Karunya University
(Karunya Institute of Technology and Sciences)
Declared as Deemed-to-be University under section 3 of the UGC Act, 1956
Karunya Nagar, Coimbatore - 641114, Tamil Nadu, India

KEE 2016 SYLLABUS

MATHEMATICS - KEE 2016

Applications of Matrices and Determinants:
Adjoint, inverse – properties, computation of inverses, solution of system of linear equations bymatrix inversion method. Rank of a matrix – elementary transformation on a matrix, Cramer's rule, non-homogeneous equations, homogeneous linear system and rank method.

Complex Numbers:
Complex number system - conjugate, properties, ordered pair representation. Modulus – Properties, geometrical representation, polar form, principal value, conjugate, sum, difference, product, quotient, vector interpretation, solutions of polynomial equations, De Moivre's theorem and its applications. Roots of a complex number – n^{th} roots, cube roots, fourth roots.

Analytical Geometry of two dimensions:
Definition of a conic – general equation of a conic, classification with respect to the general equation of a conic, classification of conics with respect to eccentricity. Equations of conic sections (parabola, ellipse and hyperbola) in standard forms and general forms- Directrix, Focus and Latus rectum - parametric form of conics and chords. – Tangents and normals – cartesian form and parametric form- equation of chord of contact of tangents from a point (x_1, y_1) to all the above said curves. Asymptotes, Rectangular hyperbola – Standard equation of a rectangular hyperbola.

Vector Algebra:
Scalar Product – angle between two vectors, properties of scalar product and applications of dot products. Vector product right handed and left handed systems, properties of vector product and applications of cross product - Product of three vectors – Scalar triple product, properties of scalar triple product, vector triple Product.

Differential Calculus:
Derivative as a rate measurer - rate of change, velocity, acceleration, related rates, derivative as a measure of slope, tangent, normal and angle between curves, maxima and minima. Mean value theorem - Rolle's Theorem, Lagrange Mean Value Theorem, Taylor's and Maclaurin's series, L' Hospital's Rule, stationary points, increasing, decreasing, maxima, minima, concavity, convexity and points of inflexion.

Integral Calculus and its Applications:
Simple definite integrals – fundamental theorems of calculus, properties of definite integrals. Reduction formulae – reduction formulae for $\int \sin nx\, dx$ and $\int \cos nx\, dx$, Bernoulli's formula. Area of bounded regions, length of the curve.

Differential Equations:
Differential equations - formation of differential equations, order and degree, solving differential equations (1^{st} order), variables separable, homogeneous and linear equations. Second order linear differential equations - second order linear differential equations with constant co-efficients, finding the particular integral if f (x) = e^{mx}, sinmx, cosmx, x, x^2.

Probability Distributions:
Probability – Axioms – Addition law - Conditional probability – Multiplicative law - Baye's Theorem - Random variable - probability density function, distribution function, mathematical expectation, variance Theoretical distributions - discrete distributions, Binomial, Poisson distributions- Continuous distributions, Normal distribution.

Discrete Mathematics:
Mathematical logic – logical statements, connectives, truth tables, logical equivalence, tautology.

Groups:
Binary operations, semigroups, monoids, groups, order of a group, order of an element, properties of groups.

PHYSICS - KEE 2016

Electrostatics:

Frictional electricity – Charges and their conservation – Coulomb's law – Forces between two point electric charges – Superposition principle

Electric field – Electric field due to a point charge – Electric field lines – Electric dipole – Electric field intensity due to a dipole (on its axial line and on the equatorial line) – Behaviour of dipole in a uniform electric field – Application of electric dipole in microwave oven

Electric potential – Potential difference – Electric Potential due to a point charge and due to a dipole – Equipotential surfaces – Electrical potential energy of a system of two point charges

Electric flux – Gauss's theorem – Field due to infinitely long straight wire – Field due to uniformly charged infinitely plane sheet – Field due to two parallel sheets – Field due to uniformly charged thin spherical shell (inside and outside)

Electrostatic induction – Capacitor and capacitance – Dielectric and electric polarization – Parallel plate capacitor with and without dielectric medium – Applications of a capacitor – Energy stored in a capacitor – Capacitors in series and in parallel – Action of points – Lightning arrester – Van de Graaff generator

Current Electricity:

Electric current – Flow of charges in a metallic conductor – Drift velocity and mobility – Their relation with electric current

Ohm's law – Electrical resistance – V-I chraracteristics – Electrical resistivity and conductivity – Classification of materials in terms of conductivity – Superconductivity – Elementary ideas – Carbon resistors – Colour code for carbon resistors – Combination of resistors – Series and parallel – Temperature dependence of resistance – Internal resistance of a cell – Potential difference and emf of a cell

Kirchoff's law – Illustration by simple circuits – Wheatstone's bridge and its applications for temperature coefficient of resistance measurement – Meterbridge – Special case of Wheatstone bridge – Potentiometer – Principle – Comparing the emf of two cells

Electric power – Chemical effect of current – Electro chemical cells – Primary (Voltaic, Lechlanche, and Daniel cells) – Secondary – Rechargeable cell – Lead acid accumulator

Effects of Electric Current:

Heating effect – Joule's law – Experimental verification – Thermoelectric effects – Seeback effect – Peltier effect – Thomson effect – Thermocouple, thermo emf, neutral and inversion temperature – Thermopile

Magnetic effect of electric current – Concept of magnetic field – Oersted's experiment – Biot-Savart law – Magnetic field due to an infinitely long current carrying straight wire and circular coil – Tangent galvanometer – Construction and working – Bar magnet as an equivalent solenoid – Magnetic field lines

Ampere's circuital law and its application to solenoid

Force on a moving charge in uniform magnetic field and electric field – Cyclotron – Force on current carrying conductor in a uniform magnetic field – Forces between two parallel current carrying conductors – Definition of ampere
Torque experienced by a current loop in a uniform magnetic field – Moving coil galvanometer – Conversion to ammeter and voltmeter – Current loop as a magnetic dipole and its magnetic dipole moment – Magnetic dipole moment of a revolving electron

Electromagnetic Induction and Alternating Current:
Electromagnetic induction – Faraday's law – Induced emf and current – Lenz's law
Self induction – Mutual induction – Self inductance of a long solenoid – Mutual inductance of two long solenoids
Methods of inducing emf – (1) By changing magnetic induction (2) By changing area enclosed by the coil and (3) By changing the orientation of the coil (quantitative treatment)
AC generator – Commercial generator (Single phase, three phase)
Eddy current – Applications – Transformer – Long distance transmission
Alternating current – Measurement of AC – AC circuit with resistance – AC circuit with inductor – AC circuit with capacitor – LCR series circuit – Resonance and Q-factor: power in AC circuits

Electromagnetic Waves and Wave Optics:
Electromagnetic waves and their characteristics – Electromagnetic spectrum, Radio, microwaves, Infra red, visible, ultra violet – X rays, gamma rays – Propagation of electromagnetic waves
Emission and Absorption spectrum – Line, Band and continuous spectra – Fluorescence and phosphorescence
Theories of light – Corpuscular – Wave – Electromagnetic and Quantum theories
Scattering of light – Rayleigh's scattering – Tyndal scattering – Raman Effect – Raman spectrum – Blue colour of the sky and reddish appearance of the sun at sunrise and sunset
Wave front and Huygens's principle – Reflection, Total internal reflection and refraction of plane wave at a plane surface using wave fronts.
Interference – Young's double slit experiment and expression for fringe width – Coherent source - Interference of light – Formation of colours in thin films – Analytical treatment – Newton's rings
Diffraction – Differences between interference and diffraction of light – Diffraction grating
Polarization of light waves – Polarization by reflection – Brewster's law – Double refraction – Nicol prism – Uses of plane polarised light and polaroids – Rotatory polarization – Polarimeter

Atomic Physics:
Atomic structure – Discovery of the electron – Specific charge (Thomson's method) and charge of the electron (Millikan's oil drop method) – alpha scattering – Rutherford's atom model
Bohr's model – Energy quantization – Energy and wave number expression – Hydrogen spectrum – energy level diagrams – Sodium and mercury spectra - Excitation and ionization potentials
Sommerfeld's atom model – X rays – Production, properties, detection, absorption, diffraction of X-rays – Laue's experiment – Bragg's law – Bragg s X-ray spectrometer – X-ray spectra – Continuous and characteristic X–ray spectrum – Mosley's law and atomic number

