



RESEARCH ENTRANCE TEST -2017
(RET-2017)

Syllabii
for
PhD Programmes

KLE TECHNOLOGICAL UNIVERSITY

(Established under Karnataka Act No.22, 2013)

Vidyanagar, Hubballi - 580031 www.kletech.ac.in

SCHEME OF RESEARCH ENTRANCE TEST (RET) For PhD Admission

Faculty of Engineering, Science and Mathematics	
Part I: Mathematics Section (Maths-1) Questions carrying one mark (Objective/multiple choice, covering full syllabus)	30 Questions
Part II: Discipline Oriented Section Questions carrying one mark (Objective/multiple choice, preferably involving numerical - 50 questions covering full syllabus)	50 Questions
Part III : Aptitude section : Reading Comprehension data Sufficiency & Data Interpretation, Logical Reasoning computer awareness.	20 Questions
Total	100 Marks

Faculty of Humanities and Social Science	
Part I: General Aptitude Verbal Ability, Numerical Analysis Quantitative ability- Questions carrying one mark	30 Questions
Part II: Discipline Oriented Section Questions carrying one mark (Objective/multiple choice, preferably involving numerical - 50 questions covering full syllabus)	50 Questions
Part III : Aptitude section : Reading Comprehension data Sufficiency & Data Interpretation, Logical Reasoning computer awareness.	20 Questions
Total	100 Marks

Part –I (30 Questions - 1 mark each)

Syllabus : Mathematics

Faculty of Engineering and Mathematics

1. Matrices : Definition, Rank of matrix Systems of m linear equations with n unknown, Eigen value and eigen vectors of a square matrix.
2. Calculus
 - Differential Calculus : Limits and Continuity , Differentiation and its applications, Partial Derivatives (Basics)
 - Integral Calculus : Reduction formulae, Definite Integrals, Properties and Multiple Integrals,
3. Vector Algebra; Definitions, Vector products.
4. Complex numbers; Definitions, Properties; Amplitude & Modules of a complex number, De Moivre's theorem and examples.
5. Applied Mathematics - Laplace Transforms (Elementary transformation), Fourier series, (Basics definition and examples.) , half range Fourier series and harmonic analysis.
6. Numerical Analysis:
 - Numerical Solutions of Algebraic and transcendental equations, Finite differences , Interpolation (For equal and unequal intervals) Numerical solutions of first order differential equations , Numerical Integration
7. Statistics and Probability: Measures of central tendency and dispersion curve fitting by least square methods . Correlation and regression analysis. Probability Axioms, conditional probability, probability distribution-Binomial poisson and normal distribution

TEXT BOOKS:

1. Higher Engineering Mathematics – Dr. B.S. Grewal (37th Edition)
2. Elementary Engineering Mathematics- Dr. B.S. Grewal
3. Advanced Engineering Mathematics –Erwin Kreyszig
4. Introduction to Numerical Analysis –S.S. Sastry

Syllabus : Mathematics (Physics & Chemistry)
Faculty of Physics & Chemistry

1. **Complex Numbers:** Algebraic properties of complex number. Argand plane and polar representation of complex numbers and problems, solution of quadratic equations in the complex number system, Square-root of a Complex number and problems.
2. **Sequence and Series:** Definitions, n^{th} term and sum to n term of Arithmetic Progression (AP), Geometric Progression (G.P.). Sum to n terms of the special series : $\sum n$, $\sum n^2$ and $\sum n^3$
3. **Matrices:** Types of matrices, Algebra of matrices, Symmetric and skew symmetric matrices: Definitions, Properties, inverse of a matrix. Determinants, properties of determinants, minors, cofactors, singular and non-singular matrices, their properties, Consistency, inconsistency and solutions of system of linear equations.
4. **Calculus:** Limits, Indeterminate forms, Definition of continuity of a function at a point and on a domain, Derivative: Rules of differentiation, Derivative of composite functions, inverse trigonometric functions, implicit function and Logarithmic functions. Tangents and normal. Second order derivatives, Maxima and minima.
5. **Integrals:** Geometrical Interpretation of indefinite integral, properties, application of integrals to find area.
6. **Differential Equations:** Definition, order and degree, solutions of a differential equation. Formation of differential equation, Solution of differential equations by method of separation of variables, Homogeneous and linear differential equations of first order and first degree.
7. **Vectors and Three-Dimensional Geometry:** Definition of Vectors and scalars, magnitude and direction of a vector. Position vector of a point dividing a line segment in a given ratio (section formula). Scalar (dot) product of vectors, Vector (cross) product of vectors: definition, properties Direction cosines/ratios of vectors: direction angles, direction cosines, direction Ratios, relation between direction ratio and direction cosines Three-dimensional Geometry. Straight lines in space: coplanar and skew lines, distance between two skew lines, distance between two parallel lines. Angle between two lines. Equation of plane, a plane in normal form, Intercept form of equation of a plane, angle between two planes, equation of plane passing through the intersection of two given planes, angle between line and plane, condition for the coplanarity of two lines, distance of a point from a plane

