

Examination syllabus of Competitive Papers (Graduate level)

Zoology

Animal Diversity

Part 1 (Non chordata)

Salient Features and outline classification upto classes of Non-Chordates - phyla, Locomotory organelles and Locomotions in Protozoa, Morphology, life cycle and control measures of *Trypanosoma* and *Plasmodium*, Canal system in Sponges, Polymorphism in Coelentrates, Life cycle of *Taenia* and *Ascaris*, parasitic adaptations in Helminthes. Metamerism in Annelids and it's significance, Zoological importances and distribution of *Peripatus*, Torsion in Gastropods, water vascular system in Echinoderms.

Part 2 (chordata)

General characters and outline classification of Chordates upto classes, salient features of body organization and systematic position of *Balanoglossus* and *Amphioxus*, External features of *Petromyzon*, scales and fins of fishes, parental care in fishes, parental care in Amphibians, Neoteny, General characters of *Gymnophiona*, poisonous and non-poisonous snakes, venom and anti-venom, biting mechanism in snakes, Flightless birds and their distribution, flight adaptations in birds, distribution and affinities of prototheria, adaptive radiations with particular reference to aquatic mammals.

Examination Syllabus of Competitive Papers(Graduate Level)

Embryology, Animal behaviour, Applied Zoology, Toxicology.

Part :1- Embryology, Animal Behaviour

Gametogenesis, Mechanism of Fertilization, Types of eggs, cleavage patterns, blastulation and gastrulation (frog and chick), foetal membranes (chick), retrogressive metamorphosis in Ascidians, Types of regeneration, embryonic induction(origin structure and significance of primary organizer).

Patterns of behaviour – Stereotyped, innate behaviour (taxis and reflexes), fixed action patterns, sign or key stimulus or releasers and innate releasing mechanism, migration in birds with particular reference to the mechanism of navigation, introduction to socio-biology (Social structure of primates).

Part : 2- Applied Zoology, Toxicology

Elementary Knowledge of aquaculture, sericulture, apiculture, Lac-culture, pearl culture.

Introduction and brief history of Toxicology, general principles of Toxicology, brief history of environmental toxicology,(kind and source of toxic agents - animal toxins, plant toxins, pesticides, metals, food additives), dose responses, relationships, frequency and cumulative responses, determination TL_m values, LC_{50} , margin of safety, Threshold limits.

Examination Syllabus of Competitive Papers(Graduate Level)

Ecology, Environmental biology , Microbiology, and Biostatistics

Part: 1 – Ecology and Environmental Biology

Definition of ecology and its relationship.

The environment: A biotic, biotic factors, edaphic factors.

Concept of Ecosystem, Energy flow in ecosystem, Trophic Level.

Productivity: Primary and Secondary, Food chain, Grazing and detritus, food web.

Biosphere:- Hydrosphere, Lithosphere and Atmosphere.

Biogeochemical cycles, Carbon and Nitrogen Cycles.

Population: Definition, Biotic Potential, Density, Natality, Mortality, Growth curves.

Concept of Biodiversity, Conservation and management of Biodiversity. Concept of protected areas, Ex-situ and In-situ conservation, India's wild life habitats distributions, conservation status and efforts.

Principles of Zoo-geographical realms of the world characteristics fauna of oriental region, barriers and means of dispersal, pollution and biomagnifications.

Part : 2- Microbiology and Biostatistics

Media preparation, Sterilization, General structure and multiplication of viruses, general characters of bacteriophages.

Biostatistics as a tool in research, data collection, random and non- random sampling, data tabulation, data presentation(graph, histogram and scattered diagrams), calculation of mean, mode and median, standard error.

