



The examination shall have one question paper each for concerned major subject group. The questions will consist of 150 multiple choice objective type questions, each with four options.

- In each major subject group, 150 multiple choice, objective type questions would be serially numbered from 1-150 and will carry one mark each.
- Candidate will be required to choose the correct answer and mark in the OMR answer Sheet by darkening the corresponding circle/ bubble against the serial number of the question with black/ blue ink ball-point pen.
- For correct answer 1 mark will be given and for incorrect answer $-\frac{1}{4}$ mark will be deducted.

SYLLABUS FOR SKUAST-J ENTRANCE TEST FOR ADMISSION TO UNDERGRADUATE PROGRAMMES

Notes:

- Candidates applying for admission to B.V.Sc. & A.H. Programme have to select Physics, Chemistry, and Biology sections, respectively, in the Entrance Test.
- Candidates seeking admission to B.Sc. (Hons.) Agriculture, B.Sc. (Hons.) Horticulture, B. Tech. Biotechnology and B. Tech. Dairy Technology can select one from Biology/ Mathematics/Agriculture section besides Physics and Chemistry Sections in the Entrance Test.
- Candidates seeking admission to B. Tech. Agricultural Engineering have to select either Mathematics or Agriculture section besides Physics and Chemistry Sections in the Entrance Test.

PHYSICS

UNIT 1: PHYSICS AND MEASUREMENT

Units of measurements, System of Units, SI Units, fundamental and derived units, least count, significant figures, Errors in measurements, Dimensions of Physics quantities, dimensional analysis and its applications.

UNIT 2: KINEMATICS

The frame of reference, motion in a straight line. Position- time graph, speed and velocity; Uniform and non-uniform motion, average speed and instantaneous velocity, uniformly accelerated motion, velocity-time, position-time graph, relations for uniformly accelerated motion, Scalars and Vectors, Vector. Addition and subtraction, scalar and vector products, Unit Vector. Resolution of a Vector, Relative Velocity, Motion in a plane, Projectile Motion, Uniform Circular Motion.

UNIT 3: LAWS OF MOTION

Force and inertia, Newton's First Law of motion; Momentum, Newton's Second Law of motion, Impulses; Newton's Third Law of motion. Law of conservation of linear momentum and its applications. Equilibrium of concurrent forces.
Static and Kinetic friction, laws of friction, rolling friction.
Dynamics of uniform circular motion; centripetal force and its applications; vehicle on a level circular road, vehicle on a banked road.

UNIT 4: WORK, ENERGY AND POWER

Work done by a constant force and a variable force; kinetic and potential energies, work-energy theorem, power.
The potential energy of spring conservation of mechanical energy, conservative and non-conservative forces; motion in a vertical circle; Elastic and inelastic collisions in one and two dimensions.

UNIT 5: ROTATIONAL MOTION

Centre of the mass of a two-particle system, Centre of the mass of a rigid body; Basic concepts of rotational motion; moment of a force; torque, angular momentum, conservation of angular momentum and its applications.



The moment of inertia, the radius of gyration, values of moments of inertia for simple geometrical objects, parallel and perpendicular axes theorems and their applications. Equilibrium of rigid bodies, rigid body rotation and equations of rotational motion, comparison of linear and rotational motions.

UNIT 6: GRAVITATION

The universal Law of gravitation. Acceleration due to gravity and its variation with altitude and depth. Kepler's Law of planetary motion. Gravitational potential energy; gravitational potential. Escape velocity Motion of a satellite, orbital velocity, time period and energy of satellite.

UNIT 7: PROPERTIES OF SOLIDS AND LIQUIDS

Elastic behavior, Stress-strain relationship, Hooke's Law. Young's modulus, bulk modulus, modulus of rigidity. Pressure due to a fluid column; Pascal's Law and its applications. Effect of gravity on fluid pressure.

Viscosity, Stokes' Law, terminal velocity, streamline and turbulent flow. critical velocity, Bernoulli's principle and its applications.

Surface energy and surface tension, angle of contact, excess of pressure across a curved surface, application of surface tension-drops, bubbles and capillary rise. Heat, temperature, thermal expansion; specific heat capacity, calorimetry; change of state, latent heat, Heat transfer-conduction, convection and radiation.

UNIT 8: THERMODYNAMICS

Thermal equilibrium, Zeroth Law of thermodynamics, the concept of temperature. Heat, work and internal energy. The first law of thermodynamics, isothermal and adiabatic processes.

The second law of thermodynamics; reversible and irreversible processes.

UNIT 9: KINETIC THEORY OF GASES

Equation of state of a perfect gas, work done on compressing a gas, Kinetic theory of gases - assumptions, the concept of pressure. Kinetic interpretation of temperature; RMS speed of gas molecules; Degrees of freedom. Law of equipartition of energy and applications to specific heat capacities of gases; Mean free path. Avogadro's number.

UNIT 10: OSCILLATIONS AND WAVES

Oscillations and periodic motion - time period, frequency, displacement as a function of time. Periodic functions. Simple harmonic motion (S.H.M.) and its equation; phase; oscillations of a spring -restoring force and force constant; energy in S.H.M. - Kinetic and potential energies; Simple pendulum - derivation of expression for its time period;

Wave motion. Longitudinal and transverse waves, speed of travelling wave. Displacement relation for a progressive wave. Principle of superposition of waves, reflection of waves. Standing waves in strings and organ pipes, fundamental mode and harmonics, Beats.

UNIT 11: ELECTROSTATICS

Electric charges: Conservation of charge, Coulomb's Law forces between two point charges, forces between multiple charges; superposition principle and continuous charge distribution.

Electric field: Electric field due to a point charge, Electric field lines. Electric dipole, Electric field due to a dipole. Torque on a dipole in a uniform electric field.

Electric flux. Gauss's Law and its applications to find field due to infinitely long uniformly charged straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell. Electric potential and its calculation for a point charge, electric dipole and system of charges; potential difference, Equipotential surfaces, Electrical potential energy of a system of two point charges and of electric dipole in an electrostatic field.

Conductors and insulators. Dielectrics and electric polarization, capacitors and capacitances, the combination of capacitors in series and parallel, capacitance of a parallel plate capacitor with and without dielectric medium between the plates. Energy stored in a capacitor.



UNIT 12: CURRENT ELECTRICITY

Electric current. Drift velocity, mobility and their relation with electric current, Ohm's Law. Electrical resistance. V-I characteristics of ohmic and non-ohmic conductors. Electrical energy and power. Electrical resistivity and conductivity. Series and parallel combinations of resistors; Temperature dependence of resistance.

Internal resistance, potential difference and e.m.f of a cell, a combination of cells in series and parallel. Kirchhoff's Laws and their applications. Wheatstone bridge, Metre Bridge.

UNIT 13: MAGNETIC EFFECTS OF CURRENT AND MAGNETISM

Biot-Savart Law and its application to current carrying circular loop, Ampere's Law and its applications to infinitely long current carrying straight wire and solenoid, Force on a moving charge in uniform magnetic and electric fields.

Force on a current-carrying conductor in a uniform magnetic field. The force between two parallel currents carrying conductors-definition of ampere. Torque experienced by a current loop in a uniform magnetic field; Moving coil galvanometer, its sensitivity and conversion to ammeter and voltmeter.

Current loop as a magnetic dipole and its magnetic dipole moment. Bar magnet as an equivalent solenoid, magnetic field lines; Magnetic field due to a magnetic dipole (bar magnet) along its axis and perpendicular to its axis. Torque on a magnetic dipole in a uniform magnetic field. Para- dia- and ferromagnetic substances with examples, effect of temperature on magnetic properties.

UNIT 14: ELECTROMAGNETIC INDUCTION AND ALTERNATING CURRENTS

Electromagnetic induction: Faraday's Law, Induced emf and current; Lenz's Law, Eddy currents. Self and mutual inductance. Alternating currents, peak and RMS value of alternating current/ voltage; reactance and impedance; LCR series circuit, resonance; power in AC circuits, watt less current, AC generator and transformer.

UNIT 15: ELECTROMAGNETIC WAVES

Displacement current, Electromagnetic waves and their characteristics, Transverse nature of electromagnetic waves, Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, X-rays, Gamma rays), Applications of e.m. waves.

UNIT 16: OPTICS

Reflection of light, spherical mirrors, mirror formula. Refraction of light at plane and spherical surfaces, thin lens formula and lens maker formula. Total internal reflection and its applications. Magnification, Power of a Lens, Combination of thin lenses in contact, Refraction of light through a prism, Microscope and Astronomical Telescope (reflecting and refracting) and their magnifying powers.

Wave optics: wave front and Huygens' Principle, Laws of reflection and refraction using Huygens principle. Interference, Young's double-slit experiment and expression for fringe width, coherent sources and sustained interference of light. Diffraction due to a single slit, width of central maximum. Polarization, plane-polarized light; Brewster's Law, uses of plane-polarized light and Polaroid.

UNIT 17: DUAL NATURE OF MATTER AND RADIATION

Dual nature of radiation, Photoelectric effect, Hertz and Lenard's observations; Einstein's photoelectric equation; particle nature of light, Matter waves-wave nature of particle, de Broglie relation.

UNIT 18: ATOMS AND NUCLEI

Alpha-particle scattering experiment; Rutherford's model of atom; Bohr model, energy levels, hydrogen spectrum. Composition and size of nucleus, atomic masses, Mass-energy relation, mass defect; binding energy per nucleon and its variation with mass number, nuclear fission and fusion.



UNIT 19: ELECTRONIC DEVICES

Semiconductors; semiconductor diode; 1-V characteristics in forward and reverse bias; diode as a rectifier; 1-V characteristics of LED, the photodiode, solar cell and Zener diode; Zener diode as a voltage regulator. Logic gates (OR. AND. NOT. NAND and NOR).

