APPENDIX-5

JELET syllabus

Mathematics (JELET)

A. Matrices up to order 3:

Definition of Matrix and its order. Different types of Matrices. (Rectangular, square, row, column, upper triangular, lower triangular, diagonal, scalar, identity, null). Equality of two matrices. Addition, subtraction, multiplication of a matrix by a scalar and multiplication of two matrices. Transpose of a matrix, symmetric and skew symmetric matrices, simple problems. Singular and non-singular matrices, adjoint and inverse of a matrix of order 3.
Eigen Values of matrix up to order 3. Statement of Cauchy Hamilton Theorem and application for determining inverse of matrix. Diagonalization of matrices.

B. Determinant up to order 3:

Definition and expansion of determinants of order 2 and 3. Minor and cofactors. Elementary properties of Determinants (statements only) and simple problems. Solutions of linear simultaneous equations (up to 3 unknowns) by Cramer's Rule.
Rank of a matrix up to order 3. Linear homogeneous and non-homogeneous system of equations – statements of the relevant results and its applications.

C. Complex Number:

Definition of complex numbers, Cartesian and polar. Exponential form of complex numbers. Modulus, amplitude and conjugate of a complex number. Algebra of complex numbers (Equality, Addition, Subtraction, Multiplication). Cube roots of unity and its properties. De Moivre's theorem (statements only) and simple problems.

D. Co-ordinate Geometry(2D):

Concept of polar co-ordinates and its relation to Cartesian co-ordinates. Conic section in 2D – Definition, simple properties, Tangents and Normal.

E. Vector Algebra:

Definition of a vector quantity. Concept of Position vector and Ratio formula. Rectangular resolution of a vector. Algebra of vectors – equality, addition, subtraction, and scalar multiplication. Scalar (Dot) product of two vectors of with properties. Vector (cross) product of two vectors with properties. Applications: Application of dot product in work done by a force and projection of one vector upon another, application of cross product in finding vector area and moment of a force.
Scalar and vector triple product and their geometrical interpretations. Linear combination of 3 vectors. Linear dependence and independence of vectors.

F. Differential Calculus:

Concept of function of one variable – Domain and range. Type of different functions including periodic functions. Limit and continuity. Standard limits. Types of discontinuity. Derivative of a functions (1^{st} order and 2^{nd} order). Statements and Applications of Roll's Theorem, Mean Value Theorem. Indeterminant Form. L'Hospital's rule.

G. Application of Derivative:

Geometric meaning of derivative. Rate measurement. Maxima and Minima (one variable)

H. Partial Differentiation:

Definition and meaning of partial derivative. Evalution of partial derivatives. Definition and examples of homogeneous functions. Euler's theorem (1^{st} order) on homogeneous functions for 2 variables (without proof). Problems.

I. Integral Calculus:

Definition of Integration as inverse process of differentiation. Rules for integration (sum, difference, scalar multiple). Integration of standard functions. Integration by substitution. Integration by parts. Integration by partial fraction.
Definition of definite integral and simple problems. Properties of definite integral with simple problems. Application of definite integral – area of bounded region.

J. Ordinary Differential Equation:

Definition of ordinary differential equation, order and degree. Solution of differential equation of first order and first degree. Separation of variables. Homogeneous type. Exact type. Linear type. Solution of differential equation of first order but not of the first degree. Solution of linear second order differential equation with constant coefficients. Complementary Functions (C.F). Particular integral for polynomial function e^{ax}, sinax and

cosax, $[F(-a^2)\neq 0]$ $e^{ax}V$ where V is a function. Simple problem.

K. Probability:

Definition of random experiment, sample space, event, occurrence of events and types of events (e.g., Impossible, mutually exclusive, Exhaustive, Equally likely). Classical definition of probability, simple problems. Statements of total probability, compound probability and Base's Theorem and simple problems.

Physics (JELET)

A. **Units, dimension, and measurement**: CGS, MKS, SI units. Dimensions of common physical quantities, dimensional analysis. Common errors in measurement. Error, accuracy, precision, resolution, significant figure.

