SYLLABUS

Subject: LIFE SCIENCE

Note:

There are two Papers for each of the subjects. Paper – I on Teaching and Research aptitude, Paper – II based on the syllabus of concerned subjects. Details are furnished below:

PAPER – I

Subject : General Paper on Teaching & Research Aptitude

The Test is intended to assess the teaching/research aptitude of the candidate. They are supposed to possess and exhibit cognitive abilities like comprehension, analysis, evaluation, understanding the structure of arguments, evaluating and distinguishing deductive and inductive reasoning, weighing the evidence with special reference to analogical arguments and inductive generalization, evaluating, classification and definition, avoiding logical inconsistency rising out of failure to see logical relevance due to ambiguity and vagueness in language. The candidates are also supposed to have a general acquaintance with the nature of a concept, meaning and criteria of truth, and the source of knowledge. There will be 50 questions for Paper – I.

1. The Test will be conducted in objective mode. The Test will consist of two Papers. All the two Papers will consists of only objective type questions and will be held on the day of Test in two separate sessions as under :

Session	Paper	Number of Questions	Marks	Duration
First	I	50 question	50 ×2 = 100	1 Hours
Second	II	100 questions	100×2 =200	2 Hours

2. Candidates who appear in two Papers and secure at least 40% aggregate marks for candidates belonging to General Category and at least 35% aggregate marks for candidates belonging to reserved categories will be declared qualifies for Eligibility for Assistant Professor by following the reservation policy of the State Government.
3. The Syllabus of Paper – II and Paper – III will be combined for Paper – II of each subject.

LIFE SCIENCE

PAPER - II

1. **Cell Biology :**
   Structure and function of cells and intracellular organelles (of both prokaryotes and eukaryotes) mechanism of cell division including (mitosis and meisosis) and cell differentiation. Cellcell interaction : Malignant growth; Immune response Dosage compensation and mechanism of sex determination.

2. **Biochemistry :**
   Structure of atoms, molecules and chemical bonds; Principles of physical chemistry; Thermodynamics, Kinetics, dissociation and association constants; Nucleic acid structure, genetic code, replication, transcription and translation, Structure, function and metabolism of carbohydrates, lipids and proteins; Enzymes and coenzyme; Respiration and photosynthesis.

3. **Physiology :**
   Response to stress : Active transport across membranes; Plant and animal hormones; Nutrition (including vitamins); Reproduction in plants, microbes and animals.

4. **Genetics :**
   Principles of Mendelian inheritance, chromosome structure and function; Gene Structure and regulation of gene expression; Linkage and genetic mappings; Extrachromosomal inheritance (episomes, mitochondria and chloraplasts); Mutation; DNA damage and repair, chromosome aberration; Transposons; Sexlinked inheritance and genetic disorders; Somatic cell genetic; Genome organisation (in both prokaryotes and eukaryotes).

5. **Evolutionary Biology :**
   Origin of life (including aspects of prebiotic environment and molecular evolution); Concepts of evolution; Theories of

organic evolution; Mechanisms of speciation; Hardyweinberg genetic equilibrium, genetic polymorphism and selection; Origin and evolution of economically important microbes; plants and animals.

6. **Environmental biology :**
   Concept and dynamics or ecosystem, components, food chain and energy flow; productivity and biogeochemical cycles; Types of ecosystems, Population ecology and biological control; Community structure and organisation; Environmental pollution; Sustainable development; Economic importance of microbes, plants and animals.

7. **Biodiversity and Taxonomy:** Species concept; Biological nomenclature, theories of biological classification, Structural biochemical and classification, Structural biochemical and molecular systematics; DNA finger printing, numerical taxanomy, Biodiversity, characterization, generation maintenance and loss; Magnitude and distribution of biodiversity, economic value, wildlife biology, conservation strategies, crypreservation.

PAPER - III

1. Principles of Taxonomy as applied to the systamics and Classification of Plant Kingdom : Taxonomic structure; Biosystematics; Plant geography; Floristics.
2. Patterns of variation in morphology and life history in plants, broad outlines of classification phytes and pteridophytes; Principles of palaeobotany; Economic importance of algae, fungi and lichens.
3. Comparative anatomy and developmental morphology of gymnosperms and angiosperms, Histochemical and ultrastructural aspects of development; Differentiation and morphogenesis.
4. Androgenesis and gynogenesis; Breeding system; Pollination biology; structural and functional aspects of pollen and pistil; Male sterility; Self and inter-specific incompatability; Fertilization, Embryo and seed development.
5. Plants and civilization; Centres of origin and gene diversity;

Botany, utilization, cultivation and improvement of plants for food, drug, fibre and industrial values, Unexploited plants of potential economic value; Plants as a source of renewable energy; Genetic resources and their conservation.

