KIITEE Syllabus - 2025 (Section Wise)

Kalinga Institute of Industrial Technology Entrance Examination

PHYSICS

Unit १: Units and Measurement

Units for measurement, system of units- S.I., fundamental and derived units. Dimensions and their applications.

Unit २: Description of Motion in One Dimension
Motion in a straight line, uniform and non-uniform motion, their graphical representation. Uniformly accelerated motion, and its application

Unit ३: Description of Motion in Two and Three Dimensions Scalars and vectors, vector addition, a real number, zero vector and its properties. Resolution of vectors. Scalar and vector products, uniform circular motion and its applications projectile motion.

Unit ४: Laws of Motion

Force and inertia-***Newton's Laws of Motion.*** Conservation of linear momentum and its applications, rocket propulsion, friction- laws of friction.

Unit ५: Work, Energy and Power Concept of work, energy and power. Energy- Kinetic and potential. Conservation of energy and its applications, Elastic collisions in one and two dimensions. Different forms of energy.

Unit ६: Rotational Motion and Moment of Inertia
Centre of mass of a two-particle system. Centre of mass of a rigid body, general motion of a rigid body, nature of rotational

motion, torque, angular momentum, its conservation and applications.
Moment of inertia, parallel and perpendicular axes theorem, expression of moment of inertia for ring, disc and sphere.

Unit ७:- Gravitation
Acceleration due to gravity, one and two-dimensional motion under gravity. Universal law of gravitation, variation in the acceleration due to gravity of the earth. Planetary motion, ***Kepler's laws, artificial satellite***-geostationary satellite, gravitational potential energy near the surface of earth, gravitational potential and escape velocity.

Unit ८: Solids and Fluids
Inter-atomic and Inter-molecular forces, states of matter.
(A) Solids: Elastic properties, Hook's law, Young's modulus, bulk modulus, modulus of rigidity.
(B) Liquids : Cohesion and adhesion. Surface energy and surface tension. Flow of fluids, ***applications.***

Bernoulli's theorem and its Viscosity, Stoke's Law, terminal velocity.

Unit ९: Oscillations Periodic motion, simple harmonic motion and its equation of motion, energy in S.H.M., Oscillations of a spring and simple pendulum.

Unit १०: Waves

Wave motion, speed of a wave, longitudinal and transverse waves, superposition of waves, progressive and standing waves, free and forced Oscillations, resonance, vibration of strings and air-columns, beats, Doppler effects.

Unit ११: Heat and Thermodynamics Thermal expansion of solids, liquids and gases and their specific heats, Relationship between Cp and Cv for gases, first law of thermodynamics, thermodynamic processes. Second law of thermodynamics, Carnot cycle efficiency of heat engines.

Unit ١٢: Transference of Heat

of transference of heat. Thermal Modes
conductivity. Black body radiations, Kirchoff's Law, Wien's law, Stefan's law of radiation and Newton's law of cooling.

Unit ١٣: Electrostatics
Electric charge-its unit and conservation, ***Coulomb's law, dielectric constant, electric*** field, lines of force, field due to dipole and its behaviour in a uniform electric field, electric ***flux, Gauss's theorem and its applications.*** Electric potential, potential due to a point charge. Conductors and insulators, distribution of charge on conductors. Capacitance, parallel plate capacitor, combination of capacitors, energy of capacitor.

Unit ١٤: Current Electricity
Electric current and its unit, sources of energy, cells-primary and secondary, grouping of cells resistance of different materials, temperature ***Ohm's law,Kirchoff's law, series and parallel circuits.*** Wheatstone Bridge with their applications and ***dependence, specific resistivity,*** potentiometer with their applications

Unit ١٥: Thermal and Chemical Effects of Currents
Heating effects of current, electric power, simple concept of thermo-electricity-Seeback effect and thermocouple, Chemical effect of current-

Faraday's laws of electrolysis.

Unit ١٦: Magnetic Effects of Currents

Oersted's experiment, BioSavert's law, magnetic filed due to straight wire, circular loop and solenoid, force on a moving charge in a uniform magnetic field (Lorentz force), force and torques on currents in a magnetic field, force between two current carrying wires, moving coil galvanometer and conversion to ammeter and voltmeter.

Unit ١٧: Magneto statics
Bar magnet, magnetic field, lines of force, torque on a bar magnet in a magnetic field, para, dia and ferro ***earth's magnetic field,*** magnetism, magnetic induction, magnetic susceptibility.

Unit ١٨: Electromagnetic Induction Alternating Currents
Induced e.m.f., Faraday's Law,Lenz's Law, Self and Mutual Inductance, alternating currents, impedance and reactance, power in a.c. Circuits with L.C. And R Series Combination, resonant circuits. Transformer and A.C. generator.

Unit ١٩: Ray Optics
Reflection and refraction of light at plane and curved surfaces, total internal reflection, optical fibre; deviation and dispersion of light by a prism; Lens formula, magnification and resolving power, microscope and telescope.

Unit ٢٠: Wave Optics Wave nature of light; Interference-
Young's double slit experiment. Diffraction-diffraction due to a single slit. Elementary idea of polarization.

Unit ٢١: Electromagnetic Waves
Electromagnetic waves and their characteristics, Electromagnetic wave spectrum from gamma to radio waves-propagation of EM waves in atmosphere.

Unit ٢٢: Electron and Photons Charge on an electron, e /m for an electron, ***photoelectric effect and Einstein's equation of*** photoelectric effect.