Examination Syllabus of Competitive Papers(Graduate Level)

Taxonomy, Evolution, Biotechnology and Bioinformatics

Part :1(Taxonomy and Evolution)

Taxonomy and systematics, rules of nomenclature, binomial and trinomial, ICZN, components of classification, Linnaeus hierarchy, species concept, species as category, a brief concept and evidences of evolution, Lamarkism, Darwinism and modern synthetic theory, evolution of man, geological time scale, types of fossils,

Part 2: Biotechnology and Bioinformatics

Definition and scope of biotechnology, biotechnological innovations in the areas of medical, agriculture, industrial and forensic sciences, brief knowledge of PCR and its significance, elementary knowledge of computer: input and output devices, elementary ideas of software and hardware, use of computer in biological sciences

Examination Syllabus of Competitive Papers(Graduate Level)

Biological Chemistry and Physiology

Part 1: Biological Chemistry

Introduction to biological molecules, proteins, amino acids, carbohydrates, lipids, vitamins and enzymes-their structure, metabolism of carbohydrates

Part 2: Physiology

Food constituents, intracellular and extra cellular digestion, digestion and absorption, of carbohydrates, fats and proteins, types of respiration, respiratory pigments, gaseous transports and control of respiration, excretion of nitrogenous wastes, urine formation in mammals, composition of blood and function of blood corpuscles, haemopoiesis and blood coagulation, blood groups, types of heart, physiology of heart beat, types of neurons, resting and action potential of nerves, synapse and chemical transmission of nerve impulse, muscle contraction and its mechanism, general characteristics of endocrine system, mechanism of hormone action, brief knowledge of structure and hormonal function of the glands-thyroids, pituitary, pancreas, adrenal, testis, ovary and parathyroid.

Examination Syllabus of Competitive Papers(Graduate Level)

Cell Biology and Genetics

Part 1: Cell biology

Prokaryote and Eukaryote cell, models and functions of plasma membrane, structures and functions of cell organelles-mitochondria, Lysosomes, ribosomes, chloroplasts, centrioles, golgi complex, Endoplasmic reticulum, nucleus and nucleolus, basic features of cell cycle- mitosis and meiosis, polytene, and lamp brush chromosomes, nucleic acids (DNA and RNA), nucleosides and nucleotides, genetic and non-genetic RNA, expression of gene-Protein synthesis

Part 2: Genetics

Mendelian laws, symbols and terminology, linkage- kinds and chromosomal theory, coupling and repulsion hypothesis, crossing over –somatic and germinal, sex determination-chromosome mechanism, genic balance theory, sex linked gene(colour blindness and haemophilia in man), sex linkage in *Drosophila*, cytoplasmic inheritance-kappa particles in *Paramecium*, inheritance of plastids, eugenics, mutations-chromosomal and gene mutation and their interpretation.

BOTANY (GRADUATE LEVEL)

UNIT I- MICROBIOLOGY, FUNGI, LICHENS AND ELEMENTARY PLANT PATHOLOGY

1. Viruses – Structure, transmission, multiplication, bacteriophages and economic importance.
2. Bacteria – Structure, reproduction and economic importance.
3. Salient features of fungi, Broad classification of Fungi (Alexopoulos) upto class level, nutrition of Fungi, Reproduction in Fungi - asexual reproduction, sexual reproduction, heterothallism, heterokaryosis and parasexual cycle, Economic importance of fungi, Life history of *Mucor*, *Penicillium*, *Puccinia*, *Agaricus*, *Alternaria*.
4. Lichens – Characteristics, general structure, symbiotic relationship, reproduction and economic importance.
5. Pathology of fungal plant diseases- A brief idea about disease symptoms, establishment of diseases, categories of plant diseases on the basis of their occurrence.
6. Control of plant diseases - brief idea about exclusion, eradication, protection by fungicides and by developing resistance.

UNIT II- ALGAE, BRYOPHYTA & PTERIDOPHYTA

1. Algae - Introduction and salient features, Classification of algae upto class level, range of vegetative structure, cell structure of prokaryotic and eukaryotic Algae, Reproduction, types of life cycles (haplontic, diplontic, diplohaplontic, haplobiontic and diplobiontic) and alternation of generations in algae, ecology of algae, Life cycle of *Nostoc*, *Chlamydomonas*, *Oedogonium*, *Vaucheria*, *Ectocarpus*, *Polysiphonia*, Diatoms, Economic importance of algae.
2. Bryophyta - Salient features of Bryophytes, Habitats, distribution and economic importance of Bryophyta, Classification of Bryophytes, A brief account of alternation of generations, Life history of *Marchantia*, *Anthoceros* and *Funaria*.
3. Pteridophyta - Salient features of Pteridophytes, habitat, distribution, classification, and economic importance of pteridophytes, alternation of generations in pteridophytes, Telome theory, steler system, apogamy, agamospory, apospory, heterospory and seed habit, life history of *Rhynia*, *Selaginella*, *Equisetum*, *Pteris*.

