Marks

UNIT-I - (40 Marks)

Algae, Fungi, Bryophytes and Pteridophytes: Structure, reproduction, economic importance and life history.

Classification of Angiosperm- Bentham and Hooker's system of classification; economic importance of *Oryza sativa, triticum aestivum, Zea mays, Gossypium hirsutum, Cocos mucifera, Camellia sinensis; Mangifera indica, Coffea arabica, Michelia champaca, Tectona grandis*.

Photosynthesis: C_4 and CAM plants.

Hormones: role of auxins, gibberellins, cytokinins.

Amino acids: classification and structure; DNA replication.

Pathology: Modes of infection, transmission, dissemination and control of plant diseases.

Mendel's law of inheritance; lethal genes, complementary genes, duplicate genes and epistatic genes. **Microorganisms:** antibiotics, biofertilizers, C & N cycle; Nitrogen fixation.

Plant breeding: pure line & mass selection, hybridization, plus tree. Mutations and cytoplasmic inheritance; linkages and crossing over. Apomixis and polyembryony.

MAPs: Prospects of medicinal and aromatic plants in India.

Ecosystem function and structure: energy flow, food chain, ecological pyramids.

Ecological succession: types and pattern.

Environmental biology: biosphere, renewable and non-renewable resources, Greenhouse effect; climate change; acid rain; global warming; ozone depletion; biomagnifications; biodiversity conservation; concept & principles-environmental management and sustainable development.

Legislations: Environment Protection Act, 1986; Kyoto Protocol 1997, Agenda 21 of Earth Summit 1992. Principles, goals and objectives of environmental education.

Principles and application of Remote Sensing and GIS.

Forest types of India and Mizoram.

UNIT-II - (40 Marks)

Biosystematics: Principles and basis of classification; binomial nomenclature.

Protozoa: Locomotion and reproduction.

Structural organization of chordate : Hemichordates and Urochordates.

Comparative account of the integument, skeletal, circulatory, urinogenital & nervous systems of vertebrates. Structure and function of cell and cytoplasmic constituents.

Cell division. Oxidation of fats and TCA cycle oxidative phosphorylation electron transport chain.

Molecular biology : Watson& Crick model of DNA, replication of DNA.

Genetic code: Protein synthesis, sex chromosomes and sex determination. Mendelian laws of inheritance, recombination, linkage and crossing over.

Mutation- natural and induced mutations.

DNA finger printing, transgenic animals, blotting techniques, animal cloning. Biochemistry: carbohydrates, lipids and nucleic acids.

Physiology: structure and function of heart, kidney, types of muscles and mechanism of contraction, neuron-type and structure.

Zoonoses: Classification, definition, types, role of birds in prevalence and transmission of zoonotic diseases.

Evolution: Origin of life; Lamarkism and Darwinism, sources and nature of variations; natural selection. **Zoogeographical realms of the world**.

Developmental biology: Gametogenesis, Fertilization, types of eggs and cleavage.

Parasitology: life history, mode of infection and pathogenecity of Plasmodium falciparum and Trypanosoma brucei.
Swine flu: causes, symptom, treatment and occurrence in Mizoram.
Ecology: Population; competition, predation, parasitism, commensalism, co-operation and mutualism. Community ecology and succession; concept of ecosystem; Biogeochemical cycles. Limiting factors; concepts of habitat and ecological niche; Biodiversity, conservation and major wild life sanctuaries in Mizoram.

UNIT-III - (40 Marks)

Atomic structure: Electronic configuration of atom, shapes of s ,p and d orbitals. de-Broglie's concept of dual character of matter, Heisenberg's Uncertainty Principle, quantum numbers, probability distribution curves. Scattering cross-section, centre of mass and lab system. Rutherford scattering. Coriolis force, central forces. Pauli's exclusion principle. Bohr's theory of hydrogen atom. Photoelectric effect.
Chemical bonding: ionic bond, covalent bond and coordinate bond, Sigma and pi bonds, concept of hybridization, types, orientation of hybrid orbitals.
Radioactivity: units of radioactivity, half-life and average-life period, nuclear binding energy, magic number concept, fission, fusion, nuclear reactors.
Colloids:
Thermodynamics: First Law of thermodynamics, Work, heat and energy, relationship between Cp and Cv. Kirchoff's equation. Second and third Law of thermodynamics. Gibbs-Hemholtz equation. Thermodynamic criteria for equilibrium. Carnot's cycle, Isothermal and adiabatic changes. Maxwell's relations.
Quantum mechanics: postulates, Schrodinger wave-equation and its applications, quantum numbers and their significance. Eigen values and functions. Einstein and Debye theories. Plank's Law. Black body radiation.
Green chemistry: principle, need, goals and limitations. Benefits and adverse effect of pesticides, safety measures in the handling of pesticides.
Natural products: terpenes- classification and biosynthesis of terpenes; alkaloids- isolation, detection and Hoffman degradation.
Material chemistry: classification of polymers, kinetics of polymerization, Flory-Huggins theory, applications of nanomaterials.