8. **Probability:** Conditional probability, Multiplication theorem, independent events, Baye's theorem, theorem of total probability and problems. Definition of a random variable, probability distribution of random variable, Mean, variance of a random variable and problems. Bernoulli trials and Binomial distribution: Definition of Bernoulli trial, binomial distribution, conditions for Binomial distribution, and simple problems.

Part –II (50 Questions - 1 mark each)

Syllabus: Civil and Environmental Engineering

1. **Structural Analysis** - Structural Systems, Methods of Joints and Sections and Truss Analysis, Strain Energy, Arches and Cables. Plane Stresses and Plane Strain, Principal Stresses and Principal Strains
2. **Fluid Mechanics**- Open Channel Flow, Water Hammer, Dimensional Analysis, Impact of Jets on Vanes, Turbines, Centrifugal Pumps.
3. **Concrete Technology** - Fresh Concrete and Hardened Concrete, Mix Design , Special Concretes , Non-destructive Testing of Concrete.
4. **Design of Concrete Structures** - Principles of Limit State Design, Serviceability Limits, Effective Lengths, Design Loads, Anchorage of Bars, Lateral Stability of Beams
5. **Geotech**- Index Properties of Soil, Classification of Soils, Soil Structures, Compaction of Soil, Consolidation of Soils, Shear Strength of Soil
6. **Transportation** - Highway Planning and Alignment, Design Principles, Pavement Materials and Construction, Wind Analysis and Site Selection for Airports.
7. **Irrigation Engineering** - Water Requirements of Crops, Canals, Diversion Works, Gravity and Earthen Dams.
8. **Steel Structures** - Steel Structural Fasteners, Tension – Compression – Flexure Members Connections.
9. **Theory of Elasticity** - Plane Stresses and Plane Strain, Principal Stresses and Principal Strains, Strain Displacement Relationship, Equilibrium and Boundary Condition, Generalised Hook's Law.

Syllabus: Computer Science and Engineering

(CSE/ISE/MCA)

1. Discrete Mathematical Structures
2. Computer Organization
3. Data Structures using C
4. Operating systems
5. OOP with C++
6. DBMS
7. Design and Analysis of Algorithms
8. Object Oriented Analysis and Design
9. Software Engineering
10. Computer Networks

Syllabus : Electrical, Electronics & Communication Engineering

(ECE/EEE/IT/TC/BM/ML and other allied branches)
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1. Fundamentals of DC, AC Circuits and Network Theorems.
2. Electrical Machines: AC and DC, Transformers
3. Electronic devices, circuits and Applications.
4. Simplification of Boolean Expressions: Karnaugh maps combinational logic Design.
5. Sequential logic circuits: Flip flops and counters, shift Registers
6. Response of control systems: Nyquist and Bode plots, phase and gain margins.
7. Thyristors: Choppers and Inverters.
8. Field Theory: Electric and magnetic fields, Maxwells equations.
9. Fundamentals of Signal processing and Communication Techniques
10. Microprocessors: Architecture, operation, programming and interfacing
11. Transducers.

Syllabus: Mechanical Engineering

(IP/IEM/Auto/ME/ and Other Allied branches)

1. Prime movers (I. C. Engines) : Classification of I. C. Engines - two stroke and four stroke petrol and diesel engines. Mechanical efficiency, BHP and IHP, laws of thermodynamics, applications.
2. Refrigeration and air conditioning: Properties, COP, refrigeration effect, one tonne of refrigeration.
3. Manufacturing processes : Parts of a lathe, operations in a lathe, types of drilling machines, operations in a drilling machine, types of milling machines, operations in a milling machine, grinding machine, types of grinding machines, bonding materials, grinding terminology, welding classification and types, soldering, brazing, lubrication and bearing types.
4. Power transmission and mechatronics : Belt drives, gear drives. Introduction to mechatronics - open loop and closed loop control systems, advantages and disadvantages.
5. Heat treatment of metals : Annealing, normalizing, hardening, tempering, carburizing, cyaniding, nitriding and flame hardening, iron-carbon equilibrium diagram.
6. Composite materials - types of matrix materials, fibre reinforced composites (FRP) and metal matrix composites (MMC), advantages and applications.