UNIT 20: EXPERIMENTAL SKILLS

Familiarity with the basic approach and observations of the experiments and activities;

1. Vernier calipers-its use to measure the internal and external diameter and depth of a vessel.
2. Screw gauge-its use to determine thickness/ diameter of thin sheet/wire.
3. Simple Pendulum-dissipation of energy by plotting a graph between the square of amplitude and time.
4. Metre Scale - the mass of a given object by the principle of moments.
5. Young's modulus of elasticity of the material of a metallic wire.
6. Surface tension of water by capillary rise and effect of detergents.
7. Co-efficient of Viscosity of a given viscous liquid by measuring terminal velocity of a given spherical body.
8. Speed of sound in air at room temperature using a resonance tube.
9. Specific heat capacity of a given (i) solid and (ii) liquid by method of mixtures.
10. The resistivity of the material of a given wire using a metre bridge.
11. The resistance of a given wire using Ohm's Law.
12. Resistance and figure of merit of a galvanometer by half deflection method.
13. The focal length of;
 - i. Convex mirror
 - ii. Concave mirror and
 - iii. Convex lens, using the parallax method.
14. The plot of the angle of deviation v/s angle of incidence for a triangular prism.
15. Refractive index of a glass slab using a travelling microscope.
16. Characteristic curves of a p-n junction diode in forward and reverse bias.
17. Characteristic curves of a Zener diode and finding reverse breakdown voltage.
18. Identification of Diode. LED. Resistor. A capacitor from a mixed collection of such items.

CHEMISTRY

UNIT 1: SOME BASIC CONCEPTS IN CHEMISTRY

Matter and its nature, Dalton's atomic theory; Concept of atom, molecule, element and compound; Laws of chemical combination; Atomic and molecular masses, mole concept, molar mass, percentage composition, empirical and molecular formulae; Chemical equations and stoichiometry.

UNIT 2: ATOMIC STRUCTURE

Nature of electromagnetic radiation, photoelectric effect; Spectrum of the hydrogen atom. Bohr model of a hydrogen atom-its postulates, derivation of the relations for the energy of the electron and radii of the different orbits, limitations of Bohr's model; Dual nature of matter, de Broglie's relationship. Heisenberg uncertainty principle. Elementary ideas of quantum mechanics, quantum mechanics, the quantum mechanical model of the atom, its important features. Concept of atomic orbitals as one-electron wave functions; Variation of ψ and ψ^2 with r for 1s and 2s orbitals; various

Quantum numbers (principal, angular momentum and magnetic quantum numbers) and their significance; shapes of s, p and d-orbitals, electron spin and spin quantum number; Rules for filling electrons in orbitals–Aufbau principle. Pauli's exclusion principle and Hund's rule, electronic configuration of elements, extra stability of half-filled and completely filled orbitals.



UNIT 3: CHEMICAL BONDING AND MOLECULAR STRUCTURE

Kossel-Lewis approach to chemical bond formation, the concept of ionic and covalent bonds. Ionic Bonding; Formation of ionic bonds, factors affecting the formation of ionic bonds; calculation of lattice enthalpy.

Covalent Bonding: Concept of electronegativity. Fajan's rule, dipole moment; Valence Shell Electron Pair Repulsion (VSEPR) theory and shapes of simple molecules.

Quantum mechanical approach to covalent bonding: Valence bond theory-its important features. The concept of hybridization involving s, p and d orbitals; Resonance.

Molecular Orbital Theory-Its important features. LCAOs, types of molecular orbitals (bonding, anti-bonding), sigma and pi-bonds, molecular orbital electronic configurations of homo nuclear di atomic molecules, the concept of bond order, bond length and bond energy. Elementary idea of metallic bonding. Hydrogen bonding and its applications.

UNIT 4: CHEMICAL THERMODYNAMICS

Fundamentals of thermodynamics: System and surroundings, extensive and intensive properties, state functions, types of processes.

The first Law of thermodynamics: Concept of work, heat internal energy and enthalpy, heat capacity, molar heat capacity; Hess's Law of constant heat summation; Enthalpies of bond dissociation, combustion, formation, atomization, sublimation, phase transition, hydration, ionization and solution.

The second law of thermodynamics: Spontaneity of processes; ΔS of the universe and ΔG of the system as criteria for spontaneity. ΔG^0 (Standard Gibbs energy change) and equilibrium constant.

UNIT 5: SOLUTIONS

Different methods for expressing the concentration of solution-molality, molarity, mole fraction. Percentage (by volume and mass both), the vapour pressure of solutions and Raoult's Law-Ideal and non-ideal solutions, vapour pressure-composition, plots for ideal and non-ideal solutions; Colligative properties of dilute solutions-a relative lowering of vapour pressure, depression of freezing point, the elevation of boiling point and osmotic pressure; Determination of molecular mass using colligative properties; Abnormal value of molar mass, van't Hoff factor and its significance.

UNIT 6: EQUILIBRIUM

Meaning of equilibrium, the concept of dynamic equilibrium.

Equilibria involving physical processes; Solid-liquid, liquid-gas and solid-gas equilibria, Henry's Law. General characteristics of equilibrium involving physical processes.

Equilibrium involving chemical processes: Law of chemical equilibrium, equilibrium constants (K_p and K_c) and their significance, the significance of ΔG and ΔG^0 in chemical equilibrium, factors affecting equilibrium concentration, pressure, temperature, the effect of catalyst; Le Chatelier's principle.

Ionic equilibrium: Weak and strong electrolytes, ionization of electrolytes, various concepts of acids and bases (Arrhenius. Bronsted -Lowry and Lewis) and their ionization, acid-base equilibria (including multistage ionization) and ionization constants, ionization of water. pH scale, common ion effect, hydrolysis of salts and pH of their solutions, the solubility of sparingly soluble salts and solubility products, buffer solutions.

UNIT 7: REDOX REACTIONS AND ELECTROCHEMISTRY

Electronic concepts of oxidation and reduction, redox reactions oxidation number, rules for assigning oxidation number, balancing of redox reactions.

Electrolytic and metallic conduction, conductance in electrolytic solutions, molar conductivities and their variation with concentration; Kohlrausch's Law and its applications.

Electrochemical cells - Electrolytic and Galvanic cells, different types of electrodes, electrode potentials including standard electrode potential. Half -cell and cell reactions, emf of a Galvanic cell and its measurement; Nernst equation and its applications; Relationship between cell potential and Gibbs' energy change; Dry cell and lead accumulator; Fuel cells.



UNIT 8: CHEMICAL KINETICS

Rate of a chemical reaction, factors affecting the rate of reactions; concentration, temperature, pressure and catalyst; elementary and complex reactions, order and molecularity of reactions, rate law, rate constant and its units, differential and integral forms of zero and first-order reactions, their characteristics and half - lives, the effect of temperature on the rate of reactions. Arrhenius theory, activation energy and its calculation, collision theory of bimolecular gaseous reactions (no derivation).

INORGANIC CHEMISTRY

UNIT 9: CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES

Modern periodic law and present form of the periodic table, s,p,d and f block elements, periodic trends in properties of elements atomic and ionic radii. Ionization enthalpy, electron gain enthalpy. valence, oxidation states and chemical reactivity.

UNIT 10: P-BLOCK ELEMENTS

Group-13 to Group 18 Elements

General Introduction: Electronic configuration and general trends in physical and chemical properties of elements across the periods and down the groups; unique behavior of the first element in each group.

UNIT 11: d-and f- BLOCK ELEMENTS

Transition Elements

General introduction, electronic configuration, occurrence and characteristics, general trends in properties of the first – row transition elements – physical properties, ionization enthalpy, oxidation states. Atomic radii, colour, catalytic behaviour, magnetic properties, complex formation, interstitial compounds, alloy formation; Preparation, properties and uses of $K_2Cr_2O_7$ and $KMnO_4$.

Inner Transition Elements

Lanthanoids- Electronic configuration, oxidation states and lanthanoid contraction.

Actinoids- Electronic configuration and oxidation states.

UNIT 12: CO-ORDINATION COMPOUNDS

Introduction to coordination compounds. Werner's theory; ligands, coordination number, denticity. chelation; IUPAC nomenclature of mononuclear co-ordination compounds, isomerism; Bonding-Valence bond approach and basic ideas of Crystal field theory, colour and magnetic properties; Importance of co-ordination compounds (in qualitative analysis, extraction of metals and in biological systems).

ORGANIC CHEMISTRY

UNIT 13: PURIFICATION AND CHARACTERIZATION OF ORGANIC COMPOUNDS

Purification- Crystallization, sublimation, distillation, differential extraction and chromatography – principles and their applications.

Qualitative analysis – Detection of nitrogen, sulphur, phosphorus and halogens.

Quantitative analysis (basic principles only) –Estimation of carbon, hydrogen, nitrogen, halogens, sulphur, phosphorus.

Calculations of empirical formulae and molecular formulae; numerical problems inorganic quantitative analysis,

UNIT 14: SOME BASIC PRINCIPLES OF ORGANIC CHEMISTRY

Tetravalency of carbon: Shapes of simple molecules –hybridization (s and p); Classification of organic compounds based on functional groups; and those containing halogens, oxygen, nitrogen and sulphur; Homologous series; Isomerism – structural and stereoisomerism.



Nomenclature (Trivial and IUPAC)

Covalent bond fission- Homolytic and heterolytic; free radicals, carbocations, and carbanions; stability of carbocations and free radicals, electrophiles and nucleophiles.

Electronic displacement in a covalent bond

Inductive effect, electrometric effect, resonance and hyper conjugation.

Common types of organic reactions - Substitution, addition, elimination and rearrangement.

UNITS 15: HYDROCARBONS

Classification. isomerism, IUPAC nomenclature, general methods of preparation, properties and reactions.

Alkanes - Conformations; Sawhorse and Newman projections (of ethane); Mechanism of halogenation of alkanes.

Alkenes-Geometrical isomerism; Mechanism of electrophilic addition; addition of hydrogen, halogens, water, hydrogen halides (Markownikoffs and peroxide effect); Ozonolysis and polymerization.

Alkynes - Acidic character; Addition of hydrogen, halogens, water and hydrogen halides; Polymerization.

Aromatic hydrocarbons- Nomenclature, benzene –structure and aromaticity; Mechanism of electrophilic substitution; halogenation, nitration.

Friedel - Craft's alkylation and acylation, directive influence of the functional group in mono - substituted benzene.

UNIT 16: ORGANIC COMPOUNDS CONTAINING HALOGENS

General methods of preparation, properties and reactions; Nature of C-X bond; Mechanisms of substitution reactions.

