

Nepal Engineering College
Changunarayan-04, Bhaktapur
Entrance Test 2022

Syllabus of Mathematics [40%]:

1 Set, Logic and functions

- 1.1 Set, real number system, intervals, absolute value, logic, connectives, laws of logic
- 1.2 Function, types of functions – injective, subjective, objective, algebraic, trigonometric, exponential and logarithmic; Inverse of function, composite functions

2 Algebra

- 2.1 Matrices and determinants, types and properties, inverse of a matrix
- 2.2 Complex numbers and polynomial equations
- 2.3 Sequence and series, permutations and combination
- 2.4 Binomial theorem, exponential and logarithmic series

3 Trigonometry

- 3.1 Trigonometric equations and general values
- 3.2 Inverse trigonometric functions, principal values
- 3.3 Properties of triangles, in-centre, ortho-centre and circum-centre, solution of triangles

4 Coordinate geometry

- 4.1 Straight lines, pair of lines
- 4.2 Circles, equations of circle in different forms, tangents and normal
- 4.3 Conic section: parabola, ellipse, and hyperbola, standard equations and simple properties
- 4.4 Coordinates in space, plane and its equation

5 Calculus

- 5.1 Limit and continuity of functions, indeterminate forms, L'Hospital rule
- 5.2 Derivatives, rules of derivatives, geometrical and physical meanings, higher order derivatives, applications of derivatives: tangents and normal, rate of change, maxima and minima
- 5.3 Integration, linear properties, rules of integration, standard integrals, definite integral, applications of definite integral: area under a curve and area between two curves
- 5.4 Differential equations, order and degree, differential equation of first order and first degree: variable separation method, homogeneous, linear and exact differential equations, integrating factor

6 Vectors and their products

- 6.1 Vectors in plane and space, algebra of vectors, linear combination of vectors, linearly dependent and independent set of vectors
- 6.2 Product of two vectors, scalar and vector product of two vectors, scalar triple product

7 Statistics and probability

- 7.1 Measures of location and measures of dispersion
- 7.2 Correlation and regression
- 7.3 Basic terms in probability, conditional and compound probability, additive and multiplicative rules, Bayes' theorem, binomial distribution

Syllabus of Physics [30%]:

1 Mechanics

- 1.1 Physical quantities, vector, and kinematics: Dimensions, resolution and polygon laws of vector, vector algebra, equations of motions, projectile motion, relative motion
- 1.2 Newton's laws of motion and friction: conservation of linear momentum, applications of Newton's laws in equilibrium and non – equilibrium, laws of solid friction and verification

- 1.3 Work, energy and power: work- energy theorem, kinetic and potential energy, conservation of energy, conservative and non-conservative forces, elastic and inelastic collisions
 - 1.4 Circular motion, gravitation and SHM: centripetal force, conical pendulum, banking of track, gravitational potential, variation of g, motion of satellite, rocket launch technology, energy in SHM, spring- mass system, simple pendulum, damped and forced oscillation, resonance
 - 1.5 Rotational dynamics: Moment of inertia, radius of gyration, rotational KE, centre of gravity and centre of mass, Torque, conservation of angular momentum
 - 1.6 Elasticity: Hook's law, Young's modulus, bulk modulus, modulus of rigidity, Poisson's ratio, elastic energy
 - 1.7 Fluid Mechanics: buoyancy, flotation, Archimedes' principles, surface tension, capillarity and applications, viscosity, Newton, Stoke and Poiseuille's formula, Reynold number, continuity equation, Bernoulli's equation
- 2 Heat and thermodynamics:**
- 2.1 Temperature and quantity of heat: Thermal equilibrium, specific heat, latent heat, method of mixture, measurement of specific heat and latent heat, Newton's law of cooling, triple point.
 - 2.2 Thermal expansion: expansion of solid and liquid, measurement and applications of expansions.
 - 2.3 Transfer of heat: conduction, convections, radiation, thermal conductivity, black body radiation, Stefan- Boltzmann law
 - 2.4 Thermal properties of Matter: molecular properties of matter, Kinetic theory of gases, heat capacities of gases and solids
 - 2.5 Laws of thermodynamics: first law, heat and work, relation of specific heat of gas, thermodynamic process, second law, heat engine, efficiency, Carnot cycle, Otto cycle, Diesel cycle, Refrigeration, Entropy
- 3 Geometric and physical optics:**
- 3.1 Reflection: plane and curved mirror, mirror formula
 - 3.2 Refraction: plane surface, critical angle, total internal reflection, lateral shift, prism, minimum deviation, lenses, lens formula, lens maker's formula, combination of lenses in contact, optical fibre
 - 3.3 Dispersion: spectrum, dispersive power, chromatic aberration, achromatism, spherical aberration, scattering of light
 - 3.4 Nature and propagation of light: Huygen's principle, velocity of light
 - 3.5 Interference: coherent sources, young's double slit experiment
 - 3.6 Diffraction: fraunhofer;s diffraction, diffraction grating, resolving power
 - 3.7 Polarization: Brewster's law. Transverse nature of light, polaroid
- 4 Waves and sound:**
- 4.1 Wave motion: travelling and stationary wave
 - 4.2 Mechanical wave: velocity of sound wave in solid, gas and liquid, effect of temperature, pressure, humidity
 - 4.3 Waves in pipes and strings: closed and open pipes, resonance, resonance tube. String, laws of vibration of fixed string
 - 4.4 Acoustic phenomena: pressure amplitude, intensity level, quality and pitch, ultrasonic and infrasonic, Doppler's effect
- 5 Electricity and magnetism**
- 5.1 Electrostatics: coulomb's law, electric field and Gauss's law, potential and potential gradient, capacitors, combination of capacitors, type of capacitors, effect of dielectrics, energy stored of capacitors, polarization and displacement
 - 5.2 DC circuits: Ohm's law, resistivity and conductivity, work and power, Galvanometer and ohm meter, internal resistance, Joule's law, Kirchhoff's law and applications