Syllabus: Biotechnology

1. BASICS OF UNIT OPERATIONS - Basics of Sedimentation, Setting, Filtration, Size reduction, and Mixing. Basic modes of heat transfer, Uni-layer, Multi-layer, and Steady state conduction. Principles of Diffusion, Distillation, Drying, Evaporation, Extraction, Adsorption and Ion-exchange operations.
2. FUNDAMENTALS OF MOMENTUM TRANSFER - Fluid definition, Classification, governing equations, Hydrostatic equilibrium, barometric equation, Pressure measurements, Manometric equation, Shear stress, Shear strain, Newton's law, Fluid flow, Types of flow, Laminar and turbulent flow. Continuity equation, Energy balance equation, Bernoulli's equation, Euler equation, Momentum balance, Flow through circular and non

circular sections, Hagen-Poiseulle equations, Losses through pipe and fittings, Turbulent flow, and Friction factor.

3. BASIC BIOCHEMISTRY - Structure and properties of mono, di, and polysaccharides, structure and properties of fatty acids, neutral fats, phospholipids, glycolipids and steroids. Structure and properties of aminoacids, peptides, and proteins. Biologically important peptides. Structure and properties of purines, pyrimidines, nucleosides, nucleotides, ribonucleic acids, nucleoprotein complexes.
4. FUNDAMENTALS OF CELL STRUCTURE AND FUNCTION - Eukaryotic and prokaryotic cells, Plant and animal cells, Types of cell functions, cell division, Mitosis and Meiosis. Formal structure in cytoplasm, Nucleus, Mitochondria, Ribosome, Golgi bodies, Lysosomes. Endoplasmic Reticulum, Peroxisomes, Chloroplast and Vacuoles. Cell to cell integration, Cell locomotion (Amoeboid Flagella, Ciliar). Muscle and Nerve cell. Structure and functioning of endocrine cells including neuro-secretory cell.
5. BASICS OF BIOPHYSICAL AND BIOCHEMICAL TECHNIQUES - Rayleigh scattering, ultra centrifugation, viscometry, crystallization, X-ray crystallography, neutron diffraction, NMR spectroscopy, electron microscopy, STM, AFM, luminescence, fluorimeter, flame photometry, optical activity, CD, UV, IR, Laser, Raman ESR and EPR. Calorimetry, DSC, Spectrophotometry, Mass spectrometry, LC-MS, MALDI-TOF, Chromatography, Electrophoresis.
6. FUNDAMENTALS OF THERMODYNAMICS - System, Surrounding and Process, Closed and Open system, State and Properties, Intensive & Extensive Properties, State and Path functions, Equilibrium state and Phase rule, Zeroth law of Thermodynamics, Heat reservoir and Heat engines, Reversible and Irreversible processes. General statement of First law of Thermodynamics, First law for Cyclic Process, Non-Flow Process, Flow process, Heat capacity.
7. BASIC GENETICS AND GENETIC ENGINEERING - Nature of genetic material, DNA replication, Mendelian Laws of inheritance, monohybrid and dihybrid inheritance, law of segregation and independent assortment, Gene interactions, supplementary genes, Complementary genes, Epistasis. Identification of genetic material,
8. CLASSICAL EXPERIMENTS- Hershey & Chase, Avery McLeod etc. Multiple alleles and groups antigens. Role of genes within cells, genetic code, genetic elements that control

gene expression, method of creating recombinant DNA molecules, vectors in recombinant DNA technology, biology and salient features of vectors, types of vectors- plasmids, cosmids, phages and viruses. Gene transfer techniques, genetic engineering of plants and animals, structure and functions of T-DNA in the expression of genes, Ti plasmid mediated gene transfer.

9. INTRODUCTORY BIOINFORMATICS - Databases: Sequence database, Structure database, Medical Databases. Sequence alignment and database searches: Optional Alignment, Database similarity searching, FASTA, BLAST. Aspects of Multiple Sequence Alignment.. Phylogenetic analysis: Tree- Building Methods, Evaluating Trees and Data. Predictive methods for Detecting Functional Sites in the DNA. Predictive methods for secondary structure, tertiary folds from protein sequences. Plasmid mapping and primer design.
10. BIOPROCESS PRINCIPLES - Concept of mole and Molecule, Composition, of mixtures of Solids, liquids and gases. Composition of mixtures and solutions- Percentage by weight, mole and Volume; Normality, Molarity, Molality, and ppm, pH and pK Buffer Calculations. Outline of an integrated bioprocess and the various (upstream and downstream) unit operations involved in bioprocesses; generalized process flow sheets. Process flow sheet and unit operations in chemical and bioprocess industries; General material balance equation for steady and unsteady states. Basic concepts of Energy Balance. Coupled reactions and energy rise compounds, Reaction Stoichiometry, criteria of biochemical reaction equilibrium, equilibrium constant and standard free energy change, effect of temperature, pressure on equilibrium constants and other- factors affecting equilibrium conversion, liquid phase reactions, heterogeneous bioreaction equilibria, phase rule for reacting systems.

