4. FRAMEWORK AND CONTENTS FOR SYLLABUS

4.1 Syllabus of Mathematics [40%]

The syllabus shall be based on requirements for level of understanding of Mathematics for pursuing B.E./B.Arch. degree and largely based on revised syllabus of NEB. It consists of seven (7) chapters, with each chapter consisting of 2-4 sub-chapters, as outlined hereunder. Each university may decide on distribution of weightage across each chapter/sub-chapter.

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, Permutation 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 value

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, tangent and normal

4.3 Conic sections: 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's rule

5.2 Derivatives, rules of derivatives, geometrical & physical meanings, higher order derivatives, applications of derivative: tangent 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 separable method, homogeneous, linear and exact differential equations, integrating factor

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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 of probability, conditional and compound probability, additive and multiplicative rules, Bayes' theorem, binomial distribution

4.2 Syllabus of Physics [30%]

The syllabus shall be based on requirements for level of understanding of Physics for pursuing B.E./B.Arch. degree and largely based on the syllabus of NEB. It consists of six (6) chapters, with each chapter consisting of 4-7 sub-chapters, as outlined hereunder. Each university may decide on distribution of weightage across each chapter/sub-chapter.

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, Center of gravity and center of mass, Torque, Conservation of Angular momentum

1.6 Elasticity: Hook's law, Young modulus, Bulk modulus, modulus of rigidity, Poissons' ratio, elastic energy

1.7 Fluid Mechanics: buoyancy, flotation, Archimedes' principle, 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

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2.2 Thermal expansion: Expansion of Solid & Liquid, Measurement and Applications of expansions

2.3 Transfer of Heat: Conduction, Convection, 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, thermodynamics processes, Second law, Heat engine, efficiency, Carnot Cycle, Otto Cycle, Diesel cycle, Refrigerator, 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 Fiber

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: Fraunhoffer 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 Waves: velocity of sound in solid, gas and liquid, effect of temperature, pressure, humidity

4.3 Waves in Pipes and String: 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 & Magnetism

5.1 Electrostatics: Coulomb's law, Electric field and Gauss law, Potential and potential gradient, Capacitors, combination of capacitors, types of capacitors, effect of dielectrics, Energy stored by 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 Currents: RMS value, Phasor diagram of capacitance, inductance and resistance, Quality factor, Power factor

6. Modern Physics

6.1 Electrons: Millikons's experiment, Cathode rays, specific charge

6.2 Photons & Quantization of Energy: Photoelectric effect, Plank's constant, Bohr's theory, spectral series, De Broglie theory, Uncertainty principle, X-ray and Bragg's law, Laser

6.3 Solids & Semiconductor Devices: Intrinsic and extrinsic semiconductors, P-N junction, Rectification, Zener diode, Transistor, Logic gates

6.4 Radioactivity & 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, Lepton, Baryon, 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, Environment Pollution, Ozone Layer

6.5.6 New Technology & Materials: Nano-technology, super conductor & Perfect conductor

4.3 Syllabus of Chemistry [20%]

The syllabus is based on requirements for level of understanding of Chemistry for pursuing B.E./B.Arch. degree and largely based on the syllabus of NEB. It consists of three (3) chapters, with each chapter consisting of 3-8 sub-chapters, as outlined hereunder. Each university may decide on distribution of weightage across each chapter/sub-chapter.

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 are Hypothesis and its applications and Equivalent masses.

1.2 State 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 Volumetric Analysis,

1.6 Ionic Equilibrium, Acid, Base and Salt

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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, Phosphorous, 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, Ketones, Carboxylic Acid and Derivatives, Aliphatic and Aromatic

3.6 Nitro Compounds and Amines: Aromatic and Aliphatic

4.4 Syllabus of English [10%]

The English proficiency test for entrance in engineering is based on general English and it is designed to measure students' abilities to communicate in English. It consists of four (4) chapters, with each chapter consisting of 4-8 sub-chapters, as outlined hereunder. Each university may decide on distribution of weightage across each chapter/sub-chapter.

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/ideas

3.2 Reading between the lines

3.3 Contextual clues

3.4 Reconstruction (rewording)

4. Writing

4.1 Punctuations

4.2 Cohesive devices

4.3 Coherence

4.4 Discourse markers

5. Sounds of English

5.1 Phonemes

5.2 Phonemics symbols

5.3 Word stress

5.4 Intonation

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