Unit ٢٣: Atoms, Molecules and Nuclei Alpha particles scattering experiment, Atomic masses, size of the nucleus; radioactivity; Alpha, beta and gamma particles /rays and their properties, radioactive decay law, half life and mean life of radio-active nuclei, binding energy, mass energy relationship, nuclear fission and nuclear fusion.

Unit ٢٤ : Solids and Semi-Conductors Devices

Energy bands in solids، conductors، insulators and semi-conductors، pn junction، diodes، diode as rectifier، transistor action، transistor as an amplifier.

CHEMISTRY

Unit ١ : Some Basic Concepts : Measurement in chemistry (Precision، significant figures، S.I. units، Dimensional analysis). Laws of chemical combination. Atomic Mass، Molecular Mass، mole concept، Molar Mass، determination of Molecular formula. Chemical equation، stoichiometry of Chemical reactions.

Unit ٢ : States of Matter Gaseous state، measurable properties of gases، ***Boyle's Law, Charle's Law and absolute scale of temperature, Avogadro's hypothesis, ideal gas equation, Dalton's law of partial pressures.*** Kinetic molecular theory of gases (microscopic model of gas)، deviation form ideal behaviour.

The solid state (classification of solids، X-ray studies of crystal lattices and unit cells، packing of constituent particles in crystals). Imperfection in solids، electrical، magnetic and dielectic properties of solids. Liquid state (Properties of liquids، Vapour pressure، Surface tension، Viscosity).

Unit ٣ : Atomic Structure Constituents of the atom (discovery of electron، rutherford model of the atom).

Electronics structure of atoms-nature of light and electromagnetic waves، atomic spectra، ***bohr's model of hydrogen, shortcomings of the*** bohr model.

Dual nature of matter and radiation. de-Broglie relation. The uncertainty principle، Quantum Mechanical Model of the atom، Orbitals and Quantum numbers. Shapes of orbitals. Aufbau ***principle, Pauli Exclusion principle, Hund's*** Rule، Electronics Configuration of atoms.

Unit ٤ : Solutions

Types of solutions، Units of concentration، Vapour-***pressure of solutions and Raoult's law.*** Colligative properties. Determination of molecular mass. Non-ideal solutions and abnormal molecular masses. Volumetric analysis-concentration unit.

Unit ٥ : Chemical Energetics and Thermodynamics Energy changes during a chemical reaction، Internal energy and Enthalpy، Internal energy and Enthalpy changes، Origin of Enthalpy ***change in a reaction, Hess's Law of constant*** heat summation، numericals based on these concepts. Enthalpies of reactions (Enthalpy of combustion، neutralization، Enthalpy of Enthalpy of fusion and vaporization).

Sources of energy (conservation of energy sources and identification of alternative sources، pollution associated with consumption of fuels. The sun as the primary source).

First law of thermodynamics : Relation between Internal energy and Enthalpy، application of first law of thermodynamics.
Second law of thermodynamics : Entropy، Gibbs energy، Spontaneity of a chemical reaction، Gibbs energy change and chemical equilibrium، Gibbs energy available for useful work.

Unit ٦ : Chemical Equilibrium
Equilibria involving physical changes (solid-liquid، liquid-gas equilibrium involving dissolution of solids in liquids، gases in liquids، general characteristics of equilibrium involving physical processes)

Equilibria involving chemical systems (the law of chemical equilibrium، the magnitude of the equilibrium constant، numerical problems).

Effect of changing conditions of systems at equilibrium (change of concentration، change of temperature، effect of catalyst-***Le Chateliar's*** principle).
Equilibria involving ions- ionization of electrolytes، weak and strong electrolytes، acid-base equilibrium، various concepts of acids and bases، ionization of water، pH scale، solubility product، numericals based on these concepts.

Unit ٧: Redox Reactions and Electrochemistry

Oxidation and reduction as an electron transfer concept. Redox reactions in aqueous solutions- electrochemical cells. e.m.f. of a galvanic cell.

Dependence of e.m.f. on concentration and temperature (NERNST). equation and numerical problems based on it .Electrolysis، Oxidation number (rules for assigning oxidation number، redox reactions in terms of oxidation number، nomenclature). Balancing of oxidation-reduction equations.

Electrolytic conduction. Molar conductivity، ***Kohlrausch's Law a***nd its applications، Voltaic cell، Electrode potential and Electromotive ***force, Gibb's energy change and cell potential.*** Electrode potential and products of electrolysis، Fuel cells، corrosion and its prevention.

Unit ٨: Rates of Chemical Reactions and Chemical Kinetics

Rate of reaction، Instantaneous rate of reaction and order of reaction. Factors affecting rates of reactions- factors affecting rate of collisions encountered between the reactant molecules، effect of temperature on the reaction rate، concept of activation energy catalyst. Effect of light of rates of reactions. Elementary reactions as steps to more complex reactions. How fast are chemical reactions؟

Rate law expression. Order of a reaction (with suitable examples). Units of rates and specific rate constant. Order of reaction and effect of concentration (study will be confined to first order only). Temperature dependence of rate reactions (only elementary idea). Mechanism of reaction (only elementary idea). Photochemical reactions.

constant – Fast

Unit ٩: Surface Chemistry

Surface : Adsorption – physical and chemical adsorption، adsorption isotherms.

Colloids-Preparation and general properties، Emulsions، Micelles.

Catalysis : Homogeneous and heterogeneous، structure of catalyst، Enzymes، Zeolites.

