disease, black quarter, anthrax, Hemorrhagic septicaemia, mastitis, tick fever, milk fever, enterotoxaemia, salmonellosis, bird flue, fowl fox, and Ranikhet trypanosome & itching. **Dairy science-** Milk and milk products**-** Curd and ghee. Development and dairy industry in India- White revolution and operation flood.
Bio-Waste Management and Government: Utilization of animals in Bio-wastes and Biogas plant, Important government schemes for development of livestock dairy and pourity in India. Their important features and eligibility criteria.

BIOLOGY

Definition, branches, study area and importance in agriculture.

Section-I Botany **(25 questions)**

Unit– A

Taxonomy and classification of plants: Genus, species, binomial nomenclature, brief history of classification. Salient features and classification of plants into major groups- Algae, Bryophyta, Pteridophyta, Gymnospermae and Angiospermae, Angiosperms- Classification upto class, characteristic features and examples.

Morphology and anatomy of angiosperm plant- Morphology and modifications, internal morphology of different parts of flowering plants: root, stem, leaf, inflorescence, flower, fruit and seed. **External morphology of angiosperm Plant-** Root, stem, leaf, inflorescence, flower, fruit, seed and modification. **Anatomy of flowering plants-**Anatomy and functions of different tissues. **Plant tissue-** Definition, character & classification, meristematic tissue-Type and character. Tissue system- Epidermal, ground and vascular tissue system, internal structure of root, stem and leaf, secondary growth of root & stem. Permanent and special tissue.

Sexual reproduction in flowering plants- Flower structure, development of male and female gametophytes, pollination - Types, agencies and examples, outbreeding devices, pollen-pistil interaction, double fertilization, post fertilization events- Development of endosperm and embryo, development of seed and formation of fruit, special modes-Apomixis, parthenocarpy, polyembryony, significance of seed dispersal and fruit formation.

The Cell: The unit of life- Definitionl, cell theory and cell as the basic unit of life. Electron Microscopic structure of cell. Prokaryotic and eukaryotic cells. Plant and animal cells. Cell organelles and their functions-Nucleus (including DNA and RNA structure), mitochondria, chloroplast, endoplasmic reticulum, golgi complex, lysosomes, microbodies, microfilaments, ribosomes, centriole, cell wall, cilia and flagella, vacuoles, cell inclusions-starch grains, mineral crystals. **Cell division-** Amitosis, mitosis and meiosis. Comparison of mitosis and meiosis. Significance of meiosis, cell cycle.

Genetics- Mendel's experiments with pea and the reasons for his success. Mendel's laws of inheritance, mono and dihybrid crosses. Chromosome structure and morphology, chromosomes and genes, chromosome hypothesis. Linkages and crossing over. Mutations. Sex determination, genetic code, transcription and translation. Chromosomal disorder.

Plant Physiology: (i) **Transport in Plants-**Movement of water, gases and nutrients; cell to cell transport, diffusion, facilitated diffusion, active transport, plant water relation, semi permeable membranes, osmosis, diffusion, diffusion pressure deficit (DPD), water potential, plasmolysis. Transpiration-Types, factors affecting rate of transpiration. Guttation. Absorption of water, active and passive absorption of water and minerals. (ii) **Ascent of sap-** Path of ascent of sap, theories explaining ascent of sap. (iii) **Mineral nutrition**-Role of minerals in plant growth, macro and micro nutrient, trace elements and their importance. (iv) **Enzymes-** Introduction, enzymes as bio-catalysts, nature, classification and mode of enzyme action. (v) **Respiration-** Definition, comparison of respiration and fire. Types of respiration-

Aerobic, anaerobic and fermentation processes. Respiratory substrate, respiratory quotient, respiration sites. Mechanism of aerobic and anaerobic respiration. Glycolysis, Kreb cycle and alcoholic fermentation, Electron transport chain and oxidative phosphorylation. Energy yield (kilo calories). Factors affecting respiration. (vi) **Photosynthesis-** Definition, role of water, chlorophyll and carbon-di-oxide, light and dark reactions, photophosphorylation, Hill reaction, red drop, two pigment system, Calvin cycle, photorespiration, chemosynthesis (brief account). Factors affecting photosynthesis. (vii) **Growth-** Definition, phases of growth, plant hormones (auxins, gibberellins, cytokinin and ethylene) and growth regulation, action on various physiological processes. Factors affecting growth.

Unit – B

Ecology and Environment- Definition of ecology and environment. Environmental factors climatic, edaphic and biotic. Plant communities and their characteristics (density, frequency and abundance). Interaction between environment and organism, ecosystem concept, trophic levels producers, consumers, decomposers, food chain and food web. Ecological pyramids.

Environmental Issues: Type of pollution, air pollution and its control, sound pollution, soil pollution, water pollution and its control, agrochemicals and their effects, solid waste management, radioactive waste management, greenhouse effect and climate change impact and mitigation, ozone layer depletion, deforestation-any one case study as success story addressing environmental issue(s). Global climatic change, global warming, stratospheric zone depletion, acid rain, alnino effect. Classification of natural resources, conservation & management of rain water, soil, soil moisture, energy minerals and sea resources. **Forest resources-** Importance, forest resources in India, deforestation, forest conservation and management (Chipko movement & social forestry) **Biodiversity-** Concept, patterns, importance, loss of biodiversity, biodiversity conservation in Rajasthan.