Uses; Environmental effects of chloroform, iodoform freons and DDT.

UNIT 17: ORGANIC COMPOUNDS CONTAINING OXYGEN

General methods of preparation, properties, reactions and uses.

ALCOHOLS, PHENOLS AND ETHERS

Alcohols: Identification of primary, secondary and tertiary alcohols; mechanism of dehydration.

Phenols: Acidic nature, electrophilic substitution reactions; halogenation. nitration and sulphonation. Reimer –Tiemann reaction.

Ethers: Structure.

Aldehyde and Ketones: Nature of carbonyl group; Nucleophilic addition to $>C=O$ group, relative reactivities of aldehydes and ketones; Important reactions such as –Nucleophilic addition reactions (addition of HCN. NH_3 and its derivatives), Grignard reagent; oxidation; reduction (Wolf Kishner and Clemmensen); the acidity of α -hydrogen, aldol condensation, Cannizzaro reaction. Haloform reaction, Chemical tests to distinguish between aldehydes and Ketones. Carboxylic Acids

Acidic strength and factors affecting it

UNIT 18: ORGANIC COMPOUNDS CONTAINING NITROGEN

General methods of preparation. Properties, reactions and uses.

Amines: Nomenclature, classification structure, basic character and identification of primary, secondary and tertiary amines and their basic character.

Diazonium Salts: Importance in synthetic organic chemistry.

UNIT 19: BIOMOLECULES

General introduction and importance of biomolecules.

CARBOHYDRATES - Classification; aldoses and ketoses; monosaccharides (glucose and fructose) and constituent monosaccharides of oligosaccharides (sucrose, lactose and maltose).

PROTEINS- Elementary Idea of α -amino acids, peptide bond, polypeptides. Proteins; primary, secondary, tertiary and quaternary structure (qualitative idea only), denaturation of



proteins, enzymes.

VITAMINS- Classification and functions.

NUCLEIC ACIDS-Chemical constitution of DNA and RNA.

Biological functions of nucleic acids.

Hormones (General introduction)

UNIT 20: PRINCIPLES RELATED TO PRACTICAL CHEMISTRY

- Detection of extra elements (Nitrogen, Sulphur, halogens) in organic compounds; Detection of the following functional groups; hydroxyl (alcoholic and phenolic), carbonyl (aldehyde and ketones) carboxyl and amino groups inorganic compounds.
- The chemistry involved in the preparation of the following;
Inorganic compounds: Mohr's salt, potash alum.
Organic compounds: Acetanilide, p-nitro acetanilide aniline yellow, iodoform.
- The chemistry involved in the titrimetric exercises- Acids, bases and the use of indicators, oxalic-acid vs KMnO_4 . Mohr's salt vs KMnO_4
- Chemical principles involved in the qualitative salt analysis;
Cations- Pb^{2+} , Cu^{2+} , Al^{3+} , Fe^{3+} , Zn^{2+} , Ni^{2+} , Ca^{2+} , Ba^{2+} , Mg^{2+} , NH_4^+
Anions- CO_3^{2-} , S^{2-} , SO_4^{2-} , NO_3^- , NO_2^- , Cl^- , Br^- , I^- (In soluble salts excluded).
Chemical principles involved in the following experiments;
 1. Enthalpy of solution of CuSO_4
 2. Enthalpy of neutralization of strong acid and strong base.
 3. Preparation of lyophilic and lyophobic sols.
 4. Kinetic study of the reaction of iodide ions with hydrogen peroxide at room temperature.

BIOLOGY

UNIT 1: DIVERSITY IN LIVING WORLD

- What is living?; Biodiversity; Need for classification; Taxonomy & Systematics; Concept of species and taxonomical hierarchy; Binomial nomenclature.
- Five kingdom classification; salient features and classification of Monera; Protista and Fungi into major groups; Lichens; Viruses and Viroids.
- Salient features and classification of plants into major groups- Algae, Bryophytes, Pteridophytes, Gymnosperms (three to five salient and distinguishing features and at least two examples of each category);
- Salient features and classification of animals-nonchordate up to phyla level and chordate up to classes level (three to five salient features and at least two examples).

UNIT 2: STRUCTURAL ORGANISATION IN ANIMALS AND PLANTS

- Morphology and modifications; Tissues; Anatomy and functions of different parts of flowering plants; Root, stem, leaf, inflorescence- cymose and racemose, flower, fruit and seed (To be dealt along with the relevant practical of the Practical Syllabus) Family (malvaceae, Cruciferae, leguminosae, compositae, gramineae).
- Animal tissues; Morphology, anatomy and functions of different systems (digestive, circulatory, respiratory, nervous and reproductive) of an insect (Frog). (Brief account only)

UNIT 3: CELL STRUCTURE AND FUNCTION

- Cell theory and cell as the basic unit of life; Structure of prokaryotic and eukaryotic cell; Plant cell and animal cell; Cell envelope, cell membrane, cell wall; Cell organelles- structure and function; Endomembrane system-endoplasmic reticulum, Golgi bodies, lysosomes, vacuoles; mitochondria, ribosomes, plastids, micro bodies; Cytoskeleton. cilia, flagella, centrioles (ultrastructure and function); Nucleus-nuclear membrane, chromatin, nucleolus.



- Chemical constituents of living cells; Biomolecules-structure and function of proteins, carbohydrates, lipids, nucleic acids; Enzymes-types, properties, enzyme action, classification and nomenclature of enzymes.
- B Cell division: Cell cycle, mitosis, meiosis and their significance.

UNIT 4: PLANT PHYSIOLOGY

- Photosynthesis: Photosynthesis as a means of Autotrophic nutrition; Site of photosynthesis take place; pigments involved in Photosynthesis (Elementary idea); Photochemical and biosynthetic phases of photosynthesis; Cyclic and non-cyclic and photophosphorylation; Chemiosmotic hypothesis; Photorespiration C₃ and C₄ pathways; Factors affecting photosynthesis.
- Respiration: Exchange gases; Cellular respiration-glycolysis, fermentation (anaerobic), TCA cycle and electron transport system (aerobic); Energy relations- Number of ATP molecules generated; Amphibolic pathways; Respiratory quotient.
- Plant growth and development: Seed germination; Phases of Plant growth and plant growth rate; Conditions of growth; Differentiation, dedifferentiation and redifferentiation. Sequence of developmental process in a plant cell; Growth regulators- auxin, gibberellin, cytokinin, ethylene, ABA.

UNIT 5: HUMAN PHYSIOLOGY

- Breathing and Respiration: Respiratory organs in animals (recall only); Respiratory system in humans; Mechanism of breathing and its regulation in humans- Exchange of gases, transport of gases and regulation of respiration Respiratory volumes; Disorders related to respiration-Asthma, Emphysema, Occupational respiratory disorders.
- Body fluids and circulation: Composition of blood, blood groups, coagulation of blood; Composition of lymph and its function; Human circulatory system-Structure of human heart and blood vessels; Cardiac cycle, cardiac output, ECG. Double circulation; Regulation of cardiac activity; Disorders of circulatory system-Hypertension, Coronary artery disease, Angina pectoris, Heart failure.
- Excretory products and their elimination: Modes of excretion- Ammonotelism, ureotelism, uricotelism; Human excretory system-structure and function; Urine formation, Osmoregulation; Regulation of kidney function-Renin-angiotensin, Atrial Natriuretic Factor, ADH and Diabetes insipidus; Role of other organs in excretion; Disorders; Uraemia, Renal failure, Renal calculi, Nephritis; Dialysis and artificial kidney.
- Locomotion and Movement: Types of movement- ciliary, flagellar, muscular; Skeletal muscle-contractile proteins and muscle contraction; Skeletal system and its functions (To be dealt with the relevant practical of Practical syllabus); Joints; Disorders of muscular and skeletal system-Myasthenia gravis, Tetany, Muscular dystrophy, Arthritis, Osteoporosis, Gout.
- Neural control and coordination: Neuron and nerves; Nervous system in humans-central nervous system, peripheral nervous system and visceral nervous system; Generation and conduction of nerve impulse.
- Chemical coordination and regulation: Endocrine glands and hormones; Human endocrine system-Hypothalamus, Pituitary, Pineal, Thyroid, Parathyroid, Adrenal, Pancreas, Gonads; Mechanism of hormone action (Elementary Idea); Role of hormones as messengers and regulators. Hypo- and hyperactivity and related disorders (Common disorders e.g. Dwarfism, Acromegaly, Cretinism, goiter, exophthalmic goiter, diabetes, Addison's disease).

(Imp. Diseases and disorders mentioned above to be dealt in brief.)

UNIT 6: REPRODUCTION

- 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 and fruit formation.

- Human Reproduction: Male and female reproductive systems: Microscopic anatomy of testis and ovary; Gametogenesis-spermatogenesis & oogenesis; Menstrual cycle. Fertilisation. embryo development upto blastocyst formation, implantation; Pregnancy and placenta formation (Elementary idea); Parturition (Elementary idea); Lactation (Elementary idea).
- Reproductive health: Need for reproductive health and prevention of sexually transmitted diseases (STD); Birth control-Need and Methods. Contraception and Medical Termination of Pregnancy(MTP); Amniocentesis; Infertility and assisted reproductive technologies — IVF, ZIFT, GIFT (Elementary idea for general awareness).

UNIT 7: GENETICS AND EVOLUTION

Heredity and variation; Mendelian Inheritance: Deviations from Mendelism- Incomplete dominance. Co-dominance. Multiple alleles and Inheritance of blood groups. Pleiotropy. Elementary idea of polygenic inheritance; Chromosome theory of inheritance; Chromosomes and genes; Sex determination-In humans, birds, honey bee; Linkage and crossing over; Sex linked inheritance-Haemophilia, Colour blindness; Mendelian disorders in humans-Thalassemia; Chromosomal disorders in humans; Down's syndrome, Turner's and Klinefelter's syndromes.

Molecular basis of Inheritance; Search for genetic material and DNA as genetic material; Structure of DNA and RNA; DNA packaging; DNA replication. Central dogma; Transcription. genetic code. translation; Gene expression and regulation- Lac Operon; Genome and human genome project; DNA finger printing, protein biosynthesis.