Unit ١٠: Chemical Families Periodic Properties

Modern periodic law، Types of elements – Representatives elements (s & p block، Transition elements – d-block elements، inner transition elements-f-block elements. Periodic trends in properties- ionization enthalpy، electron gain enthalpy، atomic radii، valence، periodicity in properties of compounds).

Unit ١١: Chemical Bonding and Molecular Structure

Chemical bonds and Lewis structure، shapes of molecules (VSEPR theory)، Quantum theory of the covalent bond، simple molecules، carbon hydrogen and some other compounds، hybridization، Boron and Beryllium compounds.

Coordinate covalent bond، ionic bond as an extreme case of polar covalent bond، ionic character of molecules and polar molecules. Bonding in solid state ionic، molecular and covalent solids، metals. Hydrogen bond. Resonance.

Molecules : Molecular orbital. Theory-bond order and magnetic properties of H_2، O_2، N_2، F_2 on the basis of MOT. Hybridisation involving s، p and d orbitals (including shapes of simple and organic molecules)، Dipole moment structure of molecules.

Unit ١٢: Chemistry of Non-Metals - ١

Hydrogen (unique position in periodic table، occurrence، isotopes، properties، reactions and uses)، Hydrides-molecular، soline and interstitial

Oxygen (occurrence، preparation، properties and reactions، uses)،simple oxides؛ ozone

Water and hydrogen peroxide، structure of water molecule and its aggregates، physical and chemical properties of water، hard and soft water، water softening، hydrogen peroxide- preparation، properties، structure and uses.

Uses.

Nitrogen- Preparation، properties، compounds of Nitrogen-Ammonia، Oxides of Nitrogen، Nitric Acid-preparation، properties and uses.

Unit ١٣ : Chemistry of Non-metals-II

Boron-occurrence isolation, physical and chemical properties, borax and boric acid, uses of boron and its compounds.

Carbon, inorganic compounds of carbon-oxides, halides, carbides, elemental carbon.

Silicon- occurrence, preparation and properties, oxides and oxyacids of phosphorus, chemical fertilizers.

Sulphur – occurrence and extraction, properties and reactions, oxides, Sulphuric acid – preparation, properties and uses, sodium thiosulphate.

Halogens- occurrence, preparation, properties, hydrogen halides, uses of halogens.

Noble gases- discovery, occurrence and isolation, physical properties, chemistry of noble gases and their uses.

Unit ١٤ : Chemistry of Lighter Metals

Sodium and Potassium- occurrence and extraction, properties and uses. Important compounds-NaCl, Na_2CO_3, $NaHCO_3$, NaOH and KCl, KOH.

Magnesium and calcium-occurrence and extraction, properties and uses. Important compounds $Mgcl_2$, $MgSO_4$, CaO, $Ca(OH)_2$, $CaCO_3$, $CaSO_4$, Plaster of paris, Bleaching Powder.

Aluminium –occurrence, extraction properties and uses, compounds-$AlCI_3$, alums.

Cement.

Biological role of Sodium, Potassium, Magnesium and Calcium.

Unit ١٥ :- Heavy Metals

Iron – Occurrence and extraction, compounds of iron, oxides, halides, sulphides, sulphate, alloy and steel.

Copper and Silver- occurrence and extraction, properties and uses, compounds-oxides, halides and sulphates, photography. Zinc and Mercury- occurrence and extraction, properties and uses, compounds-oxides, halides, sulphides and sulphates.

Tin and Lead- occurrence and extraction, properties and uses, compounds-oxides, sulphides, halides.

Unit ١٦ : Chemistry of Representative Elements

Periodic properties- Trends in groups and periods (a) Oxides-nature (b) Halides-melting points (c) Carbonates and sulphates-solubility.

The chemistry of s and p block elements, electronics configuration, general characteristic properties and oxidation states of the following :-

Group ١ elements - Alkali metals
Group ٢ elements - Alkaline earth metals
Group ١٣ elements - Boron family
Group ١٤ elements - Carbon family
Group ١٥ elements - Nitrogen family
Group ١٦ elements - Oxygen family
Group ١٧ elements - Halogen family
Group ١٨ elements - Noble gases & Hydrogen

Unit ١٧ : Transition Metals Including Lanthanides

Electronic configuration : General characteristic properties, oxidation states of transition metals. General first row transition metals and properties of their compounds-oxides, halides and sulphides.

General properties of a second and third row transition elements (Groupwise discussion).

Preparation and reactions, properties and uses of Potassium dichromate Potassium permanganate.

Inner Transition Elements : General discussion with special reference to oxidation states and lanthanide contraction.

Unit ١٨ : Coordination Chemistry and Organo Metallics

Coordination compounds, Nomenclature : Isomerism in coordination compounds : Bonding *in coordination compounds, Werner's* coordination theory. Applications of coordination compounds.

Unit ١٩ : Nuclear Chemistry

Nature of radiation from radioactive substances. Nuclear reactions : Radio-active disintegration series : Artificial transmutation of elements : Nuclear fission and Nuclear fusion : Isotopes and their applications : Radio carbon-dating.

Unit ٢٠ : Purification and Characterisation of Organic Compounds

Purification (crystallization, sublimation, distillation, differential extraction, chromatography).

Qualitative analysis, detection of nitrogen, sulphur, phosphorus and halogens.

Quantitative analysis- estimation of carbon, hydrogen, nitrogen, halogens, sulphur, phosphorus (basic principles only)

Determination of molecular mass-Silver salt method, cholroplatinate salt method

Calculation of empirical formula and molecular formula.