Masers and Lasers – Spontaneous and stimulated emission – Normal population and population inversion – Ruby laser – He-Ne laser – properties and applications of laser light – holography

Dual Nature of Radiation and Matter – Relativity:

Photoelectric effect – Light waves and photons – Einstein's photoelectric equation – Laws of photoelectric emission – Particle nature of energy – Photoelectric equation – Work function – Photo cells and their application

Matter waves – Wave mechanical concept of the atom – Wave nature of particles – de Broglie relation – de Broglie wave length of an electron – Electron microscope

Concept of space, mass, time – Frame of references – Special theory of relativity – Relativity of length, time and mass with velocity – ($E = mc^2$)

Nuclear physics

Nuclear properties – Nuclear Radii, masses, binding energy, density, charge – Isotopes, isobars and isotones – Nuclear mass defect – Binding energy – Stability of nuclei-Bain bridge mass spectrometer

Nature of nuclear forces – Neutron – Discovery – Properties – Artificial transmutation – Particle accelerator

Radioactivity – Alpha, beta and gamma radiations and their properties, α-decay, β-decay and γ-decay – Radioactive decay law – Half life – Mean life – Artificial radioactivity – Radio isotopes – Effects and uses Geiger-Muller counter

Radio carbon dating – Biological radiation hazards

Nuclear fission – Chain reaction – Atom bomb – Nuclear reactor – Nuclear fusion – Hydrogen bomb – Cosmic rays – Elementary particles

Semiconductor Devices and their Applications:

Semiconductor theory – Energy band in solids – Difference between metals, insulators and semiconductors based on band theory – Semiconductor doping – Intrinsic and Extrinsic semi conductors

Formation of P-N Junction – Barrier potential and depletion layer – P-N Junction diode – Forward and reverse bias characteristics – Diode as a rectifier – Zener diode – Zener diode as a voltage regulator – LED

Junction transistors – Characteristics – Transistor as a switch – Transistor as an amplifier – Transistor biasing – RC, LC coupled and direct coupling in amplifier – Feedback amplifier – Positive and negative feedback – Advantages of negative feedback amplifier – Oscillator – Condition for oscillations – LC circuit – Colpitt oscillator

Logic gates – NOT, OR, AND, EXOR using discrete components – NAND and NOR gates as universal gates – Integrated Circuits

Laws and theorems of Boolean's algebra – Operational amplifier – Parameters – Pin-out configuration – Basic applications – Inverting amplifier – Non-inverting amplifier – Summing and difference amplifiers

Measuring Instruments – Cathode Ray oscilloscope – Principle – Functional units – Uses – Multimeter – construction and uses

Communication Systems:

Modes of propagation, ground wave – Sky wave propagation

Amplitude modulation, merits and demerits – Applications – Frequency modulation – Advantages and applications – Phase modulation

Antennas and directivity

Radio transmission and reception – AM and FM – Super heterodyne receiver

T.V. transmission and reception – Scanning and synchronizing

Vidicon (camera tube) and picture tube – Block diagram of a monochrome TV transmitter and receiver circuits

Radar – Principle – Applications

Digital communication – Data transmission and reception – Principles of fax, modem, satellite communication – Wire, cable and Fibre-optical communication

CHEMISTRY - KEE 2016

Atomic Structure:
Bohr's atomic model – limitations – Sommerfeld's theory of atomic structure; Electronic configuration and Quantum numbers; Shapes of s, p, d, f orbitals – Pauli's exclusion principle - Hund's Rule of maximum multiplicity – Aufbau principle of filling up of electrons in orbitals. Hydrogen spectrum – Lyman, Balmer, Paschen, Brakett and Pfund series; deBroglie's theory; Heisenberg's uncertainty principle – wave nature of electron – Schrodinger wave equation and its significance – Eigen values and Eigen functions. Hybridization of atomic orbitals to form molecular orbitals.

p, d and f – Block Elements:
p block elements – Phosphorous compounds; PCl_3, PCl_5 – Oxides. Hydrogen halides, Inter-halogen compounds. Xenon fluorides. General Characteristics of d–block elements – Electronic Configuration – Oxidation states of first row transition elements and their colours; Lanthanides – Introduction, Electronic configuration, general characteristics, oxidation state – lanthanide contraction.