Evolution: Origin of life; Biological evolution and evidences for biological evolution from Paleontology, comparative anatomy, embryology and molecular evidence; Darwin's contribution. Modern Synthetic theory of Evolution; Mechanism of evolution- Variation (Mutation and Recombination) and Natural Selection with examples, types of natural selection; Gene flow and genetic drift; Hardy-Weinberg's principle; Adaptive Radiation; Human evolution.

UNIT 8: BIOLOGY AND HUMAN WELFARE

Health and Disease; Pathogens; parasites causing human diseases (Malaria. Filariasis. Ascariasis. Typhoid. Pneumonia. common cold. amoebiasis. ring worm. dengue. chikungunya); Basic concepts of immunology-vaccines; Cancer, HIV and AIDS; Adolescence. drug and alcohol abuse, Tobacco abuse

Microbes in human welfare; In household food processing, industrial production, sewage treatment, energy generation and as bio control agents and bio fertilizers.

UNIT 9: BIOTECHNOLOGY AND ITS APPLICATIONS

Principles and process of Biotechnology - Genetic engineering (Recombinant DNA technology)

Application of Biotechnology in health and agriculture; Human insulin and vaccine production. gene therapy; Genetically modified organisms-Bt crops; Transgenic Animals; Biosafety issues- Biopiracy and patents.

UNIT 10: ECOLOGY AND ENVIRONMENT

Organisms and environment Population interactions- mutualism, competition, predation. parasitism; Population attributes-growth, birth rate and death rate, age distribution.

- Ecosystem; Pattern, components. productivity and decomposition; Energy flow; Pyramids of number, biomass, energy
- Biodiversity and its conservation; Concept of biodiversity; Patterns of Biodiversity; Importance of Biodiversity; Loss of Biodiversity; Biodiversity conservation; Hotspots, endangered organisms. extinction, Red Data Book. biosphere reserves, National parks and sanctuaries, Sacred Groves.



AGRICULTURE

UNIT-1. AGRONOMY

20 marks

Cultivation of common crops-wheat, paddy, cotton, jowar, bajra, maize, soybean, arhar, mustard, sunflower, pea, groundnut, gram, tobacco, barseem, potato and sugarcane under the following heads: Recommended varieties and their main characteristics, suitable areas, seed rate, time and method of sowing, irrigation, fertilizer use, control of weeds, insect-pests and diseases, harvesting, processing and yield. Soils-origin and classification loam, silt, clay, sandy loam, etc.; physical and chemical properties; soil conservation. Use of fertilizers, essential nutrients- nitrogen, phosphorus and potassium uptake by different crops, organic and inorganic fertilizers and their effects on crops and soil, methods of using fertilizers, farmyard manure, composting, green manuring, study of organic and inorganic fertilizers/manures. Pollution of soil, water and air in modern agriculture and remedial measures.

Irrigation and Drainage - water requirement of crops, measurement of water discharge, prevention of loss of water; quality of water; different methods of irrigation - flooding, basin method, border /strip method, sprinkler and drip irrigation - their advantages and limitations. Necessity for drainage, damage to soil and crops due to excess moisture, prevention of formation of acidic and alkaline soils and their management; natural calamities- floods and drought and their management.

UNIT-2. HORTICULTURE

10 marks

Study of following horticultural crops including recommended varieties and their main features, suitability for different regions, time and method of sowing, fertilizer use, irrigation, diseases and pests and their control.

Crops- cabbage, cauliflower, onion, garlic, cucurbits, bittergourd, bottlegourd, muskmelon, squash, ridgegourd; root crops-carrot, radish sweet potato, turnip; peas, tomato, bringal, lady's finger, spices; fruit crops such as banana, apple, mango, litchi, citrus, guava, papaya, peach etc.

UNIT-3. AGRICULTURAL ENGINEERING

10 marks

Type of iron and steel, wood, plastic and tin used in agricultural implements and their forms & properties. Study of different types of ploughs-their merits and demerits; mechanical devices such as cultivator, harrow, sprayer, seed drill, threshers etc. 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, intercultural, equipment for intercultural.

Power transmission through belts, pullies and gears, questions relating to number of teeth in gears according to speed and size of pullies, hand operated chaff cutters, cane crusher etc., draught and its measurement.

UNIT-4. AGRICULTURAL ECONOMICS

10 marks

Introductory agricultural economics-meaning and scope, significance of agricultural economics in national planning. Production - meaning, factors of production such as land, labour, capital and management, properties of factor of production; law of returns; intensive and extensive agriculture; Exchange - meaning, types, advantages; types of markets, general price determination; money and credit; banks and their functions; principle of international trade, Distribution-meaning, rent, wages, interest and profit; Consumption -meaning, wants and their properties, law of diminishing marginal utility, law of demand, relative prices and standard of living; Cooperation - meaning, principles of cooperation, types of cooperative societies in agriculture, single purpose and multi-purpose cooperative societies, land development banks: Agriculture-place in Five Year Plans; statistics of agricultural production in the State; Major programmes of agricultural development.

UNIT-5. ANIMAL HUSBANDRY AND VETERINARY SCIENCE

10 marks

Study of major breeds of cows, buffaloes, goat, sheep and poultry; elementary physiology and anatomy of cows and bullocks; estimate of their age; characteristics of good milch cows and buffaloes, bulls and bullocks. Care and management of pregnant cow, during calving, newborn calves, young



calves, mulch cows; poultry management. Principles of feeding of various classes of livestock and poultry. Economic feeds for various classes of livestock and poultry. Clean milk production and maintenance of hygiene. Common medicines and vaccines used in treatment/prevention of animal diseases; handling of animals for treatment; castration. Operation flood, Milk and Milk products, Identification of Adult rated milk. Note: Questions from similar topics can also be included.

MATHEMATICS

UNIT 1: SETS, RELATIONS AND FUNCTIONS:

Sets and their representation: Union, intersection and complement of sets and their algebraic properties; Power set; Relation, Type of relations, equivalence relations, functions; one-one, into and onto functions, the composition of functions.

UNIT 2: COMPLEX NUMBERS AND QUADRATIC EQUATIONS:

Complex numbers as ordered pairs of reals, Representation of complex numbers in the form $a + ib$ and their representation in a plane, Argand diagram, algebra of complex number, modulus and argument (or amplitude) of a complex number, square root of a complex number, triangle inequality, Quadratic equations in real and complex number system and their solutions Relations between roots and co-efficient, nature of roots, the formation of quadratic equations with given roots.

UNIT 3: MATRICES AND DETERMINANTS:

Matrices, algebra of matrices, type of matrices, determinants and matrices of order two and three, properties of determinants, evaluation of determinants, area of triangles using determinants, Adjoint and evaluation of inverse of a square matrix using determinants and elementary transformations, Test of consistency and solution of simultaneous linear equations in two or three variables using determinants and matrices.

UNIT 4: PERMUTATIONS AND COMBINATIONS:

The fundamental principle of counting, permutation as an arrangement and combination as Section, Meaning of $P(n,r)$ and $C(n,r)$, simple applications.

UNIT 5: MATHEMATICAL INDUCTIONS:

Principle of Mathematical Induction and its simple applications.

UNIT 6: BINOMIAL THEOREM AND ITS SIMPLE APPLICATIONS:

Binomial theorem for a positive integral index, general term and middle term, properties of Binomial coefficients and simple applications.

UNIT 7: SEQUENCE AND SERIES:

Arithmetic and Geometric progressions, insertion of arithmetic, geometric means between two given numbers, Relation between A.M and G.M sum up to n terms of special series; S_n , S_{n2} , S_{n3} . Arithmetico-Geometric progression.

UNIT 8: LIMIT, CONTINUITY AND DIFFERENTIABILITY:

Real-valued functions, algebra of functions, polynomials, rational, trigonometric, logarithmic and exponential functions, inverse function. Graphs of simple functions. Limits, continuity and differentiability. Differentiation of the sum, difference, product and quotient of two functions. Differentiation of trigonometric, inverse trigonometric, logarithmic, exponential, composite and implicit functions; derivatives of order up to two, Rolle's and Lagrange's Mean value Theorems, Applications of derivatives; Rate of change of quantities, monotonic- Increasing and decreasing functions, Maxima and minima of functions of one variable, tangents and normal.

UNIT 9: INTEGRAL CALCULAS:

Integral as an anti-derivative, Fundamental Integrals involving algebraic, trigonometric, exponential and logarithms functions. Integrations by substitution, by parts and by partial Functions. Integration using trigonometric identities.



Evaluation of simple integrals of the type

$$\int \frac{dx}{x^2+a^2}, \int \frac{dx}{\sqrt{x^2 \pm a^2}}, \int \frac{dx}{a^2-x^2}, \int \frac{dx}{\sqrt{a^2-x^2}}, \int \frac{dx}{ax^2+bx+c}, \int \frac{dx}{\sqrt{ax^2+bx+c}}, \int \frac{(px+q)dx}{ax^2+bx+c}, \int \frac{(px+q)dx}{\sqrt{ax^2+bx+c}},$$

$$\int \sqrt{a^2 \pm x^2} dx, \int \sqrt{x^2 - a^2} dx$$

Integral as limit of a sum. The fundamental theorem of calculus, properties of definite integrals. Evaluation of definite integrals, determining areas of the regions bounded by simple curves in standard form.

UNIT 10: DIFFERENTIAL EQUATIONS:

Ordinary differential equations, their order and degree, the formation of differential equations, solution of differential equation by the method of separation of variables, solution of a homogeneous and linear differential equation of the type

$$\frac{dy}{dx} + p(x)y = q(x)$$

UNIT 11: CO-ORDINATE GEOMETRY:

Cartesian system of rectangular coordinates in a plane, distance formula, sections formula, locus and its equation, translation of axes, the slope of a line, parallel and perpendicular lines, intercepts of a line on the co-ordinate axis.

Straight line

Various forms of equations of a line, intersection of lines, angles between two lines, conditions for concurrence of three lines, the distance of a point from a line, equations of internal and external bisectors of angles between two lines co-ordinate of the centroid, ortho centre and circum centre of a triangle, equation of the family of lines passing through the point of intersection of two lines.