Numerical problems in organic quantitative analysis.

structure elucidation: modern methods of

Unit ٢١ : Some Basic Principles

Classification of Organic Compounds.

Tetravalency of Carbon, Homologous series.

Functional groups- -C=C-, -C C-, and groups containing halogen, oxygen, nitrogen and sulphur. General introduction to naming organic compounds-Common names and IUPAC nomenclature of alphatic, aromatic and Cyclic Compounds. Illustration with examples of Compounds having not more than three same of different functional groups / atoms. Isomerism- Structural and stereoisomerism (geometrical and optical). Chirality-Isomerism in Compounds having one and two chiral Centres. Enantiomers, diastereoisomers, recemic forms, recemisation & resolution.

Covalent bond fission-Homolytic and Heterolytic: free radicals carbocations and carbanions. Stability of Carbocations and free-radicals. Electrophiles and Nucleophiles.

Electron displacement in a covalent bond- inductive effect, electromeric effect, resonance and

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

Unit ٢٢ : Hydrocarbons

Classification. Sources of hydrocarbons: Alkanes- General methods of preparation (from unsaturated hydrocarbons, alkylhalides, aldehydes, ketones and carburoxylic acids). Physical properties and reactions (Substitution, Oxidation and miscellaneous). Conformations of alkanes(ethane, popane butane) and cyclohexane, sawhorse and Newman projections)-mechanism of halogaration of alkanes.

Alkanes and Alkynes- General methods of preparation physical properties, Chemical reactions-Mechanism of electrophilic addition reactions in alkenes-Markowni Koff***'s Rule***, peroxide effect. Acidic character of alkynes. Polymerisation of alkenes.

Aromatic hydrocarbons- Benzene and its homologues, Isomerism, Chemical reactions of benzene. Structure of benzene, resonance. Directive influence of substituents.

Petroleum – Hydro Carbons from Petroleum, Cracking and reforming, quality of gasoline- Octane number, gasoline additives.

Unit ٢٣ : Organic Compound Containing Halogens

(Haloakanes and Haloarenes)

Methods of preparation, physical properties and reactions. Preparation, properties and uses of Chloroform and lodoform.

Unit ٢٤ : Organic Compounds Containing Oxygen

General methods of preparation, correlation of physical properties with their structures, chemical properties and uses of Alchols, polyhydric alcohols, Ethers, aldehydes, ketones, carboxylic acids and their derivatives, Phenol, Benzaldehyde and Benzoic acid -their important methods of preparation and reactions. Acidity of carboxylic acids and phenol effect of substituents on the acidity of carboxylic acids.

Unit ٢٥: Organic Compounds Containing Nitrogen

(Cyanides, isocyanides, nitrocompounds and amines)

Nomenclature and classification of amines, cyanides, isocyanides, nitrocompounds and their methods of preparation; correlation of their physical properties with structure; chemical reactions and uses- Basicity of amines.

Unit ٢٦: Synthetic and Natural Polymers Classification on Polymers, natural and synthetic polymers (with stress on their general methods of preparation) and important uses of the following.

Teflon, PVC, Polystyrene, Nylon-٦٦, terylene, Bakelite)

Unit ٢٧: Bio Molecules Processes The Cell and Biological Energy Cycle Carbohydrates: Monosaccharides, Disaccharides, Polysaccharides

Amino acids and Peptides- Structure and classification.

Proteins and Enzymes-Structure of Proteins, Role of enzymes.

Nucleic Acids-DNA and RNA

Biological functions of Nucleic acids-Protein synthesis and replication.

Lipids – Structure, membranes and their functions.

Unit ٢٨: Chemistry In Action Dyes, Chemicals in medicines (antipyretic, analgesic, antibiotics & tranquilisers), Rocket propellants. (Structural formulae non-evaluative)

Unit ٢٩: Environmental Chemistry

Environmental pollutants; soil, water and air pollution; major atmospheric pollutants; acid rain, Ozone and its reactions causing ozone layer depletion, effects of the depletion of ozone layer, industrial air pollution.

SYLLABUS FOR B.TECH./B.DESIGN/ BIOTECHNOLOGY-(B.TECH/M.TECH)

MATHEMATICS

Unit ١:- Sets, Relations and Functions

Sets and their Representations, Union, intersection and complements of sets, and their algebraic properties, Relations, equivalence relations, mappings, one-one, into and onto mappings, composition of mappings.

Unit ٢: Complex Numbers Complex numbers in the form a+ib and their representation in a plane. Argand diagram. Algebra of complex numbers, Modulus and Argument (or amplitude) of a complex number, square root of a complex number. Cube roots of unity, triangle inequality.

Unit ٣: Matrices and Determinants

Determinants and matrices of order two and three, properties of determinants, Evaluation of determinants. Area of triangles using determinants; Addition and multiplication of matrices, adjoint and inverse of matrix. Test of consistency and solution of simultaneous linear equations using determinants and matrices.

Unit ٤: Quadratic Equations Quadratic equations in real and complex number system and their solutions. Relation between roots and co-efficients, nature of roots, formation of quadratic equations with given roots; Symmetric functions of roots, equations reducible to quadratic equations-application to practical problems.

Unit ٥ : Permutations and Combinations Fundamental principle of counting; Permutation as an arrangement and combination as selection, Meaning of P (n,r) and C (n,r). Simple applications.

Unit ६: Binomial Theorem and Its Applications

Binomial Theorem for a positive integral index, general term and middle term, Binomial Theorem for any index. Properties of Binomial Co-efficients. Simple applications for approximations.