Unit – C

Economic Botany and Human Welfare- Domestication of plants-historical account, improvement of crop plants-plant breeding and plant introduction. Economic botany (botanical name, family, plant parts used and uses) of the following: **Cereals-** Wheat, rice, maize and barley, **Millets-** Bajra and sorghum, **Pulses-** Gram, blackgram, pigeonpea, cowpea, mothbean and greengram, **Fibres -** Cotton and sunnhemp, **Oil seeds -** Groundnut, rapeseed, linseed, sunflower, mustard and castor, **Cash crop-** sugarcane, potato and clusterbean, **Fruits -** Mango and banana, **Medicinal plants-** Guggal, sarpagandha, belladonna, opium and isabgol. **Spices: -** Cumin, coriander, fennel and fenugreek. Use of bio-fertilizers, economic and ecological aspects. Use of pesticides: advantages and hazards,

Unit-D

Biotechnology and Its Applications

Biotechnology: General introduction- Definition, history scope of biotechnology & importance for different fields. **Principles and processes-** Genetic engineering (recombinant DNA technology)- definition, discovery, general method & equipment, enzyme & cloning vector, plasmid, bactriophase, cosmid, gene library, gene bank. **Biotechnology and its Application-**Application of biotechnology in health and agriculture, human insulin and vaccine production, stem cell technology, gene therapy, genetically modified organisms - Bt crops, transgenic animals, biosafety issues, bio piracy and patents. **Plant tissue culture -** Definition, history, **Essential equipment-** Type of culture, step of tissue culture, achievement in plant tissue culture. Different method for gene transfer in plant. Transgenic plant, genetically modified crops and food.

Unit-E

Major disease of crop and their control: Classification of diseases- i) on the basis of pathogen, ii) on the basis of season, iii) on the basis of crops and iv) on the basis of nutrient deficiency**. Diseases of Kharif crops-** Downy mildew and green ear of pearl millet, cotton wilt, tikka disease of groundnut, peanut clump virus, bacterial blight of cotton, yellow vein mosaic of okra, early blight and leaf curl of

tomato**. Diseases of Rabi crops-** Wheat rust disease, white rust of mustard, loose smut and covered smut, little leaf of brinjal, blight and powdery mildew of cumin. **Diseases of Fruit crops in Rajasthan-** Citrus canker, powdery mildew of ber, guava wilt. Disease management method- Chemical, biological and mechanical.

Section – II Zoology **(15 questions)**

Unit-A

Animal Kingdom- salient features and classification of non-chordates animals up to phyla level and chordates up to class level. **Taxonomy and classification of animals-** Different steps of classification, system of bio-scientific classification. Peculiar characteristic of kingdom animalia. **Body organization and animal tissue-** Epithelial tissue, connective tissue, blood lymph, supporting tissues, bone, cartilage, muscular tissues, nervous. **External and internal morphology and internal structure of animals-** Amobea, earthworm cockroach in brief.

Unit-B

Invertebrates

(1) Animals and their economic importance with special reference to Agriculture;

(i) **Protozoa-** Amoeba, (ii) **Helminthes-** Soil Nematode and disease caused by nematode (molya, ear cockle, tund of wheat, root knot, (iii) **Annelida-** Earthworm, (iv) **Mollusca-** Snail & slug, (v) **Arthropoda** (various classes)- (a) Arachnida- Mites (b) Crustacea- Prawns, lobsters, (c) Diplopoda- Millipede (d) Chilopoda- Centipedes, (e) Insecta- Cockroach

(2) Important insects of crops and storage (general introduction, importance, host plants, losses, life cycle and their control)- (i) Red hairy caterpillar, (ii) White grub, (iii) Termites, (iv) Grass hopper, (v) Pod borers, (vi) Khapra beetle

Honey bee: Bee Keeping and it importance in agriculture.

(3) **Methods of insect control** (insect control: general introduction): (i) Physical and mechanical control (ii) Cultural control, (iii) Chemical control (pesticides, insecticide formulation, classification of insecticides, miticides, nematicides, rodenticides) and safe use of chemicals, (iv) Bio-control-predators and parasitoids, pheromone traps, *Trichoderma*, NPV, botanical insecticides. (v) Integrated pest management (vi) Sprayers and dusters.

Unit-C

Vertebrates

(i) **Nutrition in animals**– Nutritive elements of food, energy yielding chemicals, minerals and vitamins, balance diet.(ii) **Respiration in animals** – Gaseous exchange. (iii) **Circulation in animals**– Blood– Composition, blood groups, Rh-factor, blood coagulation. (iv) **Reproductive system** – Male and female reproductive system. (v) **Reproduction & development: (**a) Asexual & sexual reproduction in animals (b) Gametogenesis, spermatogenesis, structure of sperm, oogenesis and type of ovum, female reproductive cycle (c) Fertilization- external and internal fertilization. (d) Mechanism of fertilization.

CHEMISTRY

Unit–A **(10 questions)**

Basic concept of chemistry- Importance and scope of chemistry in daily life and agriculture. Measurements in chemistry- Significant figures and international units of measurement. Laws of chemical combination. Dalton's atomic theory- initial concept of elements, atoms and molecules. Avogadro hypothesis and its uses. Mole concept and Avogadro number. Initial concept of atomic weight, equivalent weight and molecular weight. Percentage composition, empirical formula and molecular formula. Stoichiometry of chemical reaction and calculation, limiting reagent.