

## Entrance test syllabus for PhD in chemistry in UIET,

### Kurukshetra University Kurukshetra

Note: The paper shall consist of two parts. Part I on research methodology will contain 20 questions and Part II on chemistry shall contain 80 questions. Each question will carry 2 marks.

#### Part I: Syllabus of research methodology (40 marks)

Research – Components of Research Problem – Various Steps In Scientific Research – Types of Research. Data Collection and interpretation – Sources of Data – Primary Data – Secondary Data Sampling Methods – Merits and Demerits – Experiments – Observation Method – Sampling Errors - Type-I Error & Type-II Error. Statistical Analysis – Introduction To Statistics – Probability Theories – Conditional Probability, Poisson Distribution, Binomial Distribution and Properties of Normal Distributions - Standard Deviation – Co-Efficient of Variations . Research Reports – Structure and Components of Research Report – Types of Report, Characteristics of Good Research Report, Pictures and Graphs, Research Ethics, Purpose of organizing seminars, conferences etc. Basics of computers . Different instrumental techniques such as spectroscopic techniques (IR, UV-VIS, NMR, Fluorometry, Chromatography etc.)

#### Part II: Syllabus of Chemistry (160 marks)

INORGANIC CHEMISTRY Chemical periodicity- Structure and bonding in homo- and heteronuclear molecules, including shapes of molecules (VSEPR Theory): Transition elements and coordination compounds: structure, bonding theories, spectral and magnetic properties, Organometallic compounds: synthesis, bonding and structure, and reactivity. Bioinorganic chemistry: photosystems, porphyrins, metalloenzymes, oxygen transport, electron- transfer reactions; nitrogen fixation, metal complexes in medicine.

PHYSICAL CHEMISTRY Molecular spectroscopy: Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities – selection rules; Chemical thermodynamics: Laws, state and path functions and their applications; thermodynamic description of various types of processes; elementary description of phase transitions; phase equilibria and phase rule; thermodynamics of ideal and non-ideal gases, and solutions. Statistical

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thermodynamics: Nernst equation, redox systems, electrochemical cells; collision and transition state theories of rate constants; unimolecular reactions;

ORGANIC CHEMISTRY IUPAC nomenclature of organic molecules Principles of stereochemistry: Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species. Concepts in organic synthesis: Retrosynthesis, disconnection, synthons. Asymmetric synthesis: Pericyclic reactions – electrocyclization, cycloaddition, sigmatropic rearrangements and other related concerted reactions. Principles and applications of photochemical reactions in organic chemistry. Structure determination of organic compounds by IR, UV-Vis,  $^1\text{H}$  &  $^{13}\text{C}$  NMR and Mass spectroscopic techniques.

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