Unit ७: Sequences and Series

Arithmetic, Geometric and Harmonic progressions. Insertion of Arithmetic Geometric and Harmonic means between two given numbers. Relation Between A.M., G.M. and H.M. Special series: S_n, S_{n^2}, S_{n^3}. Arithmetico-Geometric Series, Exponential and Logarithmic series.

Unit ८: Differential Calculus

Polynomials, rational, trigonometric, logarithmic and exponential functions, Inverse functions. Graphs of simple functions. Limits, Continuity, 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 upto two. Applications of derivatives: Rate of change of quantities, monotonic-increasing and decreasing functions, Maximum and minimum of functions of ***one variable, tangents and normals, Rolle's and Lagrange's Mean Value Theorems.***

Unit ९:- Integral Calculus

Integral as an anti-derivative. Fundamental integrals involving algebraic, trigonometric, exponential and logarithmic functions. Integration by substitution, by parts and partial fractions. Integration using trigonometric identities. Integral as limit of a sum. Properties of definite integrals. Evaluation of definite integrals, Determining areas of the regions bounded by simple curves.

Unit १०:- Differential Equations

Ordinary differential equations, their order and degree. Formation of differential equations. Solution of differential equations by the method of separation of variables. Solution of homogeneous and linear differential equations, and those of the type

$$\frac{dy}{dx} = f(x)$$

Unit ११:- Two Dimensional Geometry

Recall of Cartesian system of rectangular co-ordinates in a plane, distance formula, area of a triangle, condition of the collinearity of three points and section formula, centroid and in-centre of a triangle, locus and its equation, translation of axes, slope of a line, parallel and perpendicular lines, intercepts of a line on the coordinate axes.

The straight line and pair of straight lines

Various forms of equations of a line, intersection of line, angles between two lines, conditions for concurrence of three lines, distance of a point from a line Equations of internal and external bisectors of angles between two lines, coordinates of centroid, orthocenter, circumcentre of a triangle, equation of family of lines passing through the point of intersection of two lines, homogeneous equation of second degree in x and y, angle between pair of lines through the origin, combined equation of the bisectors of the angles between a pair of lines, condition for the general second degree equation of

to a representa pair of lines, point intersection and angle between two lines.

Circles and Family of Circles

Standard form of equation of a circle, general form of the equation of a circle, its radius and centre, equation of a circle in the parametric form, equation of a circle when the end points of a diameter are given, points of intersection of a line and a circle with the centre at the origin and conditions for a line to be tangent to the circle, length of the tangent, equation of the tangent, equation of a family of circles through the

Conic Sections

Sections of cones, 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 ١٢: Three Dimensional Geometry

Coordinates of a point in space, distance between two points; Section formula, direction ratios and direction cosines, 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; intersection of a line and a plane, coplanar lines, equation of a sphere, its centre and radius. Diameter form of the equation of a sphere. Unit ١٣: Vector Algebra

Vectors and Scalars, addition of vectors, components of a vector in two dimensions and three dimensional space, scalar and vector product, products scalar and vector triple Application of vectors to plane geometry.

Unit ١٤: Probability

Probability of an event, addition and multiplication theorems of probability and their application; Conditional probability, Total probability theorem, ***Bayes' Theorem,*** independence of events.

Unit ١٥: Trigonometry

Trigonometrically identities and equations. Inverse trigonometricfunctions and their properties. Properties of triangles, including centroid, incentre, circum-centre and orthocenter, solution of triangles. Heights and Distances.

BIOTECHNOLOGY- B.TECH / M.TECH & B.SC.NURSING.B.PHARMA/D.PHARMA

BIOLOGY (BOTANY AND ZOOLOGY)

Unit : ١ Diversity in Living World

Biology – its meaning and relevance to mankind What is living; Taxonomic categories and aids (Botanical gardens, herbaria, museums, zoological parks); Systematics and Binomial system of nomenclature.

Introductory classification of living organisms (Two-kingdom system, Five-kingdom system); Major groups of each kingdom alongwith their salient features (Monera, including Archaebacteria and Plantae, Cyanobacteria, Protista, Fungi, Animalia); Viruses; Lichens

Plant kingdom – Salient features of major groups (Algae to Angiosperms);

Animal kingdom – Salient features of Nonchordates up to phylum, and Chordates up to class level.

Unit : ٢ Cell : The Unit of Life ; Structure and Function

Cell wall; Cell membrane; Endomembrane system (ER, Golgi apparatus /Dictyosome, Mitochondria; Plastids, Ribosomes, Cytoskeleton; Cilia and Flagella; Centrosome and Centriole; Nucleus; Microbodies. Structural differences between prokaryotic and eukaryotic, and between plant and animal cells. Cell cycle (various phases); Mitosis; Meiosis.

Biomolecules – Structure and function of Carbohydrates, Proteins, Lipids, and Nucleic acids.

Enzymes

– Chemical nature, types, properties and mechanism of action.

Unit ٣ Genetics and Evolution

Mendelian inheritance؛ Chromosome theory of inheritance؛ Gene interaction؛ Incomplete dominance؛ Co-dominance؛ Complementary genes؛ Multiple alleles؛ Linkage and crossing over؛ Inheritance of blood groups in humans. DNA –its organization and replication؛ Gene DNA evolution، Transcription and Translation؛ expression and regulation؛ fingerprinting.

Theories and evidences including modern Darwinism.