Syllabus: Physics

1. Mechanics and Properties of Matter: Frames of Reference, Rigid body dynamics , Moment of Inertia, Laws of Conservation. Elasticity, Viscosity, Surface Tension.
2. Heat and Thermodynamics: Kinetic Theory, Laws of Radiation, Thermodynamics, Liquification of Gases, Entropy, Heat engines and Refrigeration, Thermal Conductivity.
3. Waves Acoustics : Progressive waves, Superposition, Doppler effect, Acoustics of Buildings, Fourier transforms, Ultrasonics.
4. Optics : Theories of Light, Interference, Diffraction, Polarisation, Optical Instruments Resolving Power.
5. Laser : Production, Properties and Applications.
6. Electricity and Magnetism : Electrostatics, Galvanometers, Measuring Instruments, Alternating and Direct current, Generation and Analysis, Thermoelectricity, Electromagnetism.
7. Atomic and Molecular Physics : The electron, Atomic Models, Atomic spectra, Molecular spectra, Related measurements, Zeeman effect. X-rays & X-ray Crystallography.
8. Nuclear Physics : The nucleus, Nuclear models, Mass spectrographs, Radioactivity, Accelerators, Nuclear detectors, Nuclear reactions, Cosmic ray, Mossbauer effect, Magnetic Resonance: Applications, Elementary Particles.
9. Solid State Physics : Relativity, Special and General Theories of relativity, Statistical Physics, Specific Heats of Solids, Band Theory of solids, Classification of solids, Electrical Conductivity in solids, Dielectric and Magnetic Properties, Specific Heats of Solids, Semiconductors, Applications, Semiconductor devices, Transistors, Amplifiers, Oscillators , Digital electronics, Superconductivity.
10. Quantum Physics : Failure of Classical Physics, Duality , Wave function, Schrodinger, wave equations. Solutions – Eigen values.
11. Recent Trends in Physics: Liquid Crystals, Optical Fibers ,Smart Materials, Nano- Materials.

References:

1. Elements of Properties of Matter: D.S.Mathur, S Chand & Co. Publishers. New Delhi
2. Heat Thermodynamics and Statistical Physics: Brij Lal and N. Subrahmanyam S Chand & Co. Publishers. New Delhi

3. A Text Book of Optics: Brij Lal, M N Avadhanulu & N Subrahmanyam S Chand & Co. Publishers. New Delhi
4. LASERS – Principles, Types and Applications. K. R. Nambiar. New Age International Publishers, 4835/24, Ansari Road, Daryaganj, New Delhi
5. Lasers: Fundamentals and Applications, Thyagarajan, K., Ghatak, Ajoy, Springer publications
6. Electricity and Magnetism by R. Murugesan S Chand & Co. Publishers. New Delhi
7. Introduction to Modern Physics: R.B.Singh New Age International Publishers
8. Nuclear Physics. By D.C.Tayal, Himalayan Publishers.
9. Solid State Physics Pillai, S.O, New Age International Publishers.
10. Quantum Mechanics, Theory and Applications, Ajoy Ghatak and S Lokanathan, Mac Millan Publishers India

Syllabus: Chemistry

1. Periodic Properties - Atomic radii – Ionization energy in groups and periods – Electron affinity Chemical Bonding.
2. Organic Chemistry – Classification and nomenclature of organic compounds.
Electronic effects and reactive intermediates –Principles of purification of organic compounds – Halogens – Cycloalkanes – Aromatic hydrocarbons – Elimination Reaction – Organo-metallic compounds – Alcohols – Phenols – Carboxyl compounds – Carboxylic acid – Hydroxy acids – Amines – Diazonium Compounds. Active methyl compounds –Carbohydrates – Stereochemistry – Amino acids – Peptides – proteins. Oils and Fats – Waxes – Dyes – Terpenes. Drugs - Hormones – Vitamins –
3. Inorganic Chemistry – Molecular orbital theory – General characteristics of s – block and p. block - elements - Gravimetry – Statistical analysis of results of quantitative measurements (errors – accuracy – precession etc). Nobel Gases – Non-aqueous solvents - Ion exchange - Metallurgy – Gaseous fuels.
4. Physical Chemistry - Liquid mixtures - Properties of liquid Mixtures – Colligative Properties - Chemical Kinetics – Colloids – Emulsions – Crystallography. Electrochemistry – Hydrolysis of salts – Ionic equilibria. Distribution law.