Coordination Chemistry and Solid State Chemistry
Terminology in coordination chemistry – IUPAC nomenclature of mononuclear coordination compounds – Isomerism, Geometrical isomerism in 4-coordinate, 6-coordinate complexes. Werner's theory of co-ordination, Valence Bond theory. Uses of coordination compounds. Bioinorganic compounds (Haemoglobin and chlorophyll). Lattice – unit cell, systems, types of crystals, packing in solids; Ionic crystals – Imperfections in solids – point defects. X-Ray diffraction

Thermodynamics, Chemical Equilibrium and Chemical Kinetics
First and second law of thermodynamics – spontaneous and non spontaneous processes, entropy, Gibb's free energy – Free energy change and chemical equilibrium – significance of entropy. Law of mass action – Le Chatlier's principle, applications of chemical equilibrium. Rate expression, order and molecularity of reactions, zero order, first order and pseudo first order reaction – half life period. Determination of rate constant and order of reaction. Temperature dependence of rate constant – Arrhenius equation, activation energy

Electrochemistry
Theory of electrical conductance; metallic and electrolytic conductance. Faraday's laws – theory of strong electrolytes – Specific resistance, specific conductance, equivalent and molar conductance – Variation of conductance with dilution – Kohlraush's law – Ionic product of water, pH and pOH – buffer solutions – use of pH values. Cells – Electrodes and electrode potentials – construction of cell and EMF values, Fuel cells, Corrosion and its prevention.

Isomerism in Organic Compounds

Definition, Classification – structural isomerism, stereo isomerism – geometrical and optical isomerism. Optical activity – chirality – compounds containing chiral centres – R,S notation, D,L notation.

Alcohols and Ethers

Nomenclature of alcohols – Classification of alcohols - distinction between primary, seconadary, and tertiary alcohols – General methods of preparation of primary alcohols, properties. Aromatic alcohols – preparation and properties of phenols and benzyl alcohol. Ethers – properties of aliphatic ethers – Uses. Aromatic ethers – Preparation of Anisole – Uses.

Carbonyl Compounds

Nomenclature of carbonyl compounds – Comparison of aldehydes and ketones. General methods of preparation of aldehydes – Properties – Uses. Aromatic aldehydes – Preparation of benzaldehyde – Properties and Uses. Aromatic ketones – preparation of acetophenone – Properties – Uses, preparation of benzophenone – Properties. Name reactions; Clemmenson reduction, Wolff – Kishner reduction, Cannizaro reaction, Claisen Schmidt reaction, Benzoin Condensation, aldol Condensation. Preparation and applications of Grignard reagents.

Carboxylic Acids and their derivatives

Nomenclature – Preparation of aliphatic monobarboxylic acids – formic acid – Properties – Uses. Aromatic acids; Benzoic and Salicylic acid – Properties – Uses. Derivatives of carboxylic acids; acetyl chloride (CH_3COCl) – Preparation – Properties – Uses. Preparation of acetamide, Properties – acetic anhydride – preparation, Properties. Preparation of esters – methyl acetate – Properties.

Organic Nitrogen Compounds

Aliphatic nitro compounds – Preparation of aliphatic nitroalkanes – Properties – Uses. Aromatic nitro compounds – Preparation – Properties – Uses. Distinction between aliphatic and aromatic nitro compounds. Amines; aliphatic amines – General methods of preparation – Properties – Distinction between primary, secondary, and tertiary amines. Aromatic amines – Synthesis of benzylamine – Properties, Aniline – Preparation – Properties – Uses. Distinction between aliphatic and aromatic amine. Aliphatic nitriles – Preparation – properties – Uses. Diazonium salts – Preparation of benzene diazonium chloride

Biomolecules

Carbohydrates – distinction between sugars and non sugars, structural formulae of glucose, fructose and sucrose, with their linkages, invert sugar – definition, examples of oligo and polysaccharides,

Amino acids – classification with examples, Peptides – properties of peptide bond.