B. **Kinematics**: Speed, velocity, acceleration, uniform/non-uniform, rectilinear/ circular motion. Position/ velocity-time graph. Resolution and composition of vectors, scalar multiplication of vectors.

C. **Laws of motion**: Newton's laws of motion. Force, momentum, inertia, moment of inertia, impulse, couples, moment. Conditions of equilibrium. Conservation of momentum. Centripetal and centrifugal forces. Angular displacement/ velocity/ acceleration/ momentum, torque. Static and dynamic friction, angle of repose, banking of roads.

D. **Work, power, energy**: Definition, measures, and units. Law of conservation of energy. Kinetic and potential energy.

E. **Gravitation**: The universal law of gravitation. Acceleration due to gravity and its variation on/ above/ below Earth's surface. Gravitational potential energy. Vertical linear/ vertical circular/ projectile motion.

F. **Elasticity**: Deforming force and restoring force, elastic, and plastic body. Stress-strain relationship, Hook's law, Young's modulus, Bulk modulus, Rigidity modulus, Poisson's ratio and relation between them. Elastic energy.

G. **Surface tension**: Cohesive and adhesive forces. Definition, dimension and SI unit of surface tension. Surface energy. Angle of contact. Formation of droplets, bubble; their adhesion. Capillarity, shape of liquid meniscus in a capillary tube, rise of liquid in a capillary tube. Effect of impurity and temperature on surface tension.

H. **Fluid mechanics/ Hydrostatics**: Pascal's law. Hydraulic lift. Buoyancy. Conditions of equilibrium of floating body. Archimedes' principle. Streamline flow and turbulent flow of a fluid, critical velocity. Equation of continuity and Bernoulli's theorem. Viscosity, Newton's formula for viscous force, co-efficient of viscosity. Stokes law and terminal velocity. Effect of temperature on viscosity.

I. **Thermal expansion of solid**: Linear, areal and volume expansion. Coefficients of expansions and their relation. Change of density with temperature.

J. **Transmission of heat**: Conduction, convection, radiation. Thermal conductivity (formula, definition, dimensions, and SI unit).

K. **Thermodynamics**: Thermal equilibrium, calorimetry. Zeroth law of thermodynamics. Heat, work, temperature and internal energy. First law of thermodynamics. Specific heats of gas, their relation and their ratio. Isothermal, isobaric, isochoric and adiabatic process.

L. **Reflection of Light**: Reflection of light in plane mirror. Formation of image.

M. **Refraction of light**: Refraction of light through plane surface. Laws of refraction. Refractive index, its relationship with the velocity of light in different media. Total internal reflection and critical angle. Principle of optical fibre.

N. **Lens**: Convex and concave lenses. Formation of image. Relation between u, v, f. Power of a lens (in different mediums). Equivalent focal length & power of two thin lenses in contact.

O. **Photoelectricity**: Photoemission, Work function. Photoelectric current, its variation with intensity and frequency of incident radiation. Stopping potential, Threshold frequency. Concept of photon. Einstein's photoelectric equation. Principle of solar photo-voltaic cell and its uses.

Chemistry (JELET)

A. **Atomic Structure**: Bohr model of atom, de Broglie wave equation, Quantum numbers, Orbits and Orbitals, aufbau principal, Pauli's Exclusion principle, Hund's rule of maximum multiplicity, electronic configuration of elements. Definition of Atomic number, Mass number, isotopes, isotones and isobars. Concept of hybridization sp^3, sp^2, sp and shape of molecules.

B. **Chemical Bonding**: Electrovalent, Covalent, and coordinate bonds, H-bond in HF, water, and ice. Classification of solids – crystalline and amorphous. Relationship between structure and properties of crystalline solids namely ionic solid, covalent solid and molecular solids. Covalent bonds in Carbon, Silicon and Germanium.

C. **Acids, Bases & Salts**: Avogadro number, Mole concept, weight and volume relations. Acids, Bases and Salts (Arrhenius and Lewis concept). Acidity, basicity, neutralization reaction, hydrolysis of Salts. Equivalent Weight of acids, bases, & salts; strength of solution- normality, molarity, molality, formality and percentage strength, standard solution- primary and secondary standards, concept of pH, and pH scale. Indicators and choice of indicator, principles of acidimetry and alkalimetry. Buffer solution. Solubility product principle. Common ion effect with relation to group analysis.

D. **Oxidation, Reduction, Electrochemistry:** Oxidation and Reduction by electronic concept, balancing chemical equations by ion-electron method, Redox Titration, Electrolysis, Arrhenius theory, Faraday's Laws, electrolysis of CuSO4 solution using Pt-electrode and Cu-electrode. Application of electrolysis such as Electroplating, Electro-refining and Electrotyping, Electrochemical Cells, Primary Cell- Dry Cell, Secondary Cell- Lead storage cell, Electrochemical series.

E. **Chemical Equilibrium**: Reversible and irreversible reactions, exothermic and endothermic reactions, chemical equilibrium, Le Chatelier's principle. Industrial preparation of Ammonia by Haber's Process, Nitric acid by Ostwald's process and Sulphuric acid by Contact Process. Catalyst and catalysis.

F. **Metallurgy**: Minerals, Ores, Gangue, Flux, Slag, General method of extraction of metals with reference to Iron, copper and Aluminium. Definition of Alloy, purposes of making Alloy, Composition and uses of alloys such as brass, bronze, German silver, duralumin, nichrome, bell metal, gun metal, Monel metal, alnico, Dutch metal, babbitt metal, stainless steel. Amalgams, properties and uses of cast iron, wrought iron, steel and sponge iron. Uses of different alloy steels.

G. **Water**: Soft and Hard water, action of soap on water, types of Hardness, causes of hardness, units of hardness, disadvantages of using hard water, estimation of total hardness by EDTA method, removal of hardness by Permutit process, Ion-exchange process, phosphate conditioning and Calgon treatment.

H. **Organic Chemistry**: Organic compounds, Classification, Homologous series, Functional groups, Isomerism, Nomenclature. Properties and preparation of Methane, Ethylene and Acetylene, Methylated spirit, Rectified spirit, Power alcohol, Proof spirit. Uses of Benzene, Naphthalene and phenol.

Fundamentals of Electrical & Electronics Engineering (JELET)

A. **Electrical components, measuring instruments**: Electrical components, measuring instruments: Resistors, capacitors, inductors. Principle of operation of PMMC & MI type Instrument. Principles of Voltage and Current measurement. Wheatstone bridge.

B. **Transformers**: Basic principle and construction. BH characteristics. Transformation ratio. Equivalent circuit, losses, regulation, efficiency. Auto transformer.

C. **Electrical machines**: Types of motors and their applications. Generation of rotating magnetic fields. Basic construction and working of DC motor, single phase induction motor. Torque-Speed characteristics. Speed control.

D. **DC sources and circuits**: Voltage and current sources, their transformation, Thevenin's, Norton's theorems. Kirchhoff current and voltage laws. Superposition, equivalence. Determination of branch current/ voltage in passive circuits. Time domain characteristics of reactive components.

E. **AC sources and circuits**: Amplitude, frequency, time-period, phase, peak/average/ RMS values. Exponential, complex and phasor form of representation of sinusoidal voltage and current. Impedance, power factor, active/reactive power. Voltage and current relationship in star-delta connections. Behaviour of simple RLC circuits with AC excitation.

F. B**asic semiconductor devices**: Energy level diagrams of insulator, conductor & semi-conductor. Intrinsic & extrinsic, P-type, N-type semiconductors. P-N junction diode. PNP and NPN transistors, MOSFET, CMOS.

G. A**nalog Circuits**: OPAMP, virtual ground, inverting and non-inverting amplifiers, adder, subtractor, integrator, differentiator.

H. D**igital Electronics**: Boolean Algebra, basic gates (AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR) – truth tables, symbols, and combination of gates.

Pharmacy (JELET)

Diploma Level syllabus in Pharmacy as prescribed by the Pharmacy Council of India.