5. Nuclear chemistry - Fundamental properties of nucleons – isotopes – nuclear stability – binding energy – nuclear models – fission and fusion – nuclear transmutation – radioactivity – nuclear reactors – accelerators. Application of nuclear chemistry.
6. Thermodynamics – Gas laws - Thermodynamic processes – State function –Laws of Thermodynamics - Heat engine - Free energy – Entropy – Phase equilibria.
7. Co-ordination Chemistry – Basic concepts – Valence bond theory – Crystal field theory – Bio-inorganic chemistry – Enzymes – Occurrence – properties and structure of enzymes.
8. Radiation Chemistry - Primary and secondary states in radiochemical reactions. Ionic yield – energy yield – comparison with photochemistry – Radiolysis – Units of Measurement of radiation.
9. Molecular Chemistry –Types of spectra – Rotational energy – Calculation of bond length – Vibrational energy - Selection rules and transitions. NMR Spectroscopy.
10. Polymer Chemistry – Inorganic polymers – Properties – Glass transition temperature.

Reference:

1. Text Book of Inorganic Chemistry, P.L Soni, Publisher Sultan Chand & Sons-2013
2. Organic Chemistry, Robert T, Morrison N. Boyd Publisher Prentice Hall, 6th Edition-1992
3. Principles of Physical Chemistry, B.R.Puri, L. R . Sharma. M.S. Pathania Publisher Vishal Publishing Co. 2013.
4. Polymer Science by V.R. Gowrikar, N.V. Vishwanthan, Jaadev Sreedhar Publihsers: New Age Publisher
5. Atomic and Molecular Spectroscopy, G. R .Chatwal A.K.Sham, Publisher : Himalaya Publishing House 2009.

Syllabus: Mathematics (for Faculty applying for Ph D in Mathematics only)

1. **TRIGONOMETRY:** Trigonometric ratios and relations, simple problems. Complex numbers: Definition and properties, De Moivre's theorem, roots of complex numbers
2. **INFINITE SERIES:** Convergence and divergence of series of positive terms. Standard tests for convergence. Alternating series, Leibnitz test.
3. **LINEAR ALGEBRA:** Matrices and determinants, Inverse of a matrix, rank of a matrix, consistency of a system of linear equations. Eigen values and eigen vectors
4. **CALCULUS:**
 - a. **DIFFERENTIAL CALCULUS:** nth derivative of standard functions, polar curves, angle between polar curves. Partial differentiation, maximum and minimum for function of single and two variables. Curvature and radius of curvature, mean value theorems, Taylor's and Maclaurin's expansion for a function of single variable. Indeterminate forms.
 - b. **INTEGRAL CALCULUS:** Tracing of standard curves. Beta and gamma functions. Length, Area, Volume using multiple integrals.
5. **DIFFERENTIAL EQUATIONS:** Solutions of first order and first degree differential equations,
6. **APPLIED MATHEMATICS:**
 - a. Laplace Transforms, Fourier Series & Fourier Transforms
 - b. **NUMERICAL METHODS :** Solutions of algebraic and transcendental equations, finite differences and related problems, numerical differentiation and numerical integration, Numerical solution of ordinary and partial differential equations, application to Engineering problems.
 - c. **STATISTICS AND PROBABILITY:** Correlation and regression, analysis of variance. Probability : Axioms, Including Bayes theorem, conditional probability, probability distribution-Binomial, Poisson, normal, geometric and exponential distribution.

TEXT BOOKS:

1. Higher Engineering Mathematics – Dr. B.S. Grewal (37th Edition)
2. Elementary Engineering Mathematics- Dr. B.S. Grewal
3. Advanced Engineering Mathematics –Erwin Kreyszig

4. Introduction to Numerical Analysis –S.S. Sastry

Syllabus: Humanities & Social Science *

* Syllabus will be based on the students educational qualification and communicated to the candidates by the department after the last date of submission of applications for RET.

Syllabus: Center for Engineering Education & Research *

* Candidates are informed to follow the syllabus specified in the discipline oriented section (Part-II) based on specialization of their post graduation.

Part – III (20 Questions- 1 mark each)

Common to all discipline

Part III : Aptitude section : Reading Comprehension data Sufficiency, Data Interpretation, & Logical Reasoning.	20 Questions
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Syllabus : Aptitude

Reading Comprehension data Sufficiency, Data Interpretation, Logical Reasoning.