UNIT III- GYMNASPERMS & TAXONOMY OF ANGIOSPERMS

1. General characteristics, classification (upto family level) of Gymnosperms, Ecological and economic importance of Gymnosperms, morphology, anatomy and reproduction of *Cycas* and *Pinus*. Types of fossils and their types, process of fossilization, living fossils.
2. A general account of the origin and evolution of angiosperms, Basic principles and broad outline of the classification proposed by Bentham & Hooker and Hutchinson.
3. International code of Botanical nomenclature, Botanical gardens and herbaria, Botanical survey of India.
4. Distinguishing features of the families - Ranunculaceae, Caryophyllaceae, Malvaceae, Rutaceae, Fabaceae, Rosaceae, Cucurbitaceae, Apiaceae, Rubiaceae, Solanaceae, Acanthaceae, Lamiaceae, Apocynaceae, Euphorbiaceae, Polygonaceae, Orchidaceae, Liliaceae, Poaceae.

UNIT IV- ANATOMY, EMBRYOLOGY AND MORPHOGENESIS

1. Meristems-Primary and secondary meristems, characteristics and functions, permanent tissues.
 2. A brief account of root, shoot and leaf anatomy, Root-stem transition.
 3. Secondary growth, secondary xylem, secondary phloem-structure-function, growth rings, sapwood, heartwood, periderm and anomalous secondary growth in Dicot, Monocot stem and roots.
 4. Structure of anther, microsporogenesis and development of male gametophyte.
 5. Structure of ovule, megasporogenesis and development of female gametophyte.
 6. Pollination, fertilization and life history of typical angiosperm, Endosperm and development of embryo, polyembryony, apomixis.
 7. General concept of morphogenesis, seed germination and dormancy, elementary plant movements.
 8. Plant growth regulators - Auxins, Gibberellins, Cytokinins and Abscissic acid.
 9. Physiology of flowering - photoperiodism and vernalization.
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UNIT V- ECOLOGY AND BIOSTATISTICS

1. Definition and scope of ecology.
2. Population- characters, growth curves, ecotypes and ecads.
3. Community- characteristics, life-forms and biological spectrum, ecological succession.
4. Ecosystems – Types, abiotic and biotic components, energy flow, food chain, food web and ecological pyramids.
5. Biogeochemical cycles- brief discussion of concept by giving examples of carbon, nitrogen and phosphorus cycles.
6. Biogeographical regions of India, Vegetation types of India.
7. Environmental pollution-air, water, soil, noise and radio-active pollution.
8. Definition, scope and importance of statistics, representation of statistical data.
9. Measures of central tendency - mean, median and mode.
10. Measures of dispersion- range, standard deviation, standard error.
11. Coefficient of correlation.
12. Chi-square (χ^2) test.

UNIT VI- CYTOLOGY, GENETICS, MOLECULAR BIOLOGY & BIOTECHNOLOGY

1. Cell structure and division: cytoplasmic organelles, nucleus, chromosomes.
2. Cell division - mitosis, meiosis, comparison of mitosis and meiosis.
3. Laws of inheritance: Mendel's experiments, principles of segregation, independent assortment, incomplete dominance, sex linked inheritance, sex determination.
4. Linkage and crossing over: complete and incomplete linkage, linkage group and crossing over, Mutations.
5. DNA structure and replication. RNA structure and types.
6. Genetic code and protein synthesis, Classical and modern concept of genes.
7. Introduction to Biotechnology (role in modern life), and Recombinant DNA technology- tools and techniques, cloning vectors, plasmids.
8. Basic concept of plant tissue culture techniques, collection and storage of germplasm (cryopreservation).
9. Industrial biotechnology - Fermentation and alcohol production.
10. Agriculture Biotechnology- Biofertilizers and biopesticides.

11. Nutritional Biotechnology - Mycotoxins and health hazards, control of mycotoxin production, single cell protein.
12. Elementary idea of Gene Bank. Nif and Nod Genes, c-DNA, Totipotency, Antibiotics, Mycoprotein.

