| Semester IV | | | | | | |
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| **S.No** | **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 1 | CE301T | Environmental studies | 3 | 0 | 0 | 6 |
| 2 | CH401T | Organic Reactions and Reagents | 3 | 0 | 0 | 6 |
| 3 | CH411T | Quantum Chemistry | 3 | 0 | 0 | 6 |
| 4 | CH 320 | Molecular Energetics and Dynamics | 3 | 0 | 0 | 6 |
| 5 | | Institute Elective-I | 3 | 0 | 0 | 6 |
| 6 | CH301L | Chemistry laboratory-I | 0 | 0 | 3 | 3 |
| | | **Total Credits** | | | | **33** |

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| 1 | **Title of the course** (L-T-P-C) | **Organic reactions and reagents** **(3-0-0-6)** |
| 2 | **Pre-requisite courses(s)** | Fundamental concepts and applications of chemistry (CH101) |
| 3 | **Course content** | Functional group transformations, common named reactions, oxidations, reductions and rearrangements and their applications in organic synthesis. Carbon-Carbon Bond Forming Reactions *via* enolate, enamine and imine chemistry, Grignard, cuprate and other conjugate reactions, Radical reactions and other classes (via organo silane, borane and tin based reagents, Baylis-Hillman reaction), Selectivity and protecting groups: Illustration of chemoselectivity, regioselectivity and enantioselectivity, stereoselectivity; protecting groups for alcohols, amines, acids, ketones and aldehydes. common catalysts and reagents for reactions (organic, inorganic, organometallic and enzymatic), pericyclic and photochemical reactions in organic synthesis |
| 4 | **Texts/References** | 1. Carey, F. A., Sundberg, R. J. *Advanced Organic Chemistry*, *Part A and B*, Springer, 2007.<br>2. Clayden, J., Greeves, N., Warren, S., Wothers, S. *Organic Chemistry*, Oxford University Press, **2001**.<br>3. Carruthers, W., Coldham, I. *Some Modern Methods of Organic Synthesis*, Cambridge University Press, **2004**.<br>4. Smith, M. B. and March, J. *Advanced Organic Chemistry*, Wiley Interscience, **2007**.<br>5. G. S. Zweifel and M. H. Nantz, *Modern Organic Synthesis-An Introduction*, W. H. Freeman and Company, 2006<br>6. K. Peter C. Vollhardt and Neil E. Schore "Organic Chemistry" W. H. Freeman and Company, 1999.<br>7. T.W. Greene, "*Protecting Groups in Organic Synthesis"* (3rd edition), J. Wiley & Sons, **1999**. |

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| 1 | **Title of the course** (L-T-P-C) | **Quantum Chemistry**<br>**3-0-0-6** |
| 2 | **Pre-requisite courses(s)** | -- |
| 3 | **Course content** | Introduction: Importance; Historic background; Classical vs Quantum mechanics; Wave particle duality; Uncertainty principle. Postulates of quantum mechanics; Operator algebra; Properties of hermitian operators; Commutators. Schrodinger Equation: Wave function and interpretation; Time dependent and time independent Schrodinger equation; Eigenvalue problem. Quantum mechanics applicationsto model systems: Free particle; Particle-in-a-box (1D & 3D); harmonic oscillator; Tunneling; Rigid rotor. Hydrogen and hydrogen like atoms. Methods to obtain the approximatesolution of time independent Schrödinger equation: Perturbation theory; variational method; Applications. Many electron atoms: Spin and Pauli exclusion principle; Hund's rule; Slater determinants; Electronic term symbols. |
| 4 | **Texts/References** | • D. A. McQuarrie, Quantum Chemistry, Viva Student Edition, 2016<br>• I. R. Levine, Quantum Chemistry, Pearson publication, 7th Edition 2013<br>• A. Szabo and N. S. Ostlund, Modern Quantum Chemistry, Dover Publications, New Edition, 1996<br>• K L Kapoor, Physical Chemistry-Volume 4, McGraw Hill Education Pvt. Ltd, 6th Edition 2020. |

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| 1 | **Title of the course** (L-T-P-C) | **Molecular Energetics and Dynamics** **(3-0-0-6)** |
| 2 | **Pre-requisite courses(s)** | Nil |
| 3 | **Course content** | Laws of thermodynamics. Estimations of enthalpy and free energy. Fugacity and activity and their determinations Application to chemical reactions. Overview of rate laws and determining rates and orders of reactions. Complex Reactions. Catalysis. Temperature dependence and Arrhenius law. Potential energy surfaces. Kinetic theory of collisions. Transition state theory. RRK and RRKM theories. Reaction cross-sections, rate coefficients, reaction probabilities. Photochemical reactions. Ultrafast reactions. Diffusion in solids, liquids and solutions. Chemical oscillations and nonlinear dynamics. |
| 4 | **Texts/References** | 1. P. Atkins and J. de Paula, Atkins' Physical Chemistry, 8th edition, Oxford University Press, 2006.<br>2. G. W. Castellan, Physical Chemistry, 3rd edition, Addison - Wesley/Narosa Publishing House, 1993.<br>3. G. N. Lewis and M. Randall, Thermodynamics, (Revised by K. S. Pitzer and L. Brewer), International Students Edition, McGraw Hill, 1961.<br>4. Chemical Kinetics and Dynamics, Jeffrey I. Steinfed, Joseph S. Francisco and William L. Hase.<br>5. Chemical Kinetics and Reaction Dynamics, Paul L Houston |

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| 1 | **Title of the course** (L-T-P-C) | **Chemistry laboratory-I**<br>**(0-0-3-3)** |
| 2 | **Pre-requisite courses(s)** | |
| 3 | **Course content** | Inorganic chemistry: Basic concepts of quantitative analysis, redox, precipitation and complexometric titrations. Solubility product and precipitation, organic precipitants and extractants. A brief survey of separation methods: solvent extraction and chromatography. Volumetric analysis involving redox, precipitation and complexometric titrations.<br><br>Organic chemistry: Determination of physical constants, purification of solids and liquids and methods of checking their purity. Separation of enantiomers and measurements of optical rotation. Studies of electrophilic/nucleophilic substitution reactions, redox reactions<br><br>Physical chemistry:<br><br>1. Ionization constant by spectrophotometry, enzyme kinetics, use of immobilized enzyme electrode, adsorption isotherm |
| 4 | **Texts/References** | |