Unit ٤ Structure and Function – Plants

Morphology of a flowering plant؛

Tissues and tissue systems in plants؛ Anatomy and function of root، stem (including modifications)، leaf، inflorescence، flower (including position and arrangement of different whorls، placentation)، fruit and seed؛ Types of fruit؛ Secondary growth؛

Absorption and movement of water (including diffusion، osmosis and water relations of cell) and of nutrients؛ Translocation of food؛ Transpiration and gaseous exchange؛ Mechanism of stomatal movement.

Mineral nutrition – Macro- and micro-nutrients in plants including deficiency disorders؛ Biological nitrogen fixation mechanism.

Photosynthesis – Light reaction، cyclic and non-cyclic photophosphorylation؛ Various pathways of carbon dioxide fixation؛ Photorespiration؛ Limiting factors.

Respiration – Anaerobic، Fermentation، Aerobic؛ Glycolysis، TCA cycle؛ Electron transport system؛ Energy relations.

Unit ٥ Structure and Function - Animals

Tissues؛ Elementary knowledge of morphology، anatomy and functions of different systems of earthworm، cockroach and frog.

Human Physiology – Digestive system - organs، digestion and absorption؛ Respiratory system – organs، breathing and exchange and transport of gases. Body fluids and circulation – Blood، lymph and double circulation، regulation of cardiac activity؛ Hypertension، Coronary artery diseases.

Excretion system – Urine formation، regulation of kidney function

Locomotion and movement – Skeletal system، joints، muscles، types of movement.

Control and co-ordination – Central and peripheral nervous systems، structure and function of neuron، reflex action and sensory reception؛ Role of various types of endocrine glands؛ Mechanism of hormone action.

Unit ٦ Reproduction، Growth and Movement in Plants

Asexual methods of reproduction؛ Sexual Reproduction - Development of male and female gametophytes؛ Pollination (Types and agents)؛ Fertilization؛ Development of embryo، endosperm، seed and fruit (including parthenocarpy and apomixis). Growth and Movement – Growth phases؛ Types of growth regulators and their role in seed dormancy، germination and movement؛ Apical dominance؛ Senescence؛ Abscission؛ Photo-periodism؛ Vernalisation؛ Various types of movements.

Unit ٧ Reproduction and Development in Humans

Male and female reproductive systems؛ Menstrual cycle؛ Gamete production؛ Fertilisation؛ Implantation؛ Embryo development؛ Pregnancy and parturition؛ Birth control and contraception.

Unit : ৮ Ecology and Environment

Meaning of ecology, environment, habitat and niche. Ecological levels of organization (organism to biosphere); Characteristics of Species, Population, Biotic Community and Ecosystem; Succession and Climax.
Ecosystem – Biotic and abiotic components; Ecological pyramids; Food chain and Food web; Energy flow; Major types of ecosystems including agroecosystem.
Ecological adaptations – Structural and physiological features in plants and animals of aquatic and desert habitats.
Meaning, Biodiversity – types and conservation strategies (Biosphere reserves, National parks and Sanctuaries)
Environmental Issues – Air and Water Pollution (sources and major pollutants); Global warming and Climate change; Ozonedepletion; Noise pollution; Radioactive pollution; Methods of pollution control (including an idea of bioremediation); Deforestation; Extinction of species (Hot Spots).

Unit : ৯ Biology and Human Welfare

Animal husbandry – Livestock, Poultry, Fisheries; Major animal diseases and their control. Pathogens of major communicable diseases of humans caused by fungi, bacteria, viruses, protozoans and helminths and their control. Cancer, AIDS. Adolescence and drug/alcohol abuse; Basic concepts of immunology. Plant Breeding and Tissue Culture in crop improvement.

Biofertilisers (green manure, symbiotic and free-living nitrogen-fixing microbes, mycorrhizae); Biopesticides (micro-organisms as biocontrol agents for pests and pathogens); Bioherbicides; Microorganisms as pathogens of plant diseases with special reference to rust and smut of wheat, bacterial leaf blight of rice, late blight of potato, bean mosaic, and root - knot of vegetables.

Bioenergy – Hydrocarbon - rich plants as substitute of fossil fuels.

Unit : ১০ Biotechnology and its Applications

Microbes as ideal system for biotechnology; Microbial technology in food processing, industrial production (alcohol, acids, enzymes, antibiotics), sewage treatment and energy generation.
Steps in recombinant DNA technology – restriction enzymes, DNA insertion by vectors and other methods, regeneration of recombinants.
Applications of R-DNA technology. In human health – Production of Insulin, Vaccines and Growth hormones, Organ transplant, Gene therapy. In Industry – Production of expensive enzymes, strain improvement to scale up bioprocesses. In Agriculture – GM crops by transfer of genes for nitrogen fixation, herbicide-resistance and pest-resistance including Bt crops

SYLLABUS FOR B.TECH. (LATERAL ENTRY)

MATHEMATICS

Unit १: Ordinary Differential Equation

Differential equation of first order. Linear differential equation of second order (homogeneous and nonhomogeneous case). ***Cauchy, Euler's equation, Application of*** first order differential equations (mixture ***problem, Newton's law of cooling,*** orthogonal trajectory). Application to LCR circuits, Application to free and forced vibration of Mass spring system.

Unit २: Series Method

Propertiesof power series, Radius of ***convergence of power series, Legender's equation and Legender's polynomial, properties of Legender's polynomial, Gamma function,*** ordinary and singular point Frobenious method, ***Bessel's equation and properties of Bessel's function.***

Unit ३: Laplace Transform

Laplace transforms of standard function, periodic functions, Unit step function, Transforms of derivatives and integrals. Differentiation and integration of transforms, Linearity property, Inverse Laplace transform, Shifting theorems, Convolution. Application to solve differential and integral equations (initial value problem).