6. Water Relation : Mineral nutrition; Photosynthesis and photorespiration; Nitrogen, Phosphorous and Sulphur metabolism; Stomatal physiology; Source and sink relationship.

7. Physiology and biochemistry and seed dormancy and germination; Hormonal regulation of growth and development; Photoregulation : Growth responses, Physiology of flowering : Senescence.

8. Principles of plant breeding; Important conventional methods of breeding self and cross pollinated and vegetatively propagated crops; Non conventional methods; Polyploidy ; Genetic variability; Plant diseases and defensive mechanisms.

9. Principles of taxonomy as applied to the systematics and classification of the animal kingdom; Classification and interrelationship amongst the major invertebrate phyla; Minor invertebrate phyla, Functional anatomy of the nonchordates; Larval forms and their evolutionary significance.

10. Classification and comparative anatomy of protochordates and chordates; Origin, evolution and distribution of chordates groups : Adaptive radiation.

11. Histology of mammalian organ systems, nutrition, digestion and absorption; Circulation (open and closed circular, lymphatic systems, blood composition and function); Muscular contraction and electric organs; Excretion and osmoregulation : Nerve conduction and neurotransmitters : major sense organs and receptors; Homeostatis (neutral and hormonal); Bioluminiscence; Reproduction.

12. Gametogenesis in animals : Molecular events during fertilization, Cleavage patterns and fate maps, Concepts of determination, competence and induction, totipotency and nuclear transfer experiments. Cell differentiation and differential gene activity. Morphogenetic determinants in egg cytoplasm; Role of maternal contributions in early embryonic development; Genetic Regulations of early embryonic development in Drosophila; Homeotic genes.

13. Feeding, learning, social and sexual behaviour of animals; Parental care; Circadian rhythms; Mimicry; Migration of fishes and birds; Sociobiology; Phsiological adaptation at high altitude.

14. Important human and veterinary parasites (protozoans and helminths); Life cycle and biology of Plasmodium, Trypanosoma, Ascaris, Wuchereria, Fasciola, Schistosoma and Leishmania; Molecular, cellular and physiological basis of host-parasite interactions.

15. Arthropods and vectors of human diseases (mosquitoesm, lice, flies and ticks); Mode of transmission of pathogens by vectors; Chemical, biological and environmental control of anthropoid vectors; Biology and control of chief insect pests of agricultural importance; Plant host-insect interaction, insect pest management; useful insects : Silkworm.

16. The law DNA constancy and C-value paradox; Numerical and structural changes in chromosomes; Molecular basis of spontaneous and induced mutations and their role in evolution; Environmental mutagenesis and toxicity testing; Population genetics.

17. Structure of pro-and eukaryotic cells; membrane structure and function; intracellular compartments, proteinsorting, secretory and endocytic pathways; Cytoskeleton; Nucleus; Mitochondia and chloroplasts and their genetic organisation; cell cycle; Structure and organisation of chromatin, polytene and lamphrush chromosomes; Dosage compensation and sex determination and sex-linked inheritance.

18. Interactions between environment and biota; Concept of habitat and ecological niches; Limiting factor, Energy flow, food chain, food web and tropic levels; Ecological pyramids and recycling, biotic community-concept, structure, dominance, fluctuation and succession; N.P.C. and S cycles in nature.

19. Ecosystem dynamics and management; Stability and complexity of ecosystems; Speciation and extinctions; Environmental impact assessment; Principles of conservation; Conservation strategies; Sustainable development.

20. Physico-chemical properties of water; Kinds of aquatic habitats (fresh water and marine); Distribution of and impact of

environmental factors on the aquatic biota; Productivity, mineral cycles and biodegradation in different aquatic ecosystems; Fish and Fisheries of India with respect to the management of estuarine, costal water systems and manmade reserviour; Biology and ecology of reserviours.

21. Structure, classification, genetics, reproduction and physiology of bacteria and viruses (of bacteria, plants and animals); Mycoplasma protozoa and yeast (a general accounts).

22. Microbial fermentation; Antibiotics, orgnic acids and vitamins; Microbes in decomposition and recycling processess; Symbiotic and asymbiotic N2- fixation; Microbiology of water, air, soil and sewage : Microbes as pathological agents in plants, animals and man; General design and applications of a biofermenter, Biofertilizer.

23. Antigen; Structure and functions of different clauses of immunoglobulins; Primary and secondary immune response; Lymphocytes and accessory cells; Humoral and cell mediated immunity; MHC; Mechanism of immune response and generation of immunological diversity; Genetic control of immune response, Effector mechanisms; Applications of immunological technique.