Circle, conic sections

A standard form of equations of a circle, the general form of the equation of a circle, its radius and central, equation of a circle when the endpoints of a diameter are given, points of intersection of a line and a circle with the centre at the origin and condition for a line to be tangent to a circle, equation of the tangent, sections of conics, equations of conic sections (parabola, ellipse and hyperbola) in standard forms, condition for $Y = mx + c$ to be a tangent and point (s) of tangency.

UNIT 12: THREE DIMENSIONAL GEOMETRY:

Coordinates of a point in space, the distance between two points, section formula, directions ratios and direction cosines, the angle between two intersecting lines. Skew lines, the shortest distance between them and its equation. Equations of a line and a plane in different forms, the intersection of a line and a plane, coplanar lines.

UNIT 13: VECTOR ALGEBRA:

Vectors and scalars, the addition of vectors, components of a vector in two dimensions and three-dimensional space, scalar and vector products, scalar and vector triple product.

UNIT 14: STATISTICS AND PROBABILITY:

Measures of discretion; calculation of mean, median, mode of grouped and ungrouped data. Calculation of standard deviation, variance and mean deviation for grouped and ungrouped data.

Probability: Probability of an event, addition and multiplication theorems of probability, Baye's theorem, probability distribution of a random variant, Bernoulli trials and binomial Distribution.

UNIT 15: TRIGONOMETRY:

Trigonometrical identities and equations, trigonometrical functions, inverse trigonometrical functions and their properties, heights and distance.

UNIT 16: MATHEMATICAL REASONING:

Statement logical operations and or implies, implied by if and only if, understanding of tautology, contradiction, converse and contrapositive.



**SYLLABI FOR SKUAST-JAMMU ENTRANCE EXAMINATION FOR ADMISSION TO
MASTER DEGREE PROGRAMMES**

Code 01: Major Subject Group- Basic Sciences

1. General Agriculture 30 marks

Importance of agriculture in national economy; basic principles of crop production; cultivation of rice, maize, wheat, rapeseed, mustard, chickpea, pigeon-pea, tomato, and mango. Major soils of India; role of NPK and their deficiency symptoms. General structure and function of cell organelles; mitosis and meiosis; Mendelian genetics. Elementary knowledge of growth, development, photosynthesis, respiration and transpiration; Elements of economic botany. General structure and function of carbohydrates, proteins, nucleic acids, enzymes and vitamins. Major pests and diseases of rice, wheat, cotton, chickpea, sugarcane and their management. Organic farming; bio-fertilizers; bio-pesticides. Recombinant DNA technology; transgenic crops. Important rural development programmes in India; organizational set up of agricultural research, education and extension in India. Elements of statistics.

2. Biochemistry 30 marks

UNIT-I: Importance of biochemistry in agriculture. Acid-base concept and buffers; pH. Classification, structure and metabolic functions of carbohydrates, lipids and proteins. Structure and function of nucleic acids. Enzymes, nomenclature, mechanism of action enzyme kinetic purification vitamins and minerals as coenzymes and cofactors. Metabolic pathways: glycolysis, TCA cycle, fatty acid oxidation, triglyceride biosynthesis. Electron transport chain; ATP formation. Photosynthesis: C-3, C-4 and CAM pathways. Nitrate assimilation; biological nitrogen fixation. Secondary metabolites, pathways and its role in biological sciences. DNA replication, transcription and translation; genetic code; operon concept Centrifugation, spectrophotometric, electrophoresis and chromatographic techniques, concept and application of Radio Isotopes in Biological Sciences.

3. Biotechnology 30 marks

Unit -II: Characteristics of prokaryotic and eukaryotic organisms; differences between fungi, bacteria, mycoplasmas and viruses. Physical and chemical basis of heredity; cell organelles, chromosome structure. DNA replication, transcription and translation; genetic code; operon concept. Genetic engineering; restriction enzymes; vectors; gene cloning; gene transfer. Molecular markers and their applications. Basic techniques of cell, tissue and organ culture and their implications. General applications of biotechnology. Molecular and immunological techniques. Concept of bioinformatics, genomics and proteomics.

4. Genetics & Plant Breeding 60 marks

Unit-I: Mendel's laws of inheritance and exceptions to the laws. Types of gene interactions, Pleiotropism-Penetrance and expressivity. Multiple alleles, Quantitative traits and qualitative traits and differences between them, Multiple factor hypothesis. Ultra structure of cell and cell organelles and their functions. Study of chromosome structure, morphology, number and types-karyotype and ideogram. Numerical chromosomal aberrations (Polyploidy). Structural chromosomal aberrations. Mitosis and meiosis-their significance and differences between them. DNA and its structure, function, types, modes of replication and repair. Cytoplasmic inheritance-its characteristic features and differences between chromosomal and cytoplasmic inheritance. Mutation- its characteristic features, methods of inducing mutations and CIB technique. Gene expression and differential gene activation. Lac operon and fine structure of gene.

Unit-II: Aims and objectives of Plant Breeding; Modes of reproduction, Sexual, Asexual, Apomixis and their classification, significance in plant breeding. Modes of pollination, genetic consequences, differences between self and cross-pollinated crops. Methods of breeding – introduction and acclimatization. Selection. Mass selection Johannson's pure line theory, genetic basis, pure line selection. Hybridization – Aims and objectives, types of hybridization. Methods of handling of segregating generations – pedigree method, bulk method, back cross method and various modified methods. Incompatibility and male sterility and their utilization in crop improvement. Heterosis,



inbreeding depression, various theories of Heterosis, exploitation of hybrid vigour-development of inbred lines, single cross and double cross hybrids. Population improvement programmes, recurrent selection, synthetics and composites. Methods of breeding for vegetative propagated crops. Clonal selection. Mutation breeding – Ploidy breeding. Wide hybridization, significance in crop improvement.

Unit-III: Chemical composition of seed. Seed dormancy, Seed germination, Male sterility, self-incompatibility and their role in hybrid seed production. Principles and methods of seed production of varieties and hybrids of cereals like wheat, paddy, sorghum, pearl millet and maize; pulses like chickpea, pigeon pea, green gram, black gram, soybean and cowpea; oilseeds like groundnut, brassica, sesame, sunflower and castor. Different classes of seed (Breeders seed, foundation seed, certified seed, etc.) Seed Certification Schemes, concepts and procedures. Seed Testing concepts and objectives, its role in seed quality control. Seed sampling, seed moisture testing, purity analysis, germination testing, tolerance tests and equipment. Testing for genuineness of varieties – principles and methods based on seed, seedling and plant characters, biochemical techniques namely electrophoresis of proteins and isoenzymes and DNA fingerprinting.

Code 02: Major Subject Group- Agricultural and Horticultural Sciences

1. General Agriculture 30 marks

Importance of agriculture in national economy; basic principles of crop production; cultivation of rice, maize, wheat, rapeseed, mustard, chickpea, pigeon-pea, tomato, and mango. Major soils of India; role of NPK and their deficiency symptoms. General structure and function of cell organelles; mitosis and meiosis; Mendelian genetics. Elementary knowledge of growth, development, photosynthesis, respiration and transpiration; Elements of economic botany. General structure and function of carbohydrates, proteins, nucleic acids, enzymes and vitamins. Major pests and diseases of rice, wheat, cotton, chickpea, sugarcane and their management. Organic farming; bio-fertilizers; bio-pesticides. Recombinant DNA technology; transgenic crops. Important rural development programmes in India; organizational set up of agricultural research, education and extension in India. Elements of statistics.

2. Agronomy 10 marks

UNIT-I: Principles of Agronomy, Crop ecology and geography and Agricultural Meteorology: Agronomy-meaning and scope, National & International agricultural research institutes in India, Agro climatic zone of India, Tillage, crop stand establishment and planting geometry and their effect on crop, Physiological limits of crop yield and variability in relation to ecological optima, organic farming, Precision farming, integrated farming system, principles of field experimentation. Principles of crop ecology and crop adaptation, crop plants, Greenhouse effect, climatic factors and their effect on plant processes and crop productivity. Atmospheric temperature and global warming. Crops and atmospheric humidity, weather forecasting, sustainable agriculture parameter and indicators, conservation agriculture.

UNIT-II: Field crops: Origin, distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield of cereals (rice, wheat, maize, etc), pulses (chickpea, lentil, peas, Pigeon pea, mungbean, urdbean), oilseeds (rapeseed & mustard, sunflower, sugarcane, fodder & forage crops)sorghum, maize, napier, berseem, lucerne, oats, medicinal & aromatic plants and commercial crops.

UNIT-III: Weed management: Principles of weed management, classification, biology and ecology of weeds, crop weed competition and allelopathy, concepts and methods of weed control, integrated weed management, classification, formulations, selectivity and resistance of herbicides, herbicide persistence in soil and plants, application methods and equipments, weed management in field crops.

UNIT-IV: Water management: Principles of irrigation, water resources and irrigation development in India, water and irrigation requirements, concepts and approaches of irrigation scheduling, methods of irrigation, measurement of irrigation water, application, distribution and use efficiencies, conjunctive use of water, irrigation water quality and its management, water management in major field, crops (rice, wheat, maize, groundnut, sugarcane) Agricultural drainage.



UNIT-V: Dry land Agronomy: Characteristics of Dry land farming and delineation of Dry land tracts, constraints of Dry land farming in India, types of drought and their management, contingency crop planning and mild-season corrections for aberrant weather and its recycling. Watershed management.

3. Soil Science and Agricultural Chemistry

10 marks

UNIT-I: Soil as medium for plant growth, weathering of rocks and minerals, soil profile, soil -physical mineralogical and chemical nature. Biological properties and soil, calculations of porosity and bulk density. Soil air, Soil temperature its importance in plant growth. Soil-water plant relationship, Soil colloids-properties, structure of silicate clay minerals, sources of negative charges, properties, kaolinite, illite, montmorillonite and vermiculite clay minerals, milli-equivalent concept, ion exchange capacity, buffering of soils. Problems soils-acid, saline and acid sulphate soils- their characteristics, formation, problems and management. Irrigation, water quality. Waterlogged soils.