UNIT-IV - (40 Marks)

Algebra of Sets: Set operations, Union, Intersection, Difference, Symmetric Difference, Complement, Venn diagram, Cartesian products of sets, Relation and Function, Composite Function, Inverse of a Function, Equivalence Relation, Kinds of Function.
Number Systems : Real numbers (algebraic and other properties), rational and irrational numbers, Complex numbers, Algebra of complex numbers, Conjugate and square root of a complex number, cube roots of unity, De-moivre's Theorem with simple applications.
Permutation and combinations and their simple applications, Mathematical induction, Binomial Theorem. Determinants up to third order, Minors and Cofactors, Properties of determinants. **Trigonometry:** Compound angles, Multiple and Sub-multiple angles, solution of trigonometric equations, Properties of triangles, Inverse circular function.
Differential Calculus: Concept of limit, continuity, Derivation of standard functions, successive differentiation, simple cases, Leibnitz Theorem, Partial differentiation, Simple cases, derivatives as rate measure, Maxima and minima, indeterminate forms, Geometrical applications such as tangents and normal to plane curves.
Integral Calculus: Standard methods of integration (substitution, by pars, by partial fractions etc.) Definite integrals and properties of Definite Integrals, Areas under plane curves, Differential Equations only simple cases and application to motions in a straight line.

Probability: Averages (mean, Median and Mode), Dispersion (standard deviation and variance). Definition of probability, Addition theorem, Uniqueness theorem. Standard Probability- discrete uniform, Bernoulli, Geometric, Negative binomial and Hyper-geometric.
Statistical Inference: Test of significance- Null and alternative hypotheses, Type-I and Type-II errors, properties of Bivariate normal Distribution (BVN); method of moments, method of least square. Markov Chains- order and stability; postulates of Poisson process; high level and low level graphics.
Data and Information: introduction, types, data processing using computer, data storage, physical device, RAM, CPU.
Software : definition, types, packages, hardware and software.
Network types: LAN, WAN, MAN, OSI and TCP/IP model.

UNIT-V - (40 Marks)

Earthquake and volcanoes: Causes, geological effects and distribution of earthquake belts. Geographical set up of NE India, earthquake hazards in NE India.
Theories of origin of solar system: nebular, interstellar, tidal and big bang.
Folds: classification and causes of folding. Igneous, sedimentary and metamorphic petrology: forms, texture and structure.
Fossils: definition, types and mode of preservation.
Geological exploration techniques: principles and methods.
Maps: assay, isograde and anomaly.
Hydrogeology: hydrological cycle and parameters.
Mineral resources of India: origin, geological occurrence, distribution and uses of Iron, Manganese, copper, lead, gold and aluminum. Petroleum – composition, origin, migration and entrapment; Coal- origin and classification.
Mizoram : mineral potential-present and future prospects, potential of oil, natural gas and coal.

(4) General Science PAPER – II
APPLIED SCIENCE
Objective Type - 200 Marks

Section A - (26 Marks)

Soil: definition, soil formation - materials, weathering of rocks and minerals, time and development, soil profile and its layers; soil classification and development; Soil Properties: physical and chemicals; soil biology and ecology; Soil Factors for plant growth: fertility, productivity and essential plant nutrients, organic matter, humus and litter decomposition; Acid and alkali soil formation and reclamation.

Section B - (24 Marks)

Soil erosion: factors, forms and impact, desertification, wastelands; Soil erosion control: windbreaks, shelterbelts, mulching, terracing, contouring, cover crops, diversion channels, fences; C:N ratio; soil microorganisms and their role in soil fertility; Biological nitrogen fixation and its role in plant nutrition.

Section C - (26 Marks)

Definition of Forest: general, ecological and legal; importance of forests; extent of forest in India. Need for conservation of existing and man-made forest in India and north eastern states; major forest types of India and North East India.

