SRI JAGADGURU MURUGHARAJENDRA UNIVERSITY
(Established under SJM University Act 2020)

Instructions:
1. Entrance test question paper consists of multiple choice questions for 100 Marks and it is Classified as Part-A, Part-B & Part- C
2. Entrance Test Duration shall be 3 hours
3. Part-A shall be Subject specific for 50 Marks.
   Part – B shall be General Aptitude for 30 Marks
   Part – C shall be Mathematics for 20 Marks

Part – A
Subject Specific (Engineering Discipline)
Syllabus for Chemistry - 50Marks

1 Chemical periodicity

Structure and bonding in homo- and heteronuclear molecules, including shapes of molecules (VSEPR Theory). Concepts of acids and bases, Hard-Soft acid base concept, Non-aqueous solvents. Main group elements and their compounds: Allotropy, synthesis, structure and bonding, industrial importance of the compounds. Transition elements and coordination compounds: structure, bonding theories, spectral and magnetic properties, reaction mechanisms. Inner transition elements: spectral and magnetic properties, redox chemistry, analytical applications. Organometallic compounds synthesis, bonding and structure, and reactivity. Organometallics in homogeneous catalysis. Cages and metal clusters.

2 Analytical chemistry

Separation, spectroscopic, electro- and thermoanalytical methods. Bioinorganic chemistry: photosystems, porphyrins, metalloenzymes, oxygen transport, electron- transfer reactions; nitrogen fixation, metal complexes in medicine. Characterisation of inorganic compounds by IR, Raman, NMR, EPR, Mössbauer, UV-vis, NQR, MS, electron spectroscopy and microscopic techniques. Nuclear chemistry: nuclear reactions, fission and fusion, radio-analytical techniques and activation analysis.

3 Quantum mechanics

Postulates; operator algebra; exactly-solvable systems: particle-in-a-box, harmonic oscillator

and the hydrogen atom, including shapes of atomic orbitals; orbital and spin angular momenta; tunneling. Approximate methods of quantum mechanics: Variational principle; perturbation theory up to second order in energy; applications. Atomic structure and spectroscopy; term symbols; many-electron systems and antisymmetry principle. Chemical bonding in diatomics; elementary concepts of MO and VB theories; Huckel theory for conjugated π-electron systems.

4 Group theory

Chemical applications of group theory; symmetry elements; point groups; character tables; selection rules. Molecular spectroscopy: Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities – selection rules; basic principles of magnetic resonance. Chemical thermodynamics: Laws, state and path functions and their applications; thermodynamic description of various types of processes; Maxwell's relations; spontaneity and equilibria; temperature and pressure dependence of thermodynamic quantities; Le Chatelier principle; elementary description of phase transitions; phase equilibria and phase rule; thermodynamics of ideal and non-ideal gases, and solutions. Electrochemistry: Nernst equation, redox systems, electrochemical cells; Debye Huckel theory; electrolytic conductance – Kohlrausch's law and its applications; ionic equilibria; conductometric and potentiometric titrations.

5 Organic Chemistry:

IUPAC nomenclature of organic molecules including regio- and stereoisomers. Principles of stereochemistry: Configurational and conformational isomerism in acyclic and cyclic compounds; stereogenicity, stereoselectivity, enantioselectivity, diastereoselectivity and asymmetric induction. Aromaticity: Benzenoid and non-benzenoid compounds – generation and reactions. Common named reactions and rearrangements – applications in organic synthesis. Chemistry of natural products: Carbohydrates, proteins and peptides, fatty acids, nucleic acids, terpenes, steroids and alkaloids. Biogenesis of terpenoids and alkaloids. Structure determination of organic compounds by IR, UV-Vis, 1H & 13C NMR and Mass spectroscopic techniques.

Reference Books:

1) Concise Inorganic Chemistry, J.D. Lee, Fifth Edition, John Wiley and Sons Ltd.

2) Advanced Inorganic Chemistry- Vol 1 & Vol 2, Satya Prakash etal, S. Chand Publications

3) Organic Chemistry, Morrison and Boyd, Sixth Edition, Pearson Publication.

4) Physical Chemistry, Peter Atkins and Julio de Paula, 10th Edition , Oxford Publications.

5) Fundamentals of Analytical Chemistry, Skoog etal 8th Edition, Thomson Publishers.

Part - B

General Aptitude Test Syllabus (Weightage 30%)

<u>Common to all branches</u>

1. Arithmetical Ability,
2. Data Interpretation,
3. Verbal Ability,
4. Numerical Analysis Quantitative ability,
5. Reading Comprehension data Sufficiency
6. Logical Reasoning, computer awareness.

Reference Books:

1. Quantitative Aptitute by R S Agarwal

2. Fast Track Objective Arithmetic by Rajesh Verma

Part –C

Mathematics Entrance Test Syllabus for Ph.D- 20 marks
Common to all branches

Linear Transformations: The algebra of Linear Transformation, singular and non-singular transformations, characteristic polynomials, minimal polynomials, Rank and Nullity, Eigen values and Eigen vectors.

Solutions of Linear System of Equations : Introduction to Direct Methods via., Gauss Elimination method, Gauss-Jordan method. Iteration Methods: Gauss Jordan methods, Gauss-Seidel method, Successive Over relaxation method and problems on each method.

Fourier Series : Dirichlet's conditions, Expansions of Periodic functions into Fourier series, Half range Fourier series.

Laplace Transforms: Properties of Laplace transformation, Unit step function, Convolution theorem, Solution of differential equation using Laplace transformation.

Statistical method : Curve fitting by the method of least squares – Fitting the curve of the form $y = ax + b$, $y = ax^2 + bx + c$ and $y = ax^b$. Correlation and regression.

Differential Calculus: polar curves, angle between polar curves, Curvature and radius of curvature, Taylor's and Maclaurin's expansion for a function of single variable.

Differential Equations: Ordinary Differential Equations (ODEs): Existence and Uniqueness of Solutions of initial value problems for first order ordinary differential equations, singular solutions of first order ODEs, system of first order ODEs.

Numerical methods : Solution of ODE of first order : Taylor's series method , Modified Euler's method, RK - 4th method, Milne's method , Newton forward- backward method, interpolation method.

References:

1. B. S. Grewal: "Higher Engineering Mathematics", Khanna publishers, 44th Ed.2018
2. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed. (Reprint), 2016.
3. H.K.Dass and Er. RajnishVerma: "Higher Engineering Mathematics" S.Chand Publication (2014).
4. N.P Bali and Manish Goyal: "A textbook of Engineering Mathematics" Laxmi Publications, Latest edition.