Unit ४: Fourier Series

Periodic function, Fourier series, Euler's formula, Even and odd functions, Fourier series expansions of even and odd function, half range expansion of functions, Expansion of functions with finite discontinuities.

Unit ५: Matrix

Types of matrices, algebra of matrices, rank, solution of non-homogenous system of equations, consistency of the system of equations, Linear dependance and independance, solution of homogeneous system of equation. Eigen values and eigen vectors. Norm and inner product. Orthogonal and projection matrix. Application of eigen values and vectors to the systems of linear differential equation.

Unit ६: Vectors:

Vector algebra, product of vectors, vector differentiation, vector differential operator, gradient, directional derivatives, divergence, curl, line integral, double integral, ***green's*** theorem.

ENGINEERING MECHANICS

Unit १:- Statics

Conditions of equilibrium, concept of free body diagram, methods of moments and solution to engineering problems.

Friction : Static friction, ladder friction, problems with friction, Belt friction and screw jack, force analysis of plane trusses (method of joint, method of sections, plane frames, methods of members), Parallel forces in a plane, Centre of parallel forces, Pappus Guldinus theorems, MI of plane figures, parallel axis theorem, perpendicular axis theorem, Polar MI, Principle of virtual work for a single particle, rigid bodies, systems and constrained bodies.

Unit २: Dynamics

Vibration, D' Alembert's principle, Force proportional to displacement, free momentum and impulse, Application to principle of linear momentum to a single particle, rigid bodies and ideal systems. Application to principle of angular momentum to a single particle and rotating rigid bodies. Principle of conservation of momentum.

Unit ३: Work and Energy

Principle of work and energy for ideal system, Conservation of energy.

BASIC ELECTRICAL ENGINEERING

Unit ১: Electrostatics

Coulomb's law, Electric charge, Potential, Field & Capacitance, Potential gradient due to spherical cylindrical and plane charges, Electric force, Flux density and permitivity. Calculation of Capacitance of spherical, coaxial, cylindrical and parallel plate condenser. Energy stored in a electric field.

Unit ২: Electromagnetism

Magnetic field due to current in conductor. Magnetic field intensity and Flux density. Permeability, B-H curves, Magnetisation, Concept in hystersis. Magnetomotive force and Magnetic reluctance.

Electrodynamic force:- ***Faraday's*** law of electromagnetic induction, Eddy current, emf induced in a conductor moving in a magnetic field. Energy stored in a magnetic field.

Unit ৩: D.C. Circuit

Current distribution in series and parallel circuit. Power and energy in electric circuit. Star-Delta conversion. Kirchoff's law & its application and solve electric circuit by branch & loop current method & nodal method. Superposition theorem.

Unit ৪: A.C. Circuit

Production of alternating current – Instantaneous, average & rms value of current and voltage. Peak factor, Form factor, Amplitude, Frequency, Phase difference, Addition and subtraction of alternating quantity. Phasor diagram, Resistance, Inductance, Capacitance, impedance and admittance- power and power factor-series and parallel circuits. Q factor-Threephase circuit. Star-Delta connection-Active and reactive power. Power measurement with one and two wattmeter methods-Calculation in RLC circuit, in series circuit.

Unit ৫: Instrument

Construction and principle of operation- PMMC, MI and dynamometer type ammeter, voltmeter and dynamometer type wattmeter. Power factor meter.

Unit ৬: Illumination

Law of illumination- Solid angle, Luminous flux, Luminous intensity, Illumination, brightness and luminous efficiency.

Unit ৭: Production Light

Filament lamp, Arc lamp, Electric discharge lamps, Sodium vapour lamp, Mercury vapour lamp-Theory of electrical energy radiation. Comparison between filament lamp and fluorescent lamp.

SYLLABUS FOR MCA & M.SC. COMPUTER SCIENCE

MATHEMATICS

Unit ১:- Algebra of Sets : Set operations, Union, Intersection, Difference, Symmetric Difference, Complement, Venn Diagram, Cartesian products of sets, Relation and Function, Composite Function, Inverse of a Function, Equivalence Relation, Kinds of Number Systems : Real numbers (algebraic and other properties), rational and irrational numbers, Complex numbers, Algebra of complex numbers, Conjugate and square root of a complex number, cube roots of unity, De-moivre's Theorem with simple applications. Permutation and combinations and their simple applications, Mathematical induction, Binomial Theorem. Determinants up to third order, Minors and Cofactors, Properties of determinants. Matrices up to third order, Types of Matrices. Algebra of matrices, Adjoint and inverse of a matrix. Application of determinants and matrices to the solution of linear equation (in three unknows)

Unit ২:- Trigonometry : Compound angles, Multiple and Sub-multiple angles, solution of trigonometric equations, Properties of triangles, Inverse circular function.

Unit ৩:- Co-ordinate Geometry of Two Dimensions : Straight lines, pairs of straight lines, Circles, Equations of tangents and normals to a circle. Equations of Parabola, Ellipse and Hyperbola, Ellipse and hyperbola in simple forms and their tangents (Focus, directix, eccentricity and latus rectum in all cases)

Unit ৪:- Co-ordinate Geometry of Three Dimensions : Distance and division formulae, Direction cosines and direction ratios, Projections, Angles between two planes, Angle between a line and plane. Equations of a sphere-general equation.

Unit ৫:- Vector Fundamentals, Dot and Cross product of two vectors, Scalar triple product, Simple Applications (to geometry, work and moment).

Unit ৬:- Concept of Differential Calculus limit, continuity, Derivation of standard functions, successive differentiation, simple cases, Leibnitz Theorem, Partial differentiation, Simple cases, derivatives as rate measure, Maxima and minima, indeterminate forms, Geometrical applications such as tangents and normals to plane curves.

Unit ৭:- Integral Calculus :- Standard methods of integration (substitution, by pars, by partial fractions etc.) Definite integrals and properties of Definite Integrals, Areas under plane curves, Differential Equations only simple cases such as

(i) $dy/dx = f(x)$

(ii) $dy/dx = f(x)\,g(y)$

(iii) $d^2y/dx^2 = f(x)$ and application to motions in a straight line.

Unit ৯:- Probability and Statistics : Averages (Mean, Median and Mode), Dispersion (standard deviation and variance). Definition of probability, Mutually exclusive events, Independent events, Addition theorem.

COMPUTER AWARENESS

Computer Basics: Organization of a Computer, Central Processing Unit (CPU), Structure of instructions in CPU, input/output devices, computer memory, back-up devices.

DATA REPRESENTATION

Representation of characters, integers and fractions, binary and hexadecimal representations, Binary Arithmetic : Addition, subtraction, multiplication, division, simple *arithmetic and two's complement arithmetic,* floating point representation of numbers, Boolean algebra, truth tables, venn diagram.

ANALYTICAL ABILITY AND LOGICAL REASONING

Questions in this section will test logical reasoning and quantitative reasoning.

SYLLBUS FOR M.SC. (BIOTECHNOLOGY / APPLIED MICROBIOLOGY)

BIOLOGY (١٠+٢+٣ Standard)

Unit ١:- General Biology

Taxonomy; Heredity; Genetic Variation; Conservation; Principles of ecology; Evolution; Techniques in modern biology.

Unit ٢:-Biochemistry and Physiology

Carbohydrates; Proteins; Lipids; Nucleic acids; Enzymes; Vitamins; Hormones; Metabolism; Photosynthesis. Nitrogen Fixation, Fertilization system, Osmoregulation; Nervous and Endocrine system; Vascular system; Immune system; Digestive system, Reproductive System.

Unit ٣:-Basic Biotechnology

Tissue culture; Application of enzymes; Antigen-antibody interaction; Antibody production; Diagnostic aids.

Unit ٤:-Molecular Biology

DNA; RNA; Transcription; Replication; Translation; Proteins; Lipids; Membranes; Gene transfer.

Unit ٥:-Cell Biology

Cell cycle; Cytoskeletal elements; Mitochondria; Golgi apparatus; Endoplasmic reticulum; chloroplast; Signaling.

Unit ٦:-Microbiology Isolation; Cultivation; Characterization and enumeration of virus; Bacteria; Fungi; Protozoa; Pathogenic micro-organisms.

CHEMISTRY (١٠+٢+٣ Standard)

Unit ١:-Atomic Structure

Bohr's theory and Schrodinger wave equation; Periodicity in properties; Chemical bonding; Properties of s, p, d and f block elements; Complex formation; Coordination compounds; Chemical equilibria; Chemical thermodynamics and Chemical kinetics (zero, first, second and third order reactions); Photochemistry; Electrochemistry; Acid-base concepts; Stereochemistry of carbon compounds; Inductive, Electromeric, conjugative effects and resonance.

Unit ٢:-Chemistry of Functional Groups

Hydrocarbons, alkyl halides, alcohols, aldehydes, ketones, carboxylic acids, amines and their derivatives; Aromatic hydrocarbons, halides, nitro and amino compounds, phenols, diazonium salts, carboxylic and sulphonic acids; Mechanism of organic reaction; Soaps and detergents; Synthetic polymers; Biomolecules- aminoacids, proteins, nucleic acids, lipids and carbohydrates (polysaccharides); Instrumental techniques – chromatography (TLC, HPLC), electrophoresis, UV-Vis-IR and NMR spectroscopy, mass spectrometry, etc.

MATHEMATICS (١٠+٢ Standard)

Sets, Relations and Functions, Mathematical numbers, Linear and Quadratic equations, Sequences and Series, Trignometry, Cartesian System of Rectangular Coordinates, Straight lines and Family, Circles, Conic Sections, Induction, Logarithms, complex and Combinations, Binomial Permutations Theorem, Series, Three Dimensional Geometry, Vectors, Stocks, Shares and Debentures, Average and Partition Values, Index numbers, Matrices and Determinants, Boolean Algebra, Probability, Functions, limits and Continuity, Differentiation, Application of Derivatives, Definite and Indefinite Integrals, Differential Equations, Exponential and Logarithmic Series, Mathematical Logic, Statistics, Elementary Statics and Dynamics, Partnership, Bill of Exchange, Linear of Programming, Annuities, Application Calculus in Commerce and Economics.

PHYSICS (١٠+٢ Standard)

Physical World and Measurement, Kinematics, Laws of Motion, Work, Energy and Power Electrostatics, Current electricity, Magnetic Effects of Current and Magnetism, Electromagnetic Induction and Alternating Current, Electromagnetics waves, Optics, Dual Nature of Matter and Radiations, Atomic Nucleus, Solids and Semiconductor Devices, Principles of Communication, Motion of System of Particles and Rigid Body, Gravitation, Mechanics of Solids and Fluids, Heat and Thermodynamics, Oscillations, Waves.