UNIT-II: Essentiality criteria for plant nutrition, mechanism for movement and uptake of ions in soils and plants, Forms of nutrients in soil, deficiency symptoms in plants, luxury consumption of K nutrient, nutrient interactions and chelated micronutrients. Soil fertility, evaluation and management for plant growth, soil testing and fertilizer recommendations. Soil, soil survey-type, objectives, uses, land capability classifications. Remote sensing and its application in agriculture. SIS, GIS and GPS, basic features and uses in agriculture, Elementary concepts of radio isotopes and uses in agriculture. Soil micro-organisms, classifications and their roles. Organic matter decomposition, C:N ratios, mineralization and immobilization processes, humus, role of organic matter in soil quality. Soil erosion, types and control measures. Fertilizers and manures-classifications, NPK fertilizers, their reactions in soils, green manuring, recycling of organic wastes, composting. Soil and water pollution-sources, brief idea about different pollutants in soils and their managements

4. Fruit Science

10 marks

UNIT-I: Definition and importance of horticulture, Layout and establishment of orchards; propagation methods & use of root stocks, pruning and training methods, Use of growth regulators in fruit production, High density planting, advantages of HDP and tree vigor control, Assessment of requirement of irrigation water & its methods: merits and demerits, methods of application and fertigation for important fruit crops, studies on flower & fruit drop and its control, Studies on post harvest management in major fruit crops climatic requirement and cultivation practices of fruits like mango, banana, citrus, guava, grape, litchi, spota, papaya, apple, pear, peach, pineapple, pomegranate, ber, fig, phalsa, Jack, cherry and plum; nutritive value of fruits and their role in human nutrition; basic physiology of ripening in fruits and their products; type of fruits and control of fungal and bacterial diseases; plant nutrients, deficiency symptoms of nutrients, manures and fertilizers, system of irrigation, management of important pests and diseases of fruits.

Unit-II: Nursery management: Importance of commercial nurseries in India and its management/ planning, Use of controller structures, shade houses, poly houses in fruit cultivation and propagation, Micro- propagation of plants, aseptic cultures and disadvantages, Study of tools, accessories and other equipment necessary for nursery.

5. Food Science & Technology

10 marks

Unit-I Importance of post harvest technology in horticulture crops. Maturity indices, harvesting and post harvest handling of fruits and vegetables. Pre-harvest factors affecting quality on postharvest life of fruits and vegetables. Factors responsible for deterioration of harvested fruits and vegetables. Methods of storage-pre-cooling, pre-storage treatments, low temperature storage, controlled atmospheric storage, hypobaric storage, irradiation and low cost storage structure. Various methods of packing, packaging material and transport. Types of containers, cushioning material, vacuum packing, poly shrink packing, specific packing for export of mango, banana, grapes etc.

Unit-II Importance and scope of fruits and vegetables preservation in India. Principles of preservations by heat, low temperature, chemical and fermentations. Preservation through canning, freezing,



dehydration, drying, ultraviolet and ionizing radiations. Preparation of jam, jellies, marmalades, candies, crystallized and glazed fruits, preserve, chutneys, pickles, ketchup, sauce, puree, syrups, juices, squashes and cordials. Spoilage of canned products-biochemical, enzymatic and microbial spoilage. Preservatives, colors-permitted and prohibited in India.

6. Vegetables Sciences

10 marks

Unit-I: Origin & Importance of vegetables in human diet; Vegetable Gardens; Classification of Vegetables; Vegetables regions and their climatic requirements; Seed treatment; Preparation of germination media; Containers and growing of nurseries of different vegetables; Hardening of seedlings; Different methods of fertilizer application; Different irrigation & weed management practices in vegetable crops.

Unit-II: Package of Practices for various fruit vegetables (Tomato, Brinjal, Chilli & Okra), Cucurbitaceous vegetables (Melons, Cucumber & Gourds); Cole crops (Cauliflower, Cabbage & Knol-Khol); Bulb Crops (Onion & Garlic); Leguminous crops (Peas & Beans); Root Crops (Carrot, Radish, Turnip & Beetroot) tuber crops (Sweet Potato, Colocasia, Tapioca & Yam), Leafy vegetables (Spinach & fenugreek); Perennial Vegetables (Drum stick, Coccinia & Curry leaf)

Unit-III: Introduction, history, definition & world scenario of protected cultivation; Green House effect; Uses of Green Houses; Status & scope of green house technology in India; Planning & Designing for green house – Site selection, green house orientation; Plan layout; Green house utilities-Water electricity etc; Type of green houses-classification based on the shape, material utility and covering material; Consideration of greenhouse establishment Materials for green house construction; Management of green house – Temperature, Light, Relative Humidity, Ventilation, Carbon dioxide, Irrigation & Nutrition.; Methods of green house cooling; Methods of ventilation-Natural & forced Ventilation; Green house Heating – Heating Systems heat distribution & heat Conservation practices; Nutrient film techniques (NFT)/ hydroponics; Detailed production technology of vegetables – tomato, capsicum, lettuce & cucumber, under protected conditions; Marketing of green house crops; Major diseases & insect pests of green house crops & their management.

Unit-IV: Scope & importance of vegetables seed industry in India; Different categories of seed; Techniques of seed production: Annual & biennial habits with reference to seed production in different vegetables; Seed harvesting, curing, extraction, cleaning, drying, grading, packing & storage; Viability maintenance; Minimum seed germination standards for vegetable crops; Seed certification and seed act.

7. Floriculture & Landscape Architecture

10 marks

Unit-I: History and Principles of landscaping; Characteristics of formal & informal gardens; Cultivation & landscape utilization of important trees, shrubs, climbers, ground covers, potted and shade loving plants; Principles and practices of lawn management, principles of floriculture; Importance & planning of ornamental Garden; Types & styles of ornamental gardens.

Unit-II: Regulation of commercial flowers, post-harvest management; Oil extraction techniques in commercial flowers; Dry flower arrangements, Making of greetings; Flower dyeing; Practicing the art of bonsai-wiring, selection of plants and training the bonsai plants; Constructed features- greenhouse, conservatory design; Economics of commercial flowers.

Unit-III: Production technology of Rose, Jasmine, Chrysanthemum, Gladiolus, Marigold, Tuberose, Lilium, Gerbera, Dahlia, Carnation, Anthurium & Orchids both under open and green house conditions; Pot culture; Cacti and Succulents; Scope & importance of flower seed industry in India; Seed harvesting, curing, extraction, cleaning, drying, grading, packing & storage of flower crops; Minimum seed germination standards for flower crops.

8. Plant Pathology

10 marks

UNIT-I: Pesticides- History, Production and Consumption of pesticides in India and world, Introduction-Important plant pathogenic organisms- different groups- fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, virioids, algae, protozoa and phanerogamic parasites with examples of diseases caused by them. Characteristics of prokaryotic and eukaryotic



organisms, integrated diseases management; sterilization, disinfection and pasteurization; Kochs, postulates; etiological agents of rusts, smuts, powdery/downy mildews, wilts, yellows, mosaic, necrosis, enations, blights and witchesbrooms; pH, buffer, vitamins, Major pests and diseases of major field crops like rice, wheat, Maize, rapeseed mustard, pulses, vegetable/fruit crops, chickpea, and their management.

UNIT-II: Microflora of Rhizosphere and Phyllosphere, microbes in composting Microbiology of water and food, Importance of stored grain pests, types of damage of stored product insects. Application of biotechnology in plant disease management – Importance, production of pathogen free plants through tissue culture techniques. Development of disease resistant transgenic plants through gene cloning. Importance of Mushrooms morphology and types of cultivated Mushrooms. Disease and pests of Mushroom and their management. Post harvest handling of Mushrooms.

9. Entomology

10 marks

UNIT-I: Classification of animal kingdom up to class; distinguishing characters up to orders in class general organization of an insect external morphology; metamorphosis and moulting; different physiological systems; insect pests of agricultural and horticultural crops, and their stored/processed products, insect vectors of plant disease; pests of household, medical and veterinary importance and their control; useful and beneficial insects like honeybee, lac insect, silkworm and pollinators; important plant parasitic nematodes and their control; entomo pathogenic nematodes, pest surveillance and sampling; basic principles of insect pest management-cultural, mechanical, physical, biological control (bio-control agents, techniques in biocontrol, biopesticides, microbial pesticides), host plant resistance, insecticidal (classification, mode of action, formulations), quarantine, regulatory and other novel techniques; plant protection equipments; safety measures in handling of pesticides; biotechnological approaches in IPM.

10. Agricultural Economics

10 marks

UNIT-I: Elementary principles of economics importance of Agriculture/Forestry/ livestock in national economy. Theory of consumer behaviour, theory of demand, elasticity of demand, indifference curve analysis, theory of firm, cost curves, theory of supply, price determination, market classification, concept of macroeconomics, money and banking, national income. Agricultural marketing-role, practice, institutions, cooperatives, capital formation in agriculture agrarian reforms, globalization, WTO & its impact on Indian agriculture.

11. Agricultural Extension Education

10 marks

UNIT-I: Education and their characteristics. Teaching-Learning process Extension Education and Agricultural Extension Concepts, Objectives and Principles. Sociology and Rural Sociology and its Classification. Motivation and its role. Social stratification and its form. Social Institutions and its role and role of Social change –Classification, Role of a leader, Different methods Training learning processes and Educational Psychology.

UNIT-II: Rural development and developmental programmes of pre and post independence era, community development Programme - National Extension service and Panchayati Raj system types, powers and functions. Agricultural Development Programmes -Entrepreneur behaviour, Infrastructure and Policy support for entrepreneurship forecasting market demand, sustainability of enterprise. Technical Appraisal.

UNIT-III: Communication Extension Programme Planning Project, Importance, Principles and Steps in Programme Development process, Monitoring and Evaluation of Extension Programmes Extension Teaching methods, Result Demonstration, Field trials Group contact methods and Field Trips Symposium, Panel, Debate, Forum, Buzz group, Workshop, Brain Storming, Seminar and Conference, Mass contact Methods Merits & Demerits. Factors influencing in selection of Extension Teaching Methods and Combination (Media Mix) of teaching methods. Innovative Information sources- Internet, Cyber Cafes, Video and Tele conferences, Kisan Call centers, Consultancy clinics. Agricultural and Journalism innovation. Models of adoption process, Innovation – Decision process – Elements, Adopter categories and their characteristics, factors influencing adoption process.