UNIT VII- PHYSIOLOGY AND BIOCHEMISTRY

1. Diffusion, osmosis, plasmolysis and Inhibition, Absorption of Water, active and passive absorption.
2. Transpiration- Factors affecting the rate of transpiration, significance of transpiration, mechanism of stomatal opening and closing.
3. Mineral Nutrition, Macro and Micronutrients. mineral deficiency symptoms. absorption of minerals.
4. Translocation of solutes and factors affecting translocation, mechanism of phloem transport.
5. Respiration, glycolysis, Kreb's cycle, electron transport system, redox potential, pentose phosphate pathway, ATP- biological energy currency, aerobic and anaerobic respiration., Oxidative phosphorylation, factors affecting the rate of respiration, Kreb cycle.
6. Photosynthesis - Historical background, concepts of two photosystems, Z-scheme, structure of chloroplast, pigments, photophosphorylation, Calvin cycle, factors affecting the rate of photosynthesis, CAM Plants.
7. Enzymes - Properties, classification, mechanism of enzyme action and factors affecting enzyme activities.
8. Carbohydrates – classification, properties, structure and biological role.
9. Amino acids and Proteins- classification and structure
10. Structure and function of lipids, fatty acids biosynthesis, storage and mobilization of fatty acids, β - oxidation.

UNIT VIII- ECONOMIC BOTANY AND PLANT BREEDING

1. Cereals and millets- wheat, rice and maize.
2. Food plants- potato, sugarcane; Fruits - mango, apple, banana, citrus and litchi.
3. Fibres - cotton, hemp and coir.
4. Vegetables: root vegetables, stem vegetables, leaf and fruit vegetables.
5. Timbers: Teak, shisham, sal, chir and deodar.

6. Medicinal Plants: *Aconitum*, *Atropa*, *Cinchona*, *Rauwolfia* and *Ephedra*.
 7. Oils: Linseed oil, mustard oil and groundnut oil.
 8. Plant breeding: aims and objectives, basic techniques of Plant breeding.
 9. Crop improvement methods - Selection, Plant introduction and acclimatization, hybridization and mutational breeding.
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Syllabus of agriculture Sciences

UNIT-I

Definition and scope of Agronomy, Classification of field Crops, general principles of Crop production: Climate, soil, soil preparation, seed and sowing, tillage, water management, nutrient management, plant protection management, harvesting, threshing and storage, mixed and inter-cropping, manure and fertilizers, cultivation of common crops- Cereal Crops : Wheat, Barley, Oat: oilseed Crops : Rapeseed and mustard Linseed, Sunflower ; Pulse crops : Chick pea, field pea, Lentil, Rajmah, Fodder Crops : Oat, Berseem, Lucerne; Cash Crops : Potato, sugarcane, recommended varieties, seed rate, time and method of sowing, irrigation, manure and fertilizer, weed controls, insect-pests and diseases, harvesting, processing and yield. Soils- origin and classification loam, silt, clay, sandy loam, physical and chemical properties of soil. Use of fertilizers, essential nutrients- nitrogen, phosphorus and potassium, organic and inorganic fertilizers and their effects on crops and soil, FYM and green manuring, water requirement of crops, measurement of water discharge, prevention of loss of water, different methods of irrigation – flooding, basin method, border /strip method, sprinkler and drip irrigation. Disadvantage of excess moisture, prevention of formation of acidic and alkaline soils and their management.

UNIT -II

Study of horticultural crops including recommended varieties and their main features, suitability for different regions, time and method of sowing, manure and fertilizer, irrigation, diseases and pests and their control. major vegetables like Potato, Brinjal, chillies, tomato, Cauliflower, Cabbage, knol khol, Onion, Watermelon, Okra, Radish, Carrot and Pea. cucurbits, bittergourd, bottlegourd, muskmelon, ridge gourd, root crops-carrot, radish sweet potato, turnip, fruits vegetables-tomato, bringal, botanical Classification of vegetables and fruits, pruning and training of fruit plants, Unfruitfulness , Fruit drop, Polyembryony, Parthenocarp and incompatibility. Practices involved in the production of fruits: Mango, Guava, Kagzi lime, Banana, Grape, Litchi, Papaya, Loquat, Aonla, Ber, Jack Fruit, Apple, Pear and Peach, Production techniques of plantation crops: Coconut, Cashew nut, Tea Coffee and coca