23. Enzyme Kinetics (negative and positive cooperativity); Regulation of enzymatic activity; Active sites; Coenzymes : Activators and inhibitors, isoenzymes, allosteric enzymes; Ribozyme and abzyme.

25. Van der Wall's electrostatic, hydrogen bonding and hydrophobic ineraction; Primary structure and proteins and nucleic acids; Conformation of proteins and polypeptides (secondary, Tertiary, quarternary and domain structure); Reverse turns and Ramachandran plot; Structural polymorphism of DNA, RNA and three dimentional structural of tRNA; Structure of carbohydrates, polysacchairdes, glycoproteins and peptidoglycans; Helixcoil transition; Energy terms in biopolymer conformational calculation.

26. Glycolysis and TCA cycle; Glycogen breakdown and synthesis; Gluconeogenedis, interconversion of hexoses and phentoses; Amino acid metabolism; Coordinated control of metabolism; Biosynthesis of purines and pyrimidines; Oxidation of lipids; Biosynthesis of fatty acids; Triglycerides; Phospholipids; Starois;

27. Energy metabolism (concept of free energy); Thermodynamic principles in biology; Energy rich bonds; Weak interactions; Coupled reactions and oxidative phosphorylations; Group transfer; Biological energy trensducers : Bioenergietics.

28. Fine structure of gene, Eukaryotic genome organisation (structure of chromation), coding and non-coding sequences, satellite DNA); DNA damage repaid, DNA replication, amplification and rearrangements.

29. Organization of transcriptional units; Mechanism of transcription of prokaryotes and eukaryotes; RNA procession (capping, polyadenylation, splicing, introns and exons); Ribonucleoproteins, structure of mRNA, Genetic code and protein synthesis.

30. Regulation of gene expression in pro and eukaryotes; Attenuation and antitermination; Operon concept; DNA methylation; Heterochromatilization; Transposition; Regulatory sequences and transacting factors; Environmental regulation of gene expression.

31. Biochemistry and molecular biology and cancer; Oncogenes; Chemical carcinogenesis; Genetic and metabolic disorders; Hormonal imbalances; Drug metabolism and detoxification; Genetic load and genetic counseling.

32. Lysogeny and lytic cycle in bacteriophages; Bacterial transformation; Host cell restriction; Transduction; Complementation; Molecular recombination; DNA ligase; Topoisomerases; Gyrases; Methylases; Necleases; Restriction endonucleases; Plasmids and bacteriophage base vectors for DNA and genomic libraries.

33. Principles and methods of genetic engineering and Gene targeting; Applications in agriculture, health and industry.

34. Cell and tissue culture in plants and animals; Primary culture; Cell line; Cell clones; Callus cultures; Somaclonal variation; Micropropegation; Somatic embryogenesis; Haploidy; Protoplast fusion and somatic hydridization; Cybrides; Genetransfer methods in plants and in animals; Transgenicbiology; Allopheny; Artificial seeds; Hybridoma technology.

35. Structure and organisation of membranes; Glycoconjigates and proteins in membranes; Glycoconjugates and proteins in

membrance systems; Ion transport, Na/KA/Pase; Molecular basis of signal transduction in bacteria, plants and animals; Model membrances; Liposomes.

36. Principles and application of light, phase contrast, flurescence, scanning and transmission electron microscopy, Cytophotometry and flow cytometry, ficationand staining.

37. Principles and applications of gel-filtration, Ion-exchange and affinity chromatography; Thin layer and gas chromatography; Highpressure liguid (HPLC) chromatography; Electrophoresis and electrofocussing, Ultracentrifugation (velocity and buoyant density).

38. Principles and techniques of nucleic acid hybridization and Cot curves; Sequencing of Proteins and nucleic acids; Southern, Northern and South-Western blotting techniques; Polymerase chain reaction; Methods for measuring nucleic acid and protein interactions.

39. Principles of biophysical methods used for analysis of biopolymer structure, X-ray diffraction, Fluorescence, UV, ORD/CD, Visible, NMR and ESR spectroscopy; Hydrodynamic methods, Atomic absorption and plasma emission spectors copy.

40. Principles and applications of tracer techniques in biology; Radiation, dosimetry; Radioactive isotopes and half life of isotopes; Effect of radiation on biological system; Autoradiography; Cerenkov radiation; Liquid scientification spectrometry.

41. Principles and practice of statistical methods in biological research, samples and poputations; Basic statistics-average, statistics of dispersion, coefficient of variation; Standard error; Confidence limits; Probability distributions (biomial, Poisson and normal) Tests of statistical significance; Simple correlation of regression; Analysis of variance.

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