Genetics & Plant Breeding

10 marks

Unit-I: Mendel's laws of inheritance and exceptions to the laws. Types of gene interactions, Pleiotropism-Penetrance and expressivity. Multiple alleles, Quantitative traits and qualitative traits and differences between them, Multiple factor hypothesis. Ultra structure of cell and cell organelles and their functions. Study of chromosome structure, morphology, number and types-karyotype and ideogram. Numerical chromosomal aberrations (Polyploidy). Structural chromosomal aberrations. Mitosis and meiosis-their significance and differences between them. DNA and its structure, function, types, modes of replication and repair. Cytoplasmic inheritance-its characteristic features and differences between chromosomal and cytoplasmic inheritance. Mutation- its characteristic features, methods of inducing mutations and CIB technique. Gene expression and differential gene activation. Lac operon and fine structure of gene.

Biotechnology

10 marks

Nature, structure and replication of genetic material. Chromatin and chromosome structure. Cell division. Concepts and history of Plant Biotechnology, Various aspects of plant tissue culture, somatic embryogenesis, meristem culture, micropropagation, somaclonal variation, anther and pollen culture, embryo/ovule/ovary and endosperm culture, protoplast culture and somatic hybridization, cryopreservation of germplasm, recombinant DNA technology, gene cloning approaches, methods of genetic transformation, genetic engineering, southern, northern and western hybridization, polymerase chain reaction and its variants, hybridization and PCR based DNA markers, gene and QTL mapping, marker assisted selection for precision plant breeding, application of marker assisted selection in commercial agriculture, bioinformatics tools and techniques.

Code 03: Major Subject Group- Statistics

1. General Agriculture

30 marks

Importance of agriculture in national economy; basic principles of crop production; cultivation of rice, maize, wheat, rapeseed, mustard, chickpea, pigeon-pea, tomato, and mango. Major soils of India; role of NPK and their deficiency symptoms. General structure and function of cell organelles; mitosis and meiosis; Mendelian genetics. Elementary knowledge of growth, development, photosynthesis, respiration and transpiration; Elements of economic botany. General structure and function of carbohydrates, proteins, nucleic acids, enzymes and vitamins. Major pests and diseases of rice, wheat, cotton, chickpea, sugarcane and their management. Organic farming; bio-fertilizers; biopesticides. Recombinant DNA technology; transgenic crops. Important rural development programmes in India; organizational set up of agricultural research, education and extension in India. Elements of statistics.

2. Statistics

120 marks

UNIT-I: Mathematics: Real and complex numbers; polynomial and roots; de Moivre's theorem and its applications. Elements of set theory-De Morgan's laws; vector space, linear independence orthogonality; matrices addition and multiplication, rank of matrix, determinants, inverse of matrix, solution of a system of linear equations, characteristic roots and vectors; convergence of infinite sequences and infinite series-tests for convergence, absolute convergence; co-ordinate geometry in two dimensions-line, circle, parabola, ellipse and hyperbola. Differential calculus: limits, differentiation of function of a single variable; Tylor's and Maclaurin's theorem, composite functions, total derivatives, derivative of an implicit function, change of variables, Jacobians. Integral calculus; integration by simple methods, standard forms, simple definite integrals, double integrals, change of order of integration, Gamma and Beta functions, application of double integrals to find area. Ordinary differential equations: differential equations of first order, Exact and Bernoulli's differential equations, equations reducible to exact form by integrating factors, equations of first order and higher degree, Clairaut's equation, methods of finding complementary functions and particular integrals. Calculus of finite differences, interpolation; numerical differentiation and integration, difference equations; solution of simple non-linear equations by numerical methods like Newton method.

UNIT-II: Introduction: Statistics-definition, use and limitations; Frequency Distribution and Curves; Measures of Central Tendency: Arithmetic mean; Geometric mean, Harmonic mean, Median, Mode;

measures of Dispersion: Range, Mean deviation, Quartile deviation, Variance and Coefficient of Variation, Probability: Definition and concepts, law of addition and multiplication, conditional probability, Bayes' theorem; Binomial, multinomial, Poisson and normal distribution; Introduction to sampling: Random sampling; standard Error; Tests of Significance-Types of Errors, Null Hypothesis, Level of Significance-Testing of hypothesis; Large sample Test- SND test for Means, single sample and two samples; Student's t-test for Single Sample, Two Samples and Paired t test. F test; Chi-Square Test for goodness of fit and independence of attributes; Correlation and Regression and associated tests of significance. Experimental Designs: basic principles, Analysis of variance, Completely Randomized Design (CRD), Randomized Block Design (RBD).

Code 04: Major Subject Group - Forestry**1. General Agriculture****30 marks**

Importance of agriculture in national economy; basic principles of crop production; cultivation of rice, maize, wheat, rapeseed, mustard, chickpea, pigeon-pea, tomato, and mango. Major soils of India; role of NPK and their deficiency symptoms. General structure and function of cell organelles; mitosis and meiosis; Mendelian genetics. Elementary knowledge of growth, development, photosynthesis, respiration and transpiration; Elements of economic botany. General structure and function of carbohydrates, proteins, nucleic acids, enzymes and vitamins. Major pests and diseases of rice, wheat, cotton, chickpea, sugarcane and their management. Organic farming; bio-fertilizers; biopesticides. Recombinant DNA technology; transgenic crops. Important rural development programmes in India; organizational set up of agricultural research, education and extension in India. Elements of statistics.

2. Forestry**90 marks.**

UNIT-I: Forest-importance, types, classification; ecosystem, biotic and abiotic components; ecological succession and climax; nursery and planting techniques; social forestry, farm forestry, urban forestry, community forestry; forest menstruation, forest management; silvicultural practices, natural regeneration; man-made plantations, shifting cultivation, taungya; dendrology, hardwoods, softwoods, pulp woods, fuel woods, multipurpose tree species; wasteland management. Agroforestry- importance and classification; forest soils, classification and conservation, watershed management; tree improvement- forest genetics and biotechnology; tree seed technology; rangelands, wildlife-importance, abuse, depletion, management; major and minor forest products including medicinal and aromatic plants; forest inventory, aerial photo interpretation and remote sensing; forest depletion and degradation - importance and impact on environment; global warming, role of forests and trees in climate mitigation; tree diseases, wood decay and discolouration; tree pests, integrated pest and disease management; biological and chemical wood preservation; forest conservation, Indian forest policies, Indian forest act; forest engineering; forest economics, joint forest management and tribology.

3. Plant Pathology**15 marks**

UNIT-I: Pesticides- History, Production and Consumption of pesticides in India and world. Introduction-Important plant pathogenic organisms- different groups- fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, virioids, algae, protozoa and phanerogamic parasites with examples of diseases caused by them. Characteristics of prokaryotic and eukaryotic organisms, integrated diseases management; sterilization, disinfection and pasteurization; Kochs' postulates; etiological agents of rusts, smuts, powdery/downy mildews, wilts, yellows, mosaic, necrosis, enations, blights and witches brooms; pH, buffer, vitamins, Major pests and diseases of forest trees and their management.,

UNIT-II: Microflora of Rhizosphere and Phyllosphere, microbes in composting Microbiology of water and food, Application of biotechnology in plant disease management – Importance, production of pathogen free plants through tissue culture techniques. Development of disease resistant transgenic plants through gene cloning.



4. Entomology

15 marks

UNIT-I: Classification of animal kingdom up to class; distinguishing characters up to orders in class general organization of an insect external morphology; metamorphosis and moulting; different physiological systems; insect pests of agricultural and horticultural crops, and their stored/processed products, insect vectors of plant disease; pests of household, medical and veterinary importance and their control; useful and beneficial insects like honeybee, lac insect, silkworm and pollinators; important plant parasitic nematodes and their control; entomo pathogenic nematodes, pest surveillance and sampling; basic principles of insect pest management-cultural, mechanical, physical, biological control (biocontrol agents, techniques in biocontrol, biopesticides, microbial pesticides), host plant resistance, insecticidal (classification, mode of action, formulations), quarantine, regulatory and other novel techniques; plant protection equipments; safety measures in handling of pesticides; biotechnological approaches in IPM.

Code 05: Major Subject Group- Sericulture

1. General Agriculture

30 marks

Importance of agriculture in national economy; basic principles of crop production; cultivation of rice, maize, wheat, rapeseed, mustard, chickpea, pigeon-pea, tomato, and mango. Major soils of India; role of NPK and their deficiency symptoms. General structure and function of cell organelles; mitosis and meiosis; Mendelian genetics. Elementary knowledge of growth, development, photosynthesis, respiration and transpiration; Elements of economic botany. General structure and function of carbohydrates, proteins, nucleic acids, enzymes and vitamins. Major pests and diseases of rice, wheat, cotton, chickpea, sugarcane and their management. Organic farming; bio-fertilizers; biopesticides. Recombinant DNA technology; transgenic crops. Important rural development programmes in India; organizational set up of agricultural research, education and extension in India. Elements of statistics.

2. Sericulture

90 marks

Unit-I: Introduction and brief history of Sericulture, Morphology and systematic of silkworm, Anatomy of silkworm- reproductive system, digestive system, nervous system and silk gland, Life cycle of silkworm, Disinfection and disinfectants used in Sericulture, Eggs their incubation, brushing, Chawki rearing, late age rearing moulting, seriposition and post cocoon operations, Grainage operations, Silkworm rearing technology, Diseases and pests of silkworm, Different silkworms and their host plants, Taxonomy and systematic of mulberry, Propagation and cultivation practices, Application of manures and fertilizers, Training and pruning, Leaf quality and its importance, leaf harvesting and preservation, Chawki rearing garden, Diseases and pests of mulberry.