UNIT-III

Type of iron and steel, wood, plastic and tin used in agricultural implements and their forms & properties. Study of different types of ploughs- indigenous, chisel, rotary and disc plough,. their management & cost, selection of prime movers, water lifting devices; discharge, command area, cost of different system; soil preparation, methods of ploughing, need for tillage, kinds of tillage, mechanical Power transmission through belts, pulleys and gears, EC engine and its components. Classification of tractors, Elementary knowledge about main components of tractor and their functions such as steering, clutches, transmission gears, differential and final drive, Introductory agricultural economics-meaning and scope, Production – meaning, factors of production such as land, labour, capital and management, properties of factor of production; law of returns; intensive and extensive agriculture, law of demand, relative prices and standard of living; Cooperation - meaning, principles of cooperation, land development banks: Agriculture-place in Five Year Plans; Extension Education, Extension Teaching and Learning. Extension and Rural Development Programmes: Including T and V system, National Demonstration, IRDP, Jawahar Rojgar Yozana.

UNIT-IV

Study of major breeds of cow, buffalo, goat, sheep, poultry and Pig; Physiology and anatomy of cow and buffalo; characteristics of good milch cow and buffalo, bulls and bullocks. Care and management of pregnant cow, poultry management. Principles of feeding of various classes of livestock and poultry. Clean milk production and maintenance of hygiene. Common medicines and vaccines used in treatment/prevention and control of animal diseases; handling of animals for treatment; castration. Operation flood, Milk and Milk products, Identification of Adult rated milk. Importance of farm's livestock and poultry in agriculture and Indian economy, Pathogenesis disease and vaccination. The antigens, antibiotics, antiseptics, disinfectants, The milk and its synthesis in mammary glands. Composition of milk of different species and colostrum. Details composition and physio-chemical properties of cow and buffalo's milk. Factors affecting quantity and chemical composition of milk. Chemistry of milk constituents viz. lactose, fat, protein, enzymes and vitamins. preservatives and adulterants of milk. Chemical changes occurring during storage of milk. Classification of common feeds and fodders, low-cost balanced feeds. Evaluation of energy and protein value of feed. Processing methods of animal feed stuffs. Processing of milk for filtration, clarification, bactofugation, standardization, homogenization, cream separation-centrifugation. Indigenous milk products- paneer, chhana, ghee, khoa, dahi. Other milk products- cream, butter, ice-cream, condensed milk, milk powder, cheese, dairy by products.

UNIT-V

Mendel's Law's of heredity, Chromosomal theory of inheritance, meiosis and mitosis, Linkage and crossing over - types, mechanism and significance, Nucleic acid as genetic material - structure, replication, genetic code and translation, Mutation - spontaneous and induced, Sex chromosomes and its determination in man and droisophila, sex linked characters. Mean as measures of central tendency-Mean, Median, Mode, Geometric Mean, Harmonic Mean, Weighted Range, Quartile Deviation, Variance, Standard Deviation and Coefficient of variation. Chemistry of Carbohydrates- Glucose, fructose, Galactose, Sucrose, Lactose, Maltose, Starch, Cellulose. Ammo acids, Lipids and fatty acids. Vitamin A, D, E, K, Thiamine, Riboflavin and Nicotinic acid, Plant growth substances, photoperiodism and verbalization, Insect Anatomy: Digestive, Excretory, Reproductive, Circulatory, Respiratory and Nervous systems of grasshopper, General introduction to Phylum Arthropoda, class Insecta, Mode of reproduction in crop plants in relation to breeding techniques. Genetic consequences of self and cross pollinated crops. Plant Introduction and exploration, Breeding self pollinated crops, population's improvement, Mass selection, recurrent selection. Breeding cross pollinated crops mass selection, pedigree, bulk and back cross methods. Classification of plant diseases according to cause and occurrence. Plant Pathogens: Fungi (Albugo, Erysiphe, Ustilago, Claviceps and Puccinia. Diagnostic characters of the following genera: Phytophthora, Peronospora, Sclerospora, Ustilago, Sphacelotheca, Tolyposporium, Melampsora, Alternaria, Cercospora, Fusarium, Helminthosporium, pyricularia, Rhizoctonia and Colletotrichum. Preliminary knowledge of hazards related to pesticide use, MRL, ADI, Mammalian Safety Ratio .Basic concept of Integrated Pest Management.