Section D - (24 Marks)

Regeneration: Natural regeneration: definition. Advantages and disadvantages of natural regeneration; Artificial regeneration: definition and objectives, steps involved in artificial regeneration; Silvicultural Practice: Thinning- ground thinning, silvicultural thinning, cleaning, pruning, girdling etc.; Definition and types of silvicultural systems (clear-felling, shelter wood and selection systems), Indian Irregular shelter wood system and group selection system.

Section E - (24 Marks)

Social Forestry: definitions, objectives; components: Community Forestry, Farm forestry Extension forestry, Recreation forestry, urban forestry; Social dynamic of deforestation, Role of Forestry in Environmental Conservation, Community Participation in Afforestation Programme – Chipko, Apiko movement, Joint Forest Management, Green Mizoram; National Forest Policy 1988; Wildlife Protection Act 1972; Role of Forest Policy in Forest and Wildlife Conservation.

Section F - (24 Marks)

Land Capability Classification; Cropping system – An overview, types of cropping systems-mono cropping, multiple cropping, inter cropping, mixed cropping, relay cropping, sequence cropping and their efficiency; fertilizer application, weed control, pests and diseases control; harvesting.

Section G - (26 Marks)

Agroforestry: definitions, objectives, importance and scope; Characteristics of Multipurpose tree species (MPTs); Agroforestry systems: classification based on various approaches i.e., structure, dominance of components, temporal arrangement of components and allied components; Types of Agra-forestry systems: Homestead Agro-forestry, Agroforestry models- ICAR 3-tier system, Slopping Agricultural Land Technology (SALT)/Slopping Watershed Engineering Technology (SWEET) system, their merits and demerits.

Agribiodiversity: meaning, characteristic, principle and scope; Shifting Cultivation: definition; extent and status; overview; biophysical and socio-economic problems of shifting cultivators; Status and extent of Shifting cultivation in Mizoram.

Section H - (26 Marks)

Air, water and soil pollution: monitoring and control. Solid and hazardous waste: composition, generation, characteristics and management. Natural disaster: earthquake, floods, landslides, epidemics-pre and post disaster management. EIA: concept, steps, guidelines. Principles, goals and objectives of environmental education. Eco-mark, Bio-piracy, Bio-safety. Ambient air quality standards, Emission standards, minimum national standards (MINAS), ISO 14001. Sustainable development- concept and fundamentals.

(5) General Science PAPER – III
Objective Type - 200 Marks

A. The role and impact of science and technology
in the development of India : 100 Marks

In the part relating to the role and impact of science and technology in the development of India, question will be asked to test the candidate's awareness on the role and impact of science and technology in India, emphasis will be on applied aspects. It will also include general knowledge relating to science, inventions and discoveries, terminologist, etc.

B. History, Cultural heritage and Traditional Practices and
General knowledge about Mizoram : 50 Marks

History, Cultural heritage and Traditional Practices and General knowledge about Mizoram will include broad history of Mizoram including pre and post advent of the British, Colonial Era, the Lushai Chiefs, Political upheavals, famines, socio, economics and political events after independence. Cultural and traditional practices, customary laws and practices including folk lore and songs, dances and festivals. General knowledge will include objective questions about Mizoram.

C. Aptitude Test : 50 Marks

(a) Numerical and Figure work Tests : (16 Marks)

These tests are reflections of fluency with numbers and calculations. It shows how easily a person can think with numbers. The subject will be given a series of numbers. His/Her task is to see how the numbers go together to form a relationship with each other. He/She has to choose a number which would go next in the series.

(b) Verbal Analysis And Vocabulary Tests : (14 Marks)

These tests measure the degree of comfort and fluency with the English language. These tests will measure how a person will reason with words. The subject will be given questions with alternative answers, that will reflect his/her command of the rule and use of English language.

(c) Visual And Spatial/3-D Ability Tests : (10 Marks)

These tests are used to measure perceptual speed and acuity. The subject will be shown pictures where he/she is asked to identify the odd one out; or which comes next in the sequence or explores how easily he/she can see and turn around objects in space.

(d) Abstract Reasoning Tests : (10 Marks)

This test measures the ability to analyse information and solve problems on a complex, thought based level. It measures a person's ability to quickly identify patterns, logical rules and trends in new data, integrate this information, and apply it to solve problems.