- 5.3 Thermoelectric effect: Seebeck effect, thermocouples, peltier effect, thermopile, Thomson effect
- 5.4 Magnetic effect: force on a conductor and charge, torque, Hall's effect, Biot- Savart's law, Ampere's law, force between parallel conductors
- 5.5 Magnetic properties of matter: Earth magnetism, magnetic materials, permeability, susceptibility, hysteresis
- 5.6 Electromagnetic induction: faraday's law, induced emf, AC generators, self and mutual induction, energy stored by inductor, transformer.
- 5.7 Alternating current: RMS value, phasor diagram of capacitance, inductance and resistance, quality factor, power factor

6 Modern physics

- 6.1 Electrons: Millikan's experiment, cathode rays, specific charge
- 6.2 Photons and quantization of energy: photoelectric effect, Planck's constant, Bohr's theory, spectral series, de Broglie's theory, Uncertainty principle, X – ray and Bragg's law, LASER
- 6.3 Solids and semiconductor devices: intrinsic and extrinsic semiconductors, PN junction, rectification, zener diode, transistors, logic gates
- 6.4 Radioactivity and nuclear reaction: atomic mass, Isotopes, nuclear density, Einstein's mass energy relation, mass defect, fission, fusion, law of radioactive disintegration, carbon dating, health hazard
- 6.5 Recent trends in physics:
 - 6.5.1 Particle physics: particle and anti-particle, quarks, Leptons, Baryons, Mesons, Higgs Boson.
 - 6.5.2 Universe: Big bang, and Hubble's law, Dark matter, Gravitational wave, black hole.
 - 6.5.3 Seismology: pressure wave, surface wave, internal wave.
 - 6.5.4 Telecommunication: Radio, TV and Mobile, GPS and remote sensing.
 - 6.5.5 Environment: Energy crisis, environmental pollution, ozone layer.
 - 6.5.6 New technology and materials: Nano- technology, superconductor and perfect conductor

Syllabus of Chemistry [20%]:

1 Physical chemistry

- 1.1 Chemical arithmetic: Dalton's atomic theory and Laws of stoichiometry, atomic mass and molecular mass, empirical molecular formula and limiting reactants, Avogadro's Hypothesis and its applications and equivalent masses
- 1.2 States of matter: gaseous state, liquid and solid states
- 1.3 Atomic structure and periodic classification of elements
- 1.4 Oxidation, reduction, and equilibrium
- 1.5 Volume analysis
- 1.6 Ionic equilibrium, acid, base and salt
- 1.7 Electrochemistry
- 1.8 Energetic of chemical reaction, chemical kinetics, chemical bonding and shape of molecules

2 Inorganic chemistry

- 2.1 Non- metal: hydrogen, oxygen, ozone, water, nitrogen and its compounds, Halogen, carbon, phosphorus, sulphur, noble gas and environment pollution
- 2.2 Metals: metallurgical principle, alkali metal, alkaline earth metals, coinage metals, copper, silver, gold
- 2.3 Extraction of metal: zinc and mercury, Iron compound

3 Organic chemistry

- 3.1 Introduction: fundamental principles, purification of organic compounds, nomenclature of organic compounds, structure isomerism and idea of reaction mechanism

- 3.2 Hydrocarbons: alkanes, alkenes and alkynes, aromatic hydrocarbons
- 3.3 Haloalkanes and Haloarenes
- 3.4 Alcohols, phenols and ethers
- 3.5 Aldehydes, ketons, carboxylic acid and derivatives, aliphatic and aromatic
- 3.6 Nitro compounds and amines: aromatic and aliphatic

Syllabus of English [10%]:

1 Vocabulary

- 1.1 Synonyms and antonyms
- 1.2 Homonyms, homophones
- 1.3 Word building, suffixes and prefixes
- 1.4 Meaning of words in context
- 1.5 Idioms and phrases

2 Grammar

- 2.1 Articles and possessives
- 2.2 Pronouns, prepositions, adjectives, adverbs
- 2.3 Tenses, modals, conditions
- 2.4 Subject verb agreement
- 2.5 Tag questions
- 2.6 Sentence types and transformations
- 2.7 Voice

- 2.8 Direct and indirect narration

3 Reading comprehension:

- 3.1 Contents/idea
- 3.2 Reading between the lines
- 3.3 Contextual clues
- 3.4 Reconstruction (rewording)

4 Writing:

- 4.1 Punctuation
- 4.2 Cohesive devices
- 4.3 Coherence
- 4.4 Discourse makers

5 Sounds of English:

- 5.1 Phonemes
- 5.2 Phonemics symbols
- 5.3 Word stress
- 5.4 Intonation