Unit-II: Mendel's laws of inheritance and exceptions to the laws. Types of gene interactions, Pleiotropism-Penetrance and expressivity. Multiple alleles, Quantitative traits and qualitative traits and differences between them, Multiple factor hypothesis. Ultra structure of cell and cell organelles and their functions. Study of chromosome structure, morphology, number and types-karyotype and ideogram. Numerical chromosomal aberrations (Polyploidy). Structural chromosomal aberrations. Mitosis and meiosis-their significance and differences between them. DNA and its structure, function, types, modes of replication and repair. Cytoplasmic inheritance-its characteristic features and differences between chromosomal and cytoplasmic inheritance. Mutation - its characteristic features, methods of inducing mutations and CIB technique. Gene expression and differential gene activation. Lac operon and fine structure of gene.

3. Plant Pathology

15 marks

UNIT-I: Pesticides- History, Production and Consumption of pesticides in India and world. Introduction-Important plant pathogenic organisms- different groups- fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, virioids, algae, protozoa and phanerogamic parasites with examples of diseases caused by them. Characteristics of prokaryotic and eukaryotic organisms, integrated diseases management; sterilization, disinfection and pasteurization; Koch's postulates; etiological agents of rusts, smuts, powdery/downy mildews, wilts, yellows, mosaic, necrosis, enations, blights and witches brooms; pH, buffer, vitamins, Major pests and diseases of forest trees and their management.



UNIT-II: Microflora of Rhizosphere and Phyllosphere, microbes in composting Microbiology of water and food, Application of biotechnology in plant disease management – Importance, production of pathogen free plants through tissue culture techniques. Development of disease resistant transgenic plants through gene cloning.

4. Entomology

15 marks

UNIT-I: Classification of animal kingdom up to class; distinguishing characters up to orders in class general organization of an insect external morphology; metamorphosis and moulting; different physiological systems; insect pests of agricultural and horticultural crops, and their stored/processed products, insect vectors of plant disease; pests of household, medical and veterinary importance and their control; useful and beneficial insects like honeybee, lac insect, silkworm and pollinators; important plant parasitic nematodes and their control; entomo pathogenic nematodes, pest surveillance and sampling; basic principles of insect pest management-cultural, mechanical, physical, biological control (bio control agents, techniques in bio control, bio pesticides, microbial pesticides), host plant resistance, insecticidal (classification, mode of action, formulations), quarantine, regulatory and other novel techniques; plant protection equipments; safety measures in handling of pesticides; biotechnological approaches in IPM.

Code 06: Major Subject Group- Agricultural Engineering

1. General Agriculture

(30 marks)

Importance of agriculture in national economy; basic principles of crop production; cultivation of rice, maize, wheat, rapeseed, mustard, chickpea, pigeon-pea, tomato, and mango. Major soils of India; role of NPK and their deficiency symptoms. General structure and function of cell organelles; mitosis and meiosis; Mendelian genetics. Elementary knowledge of growth, development, photosynthesis, respiration and transpiration; Elements of economic botany. General structure and function of carbohydrates, proteins, nucleic acids, enzymes and vitamins. Major pests and diseases of rice, wheat, cotton, chickpea, sugarcane and their management. Organic farming; bio-fertilizers; biopesticides. Recombinant DNA technology; transgenic crops. Important rural development programmes in India; organizational set up of agricultural research, education and extension in India. Elements of statistics.

UNIT-I: Elementary Statistics and theory of probability, differential and integral calculus, linear algebra and Fourier series, differential equations, vector algebra & vector calculus, elementary numerical analysis. *Electric* motors: Types, performance, selection, Installation and maintenance, measuring instruments, fundamentals of computers, power distribution. Thermodynamic principles; fluid mechanics, theory of machines

(10 marks)

UNIT-II: Soil mechanics, soil classification, compaction & shear strength of soils, engineering mechanics, strength of materials, Importance of farm equipment and role of mechanization in enhancing productivity & profitability of Indian agriculture; analysis of forces, design and production of farm machinery and power units; mechanics of tillage & traction operation, repair and maintenance of farm machines and equipment, farm engines; tractors and power tillers; tractor stability and operators comfort; field capacity and cost analysis; test codes and procedure; safety and ergonomic principles. Role of energy in economic development; solar, wind and bio-energy; biogas plants & gasifiers; bio-fuels from biomass; collection, characterization and storage of biomass, solar cookers & solar refrigerators.

(40 marks)

UNIT-III: Biochemical and engineering properties of biological materials; quality control & safety of raw and finished products. Principles, practices and equipments for drying, milling, separation and storage of agricultural produce and by-products; material handling equipment and operations; farmstead planning; heating & cooling load calculation; seed processing practices and equipments; food preservation methods and products development; refrigeration and air conditioning; cold stores; waste management, cost analysis & food processing plants layout, feasibility reports

(30 marks)

UNIT-IV: Surveying and leveling; hydrology, water resources in India; efficiency in water use; irrigation system and equipment; water conveyances and associated efficiency; soil-plant-water relationship; estimation of evaporation and water requirements of crop; water harvesting and use, farm



ponds and reservoirs, command area development, land use capability classification, ground water development, wells and pumping equipment, soil erosion and its control, land shaping and grading equipment and practices, hydraulic structures, drainage of irrigated and humid areas; salt balance and reclamation of saline and alkaline soils. **(40 marks)**

Code 07: Major Subject Group- Biotechnology (MSc Molecular Biology & Biotechnology and MTech Biotechnology)

1. General Agriculture (30 Marks)

Importance of agriculture in national economy; basic principles of crop production; cultivation of rice, maize, wheat, rapeseed, mustard, chickpea, pigeon-pea, tomato, and mango. Major soils of India; role of NPK and their deficiency symptoms. General structure and function of cell organelles; mitosis and meiosis; Mendelian genetics. Elementary knowledge of growth, development, photosynthesis, respiration and transpiration; Elements of economic botany. General structure and function of carbohydrates, proteins, nucleic acids, enzymes and vitamins. Major pests and diseases of rice, wheat, cotton, chickpea, sugarcane and their management. Organic farming; bio-fertilizers; biopesticides. Recombinant DNA technology; transgenic crops. Important rural development programmes in India; organizational set up of agricultural research, education and extension in India. Elements of statistics.

UNIT-I: Characteristics of prokaryotic and eukaryotic organisms; differences between fungi, bacteria, mycoplasmas and viruses. Physical and chemical basis of heredity; chromosome structure. DNA replication, transcription and translation; genetic code; operon concept. Genetic engineering; restriction enzymes; vectors; gene cloning; gene transfer. Plant cell and tissue culture; micro-propagation; somaclonal variation. Transformation; recombination; General application of biotechnology. Molecular and immunological techniques. Concept of bioinformatics, genomics and proteomics. **(40 marks)**

UNIT-II: Organelle DNA mitochondria!, chloroplast; DNA sequencing principles and translation to large scale projects; Recognition of coding and non-coding sequences and gene annotation; Molecular Tools and Their Applications, Restriction enzymes, modification enzymes, DNA and RNA markers; Conventional cytogenetics, Physical mapping by restriction hybridization analysis, FISH and related techniques, Role of antisense and RNAi in crop improvement, regulated and tissue specific expression of transgenes for crop improvement, Terminator gene technology, Environmental issues associated with transgenic crops, food safety issues and risk assessment of transgenic food crops. **(40 marks)**

UNIT-III: Plant physiology– importance in agriculture. Seed germination, viability and vigour. Photosynthesis- significance of C-3, C-4 and CAM pathway; photorespiration and its implications. Translocation of assimilates; dry matter partitioning; Harvest index of crops. Growth and development; growth analysis; crop-water relationship. Plant nutrients and their functions. Phytohormones and their physiological role. Photo-periodism and vernalisation; in flowering plants. Importance of biochemistry in agriculture. Acid-base concept and buffers; pH. Classification, structure and metabolic functions of carbohydrates, lipids and proteins. Structure and function of nucleic acids. Enzymes: structure, nomenclature, mechanism of action; vitamins and minerals as coenzymes and cofactors. Metabolic pathways: glycolysis, TCA cycle, fatty acid oxidation, triglyceride biosynthesis. Electron transport chain; ATP formation. **(40 marks)**

Code 08: Major Subject Group- Fisheries: (150)

Unit-I: Classification and taxonomical characteristics of cultivable fisheries. crustaceans and molluscs. Fresh water, brackish water and marine fishery resources of India, marine fisheries of the world. Estuarine, lacustrine. brackish water and pond ecosystem. Population dynamics, fish stock, abundance methods and analysis. Conservation and management of fishery resources. Fisheries legislations and law of the water bodies. Impact of over exploitation and climate change on fisheries resources.

UNIT-II: Reproduction and breeding behaviour in fishes and shellfishes, brood stock improvement, maturity and fecundity studies. Induced spawning methods and seed production, natural fish seed



collection and rearing methods. Types of eggs and development of larval stages of fin fishes and shellfishes. Preparation and management of fresh water and brackish water fishponds. Cultivable species identification, introduction of exotic fishes in India. Culture methods: Pen and cage culture practices, crap and shrimp hatchery management, basic aspects of biotechnology in relation to fisheries.

UNIT-III: Important limnological, oceanographical and biological parameters in relation to fisheries of lotic and lentic waters, biological productivity and its impact on fisheries. Environmental impact assessment on fisheries in lentic and lotic waters. Biological parameters including energy flow, community ecology and aquatic association, biodiversity and its conservation, aquatic pollution and its management.

UNIT-IV: Common crafts and gears used for fish capture. Boat building material and demerits of wood, steel, aluminum, Ferro cement and FRP. Different types of fibres and netting materials and their characteristics, preservation of netting. parts of a trammel net, purse-seine, gill net and tuna long line.

UNIT-V: Food chemistry, fundamentals of microbiology. General methods of fish preservation and fishery by products. Canning and packaging techniques, processing and product development techniques.

UNIT-VI: Introduction to fishery economics and concepts of cooperative, marketing and banking management. Supply v/s demand economics of hatchery management and fish culture operations. Profit maximization. Problems in estimating costs and returns in fisheries. WTO agreements in Fisheries sector, intellectual property rights (IPR) and international fish trade. Basics of statistics in fisheries and computer science.

UNIT-VII: Fisheries extension methods. Training and education needs in fisheries. Communication concepts, Modern tools of fishery extension education, participatory rural appraisal (PRA), Rapid rural appraisal (RRA). Role of women in fisheries.