# K L UNIVERSITY

## DEPARTMENT OF CHEMISTRY

## 2016-2018 M.Sc BATCH Course Outcomes vs Program Outcomes

## Course Articulation Matrix

| S No | Course Code | Course Title | LTP | Credits | CO NO | Description of the Course Outcome | Program Outcomes | | | | | | Course Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 1 | 2 | 3 | 4 | 5 | 6 | |
| 1 | 16 CY 1101 | *General Chemistry-I* | *4-0-0* | *4* | CO1 | Classify and explain of analytical data | 2 | | | | | | problem-solving skills to do well in general chemistry, as in many other disciplines |
| | | | | | CO2 | Illustrate the Titrimetric Analysis | 1 | | | | | | |
| | | | | | CO3 | Describe and Apply the Visible spectrophotometric and potentiometric | | | 2 | | | | |
| | | | | | CO4 | Develop the small computer codes using any one of the languages FORTRAN/C/BASIC | 1 | | | 3 | | | |
| 2 | 16 CY 1102 | *Inorganic Chemistry- I* | *4-0-3* | *7* | CO1 | The bonding fundamentals for both ionic and covalent compounds, including electronegativities, bond distances and bond energies using MO diagrams and thermodynamic data | 2 | | | | | | The skills will be developed in computer-based, structure visualization tools to view molecules, appropriate separation/isolation techniques for different classes of inorganic materials. |

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| | | | | | CO2 | predicting geometries of simple molecules | 1 | | | | | | |
| | | | | | CO3 | the use of group theory to recognize and assign symmetry characteristics to molecules and objects, and to predict the appearance of a molecule's vibrational spectra as a function of symmetry | 2 | | | | | | |
| | | | | | CO4 | the bonding models, structures, reactivities, and applications of coordination complexes, boron hydrides, metal carbonyls, and organometallics | 3 | | | | | | |
| | | | | | CO5 | The design and application of an analysis related to a question of relevance based on experience in the laboratory and research of the scientific literature. | | | 3 | | | | |
| 3 | 16 CY 1103 | *Organic Chemistry-I* | *4-0-3* | *7* | CO1 | Understand the basics of Stereo Chemistry, Green Synthesis & Substitution reactions. | 1 | | | | | | The skills will be developed to identify the organic compounds, separation techniques, synthesis of new drugs |
| | | | | | CO2 | Identify the stereo isomerism in many newly synthesized drugs | | 2 | | | | | |

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| | | | | | CO3 | Understand the concept of NGP, Aromaticity and Nucleophilic substitution reactions. | | | 1 | | | | |
| | | | | | CO4 | Design the green synthetic approaches to replace conventional synthesis methods | | | 2 | | | | |
| | | | | | CO5 | Knowledge in this course will train the students in scientific research approach. | | | 3 | | 2 | 1 | |
| 4 | 16 CY 1104 | *Physical Chemistry-I* | *4-0-3* | *7* | CO1 | Concepts of Classical thermodynamics & laws of thermodynamics | 1 | | | | | 1 | To gain familiarity with a variety of physico-chemical measurement techniques. |
| | | | | | CO2 | Applications of macromolecules & Micells. | | | 2 | | | | |
| | | | | | CO3 | Discuss the different aspects of kinetics of the types of reactions | 1 | | 2 | | | | |
| | | | | | CO4 | To understand the concepts of photo chemistry & luminescence | 2 | | | 3 | | | |
| | | | | | CO5 | An ability to analyze, generate experimental skills towards the industrial applications. | | | 2 | | 3 | | |
| | 16 CY 1205 | *General Chemistry-II* | *4-0-0* | *4* | CO1 | Symmetry and Group theory of the molecules | 2 | | | | | | chemistry qualification also opens up a wide range of alternative career options |
| | | | | | CO2 | Energy associates with the degrees of freedom | | 2 | | | | | |

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| | | | | | CO3 | Classical and quantum theories of Raman and Electronic Spectra of diatomic molecules and poly atomic molecules | | | | | | |
| | | | | | CO4 | Basic principles and Applications of Nuclear Magnetic Resonance Spectroscopy | 2 | | | | | |
| 6 | 16 CY 1206 | *Inorganic Chemistry- II* | *4-0-3* | *7* | CO1 | Understand the principles behind the formation of metal cluster compounds. | 2 | | | | | | Skills will be develop to Determine the appropriate characterization techniques for different classes of inorganic materials. |
| | | | | | CO2 | Explain the synthesis, properties, bonding and structures of π-complexes of transition metals, | 1 | | | | | | |
| | | | | | CO3 | Illustrate, the principles behind the Metal Ligand equilibria in solution withrespect to the formation, their Kinetic and thermal stability, and determinations. | 2 | | | | | | |
| | | | | | CO4 | Explain the features of Inorganic reaction mechanisms | 1 | | | | | | |
| | | | | | CO5 | Expertise the student in the semi-micro qualitative analysis of mixtures containing some interfering radicals and rare cations | | 2 | | | | | |

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| 7 | 16 CY 1207 | *Organic Chemistr-II* | *4-0-3* | *7* | CO1 | Derive the Electrophilic addition reaction mechanisms of C=C compounds | 2 | | | | | | To develop the experimental skills towards the industrial applications. |
| | | | | | CO2 | Describe the relationship among aromatic substitution and addition reactions. | 2 | | | | | | |
| | | | | | CO3 | Apply various reaction pathways to develop new and notable organic compounds. | 2 | | | | | | |
| | | | | | CO4 | Differentiate the Alkaloids and Terpenoids by their unique properties. | 1 | | | | | | |
| | | | | | CO5 | An ability to analyze, generate experimental skills towards the industrial applications. | | | 3 | | 2 | 2 | |
| 8 | 16 CY 1208 | Physical Chemistry-II | *4-0-3* | *7* | CO1 | Physical methods of molecular structure determination. | 1 | | | | | | To develop laboratory skills and the ability to work independently. |
| | | | | | CO2 | Application of Electron Spin Resonance spectroscopy. | 1 | | | | | | |
| | | | | | CO3 | Discuss fundamental aspect of electrochemistry for energy device application. | 2 | | | | | | |
| | | | | | CO4 | Electrochemistry of electrode electrolyte interface | 2 | | | | | | |
| | | | | | CO5 | An ability to analyze, generate experimental skills towards the industrial applications. | | | 3 | | 2 | 2 | |
| 9 | 16 CY 2109 | Organic Reaction Mechanisms and | *4-0-0* | *4* | CO1 | Ability to apply nucleophillic /electrophillic pathway to synthesize new organic entities | 2 | | | | | | The participants will acquire broad knowledge to modern organic chemical reactions and theirmechanisms and be able to design |

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| | | pericyclic reactions | | | CO2 | Apply aromatic nucleophillic and free radical substitution mechanisms in new chain linkages | 2 | | | | | | synthetic routes to complex target molecules such as drugs and natural products |
| | | | | | CO3 | Understand organic reaction mechanism in terms of pericyclic reactions at different conditions. | 2 | | | 3 | | | |
| | | | | | CO4 | Ability to explain pericyclic reactions involved in various organic rearrangement reactions. | 2 | | | 2 | | | |
| 10 | 16 CY 2110 | Organic Spectroscopy - I | 4-0-0 | 4 | CO1 | Evaluate theoretical and experimental methods of analysis using IR spectroscopy | 1 | | | | | | To develop the skills in interpretation of Organic compounds |
| | | | | | CO2 | Evaluate theoretical and experimental methods of analysis using UV spectroscopy | 1 | | | | | | |
| | | | | | CO3 | Understand proton NMR & 13C NMR and mass spectrometry methods of analysis | 3 | | | | | | |
| | | | | | CO4 | Able to apply spectroscopic methods (UV,IR,1H-NMR,13C-NMR & mass spectrometry) in organic structure elucidation. | 3 | 3 | 3 | 3 | 3 | 3 | |
| 11 | 16 CY 2111 | *Organic Synthesis-I* | *4-0-3* | *7* | CO1 | Build carbon-carbon single bond associated molecules (carbenes-carbenoids | 1 | | | | | | To develop the skills in synthesis of new drugs |
| | | | | | CO2 | Develop carbon-carbon double bonds using notable elimination reactions | 1 | | | | | | |

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| | | | | | CO3 | Make use of organic polymerization processes | 1 | | | | | | |
| | | | | | CO4 | Understand the applications of organic boranes. | 1 | | | 2 | | | |
| | | | | | CO5 | synthesise organic compounds | | | 3 | | 3 | 3 | |
| 12 | 16 CY 2112 | Natural Products | *4-0-3* | *7* | CO1 | Illustrate the synthesis and significance of microbial metabolites | 1 | | | | | | To develop the skill in separation of secondary metabolites from the from the various plants and animals |
| | | | | | CO2 | Outline the origin & chemical nature of Terpenes | 1 | | | | | | |
| | | | | | CO3 | Outline the origin & chemistry of Alkaloids | 1 | | | | | | |
| | | | | | CO4 | Demonstrate properties & synthetic methods of peptides | 1 | | | | | | |
| | | | | | CO5 | to synthesise organic compounds using multi stage reaction path | | | 3 | | 2 | 3 | |
| 13 | 16 CY 2214 | Organic Reaction Mechanisms and organic photochemistry | 4-0-0 | 4 | CO1 | Adopt addition and elimination mechanism in order to understand selected named reactions | 2 | | | | | | · Ability to work out reaction mechanisms and synthetic routes. |
| | | | | | CO2 | Conclude classification and mechanistic treatment of nucleophillic ,electrophillic and free radical rearrangements. | 2 | | | | | | |
| | | | | | CO3 | Summarize basic concepts behind organic photo chemistry | 2 | | | | | | |
| | | | | | CO4 | Select and photo chemical concepts to generate enone and aromatic compounds. | 2 | | | | | | |

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| 14 | 16 CY 2215 | Organic Spectroscopy - 2 | 4-0-0 | 4 | CO1 | Outline optical rotatory dispersion and circular dichroism. | 2 | | | | | | Skills for Interpreting $^{1}$H NMR, C13, UV, IR Spectra of Unknown Compounds in an Organic Spectroscopy |
| | | | | | CO2 | Examine the separation of chemical shifts and coupling on 2D axis | 1 | | | | | | |
| | | | | | CO3 | Take part in fragmentation of organic molecules associated with functional groups | 2 | | | | | | |
| | | | | | CO4 | Elucidate organic structures using mass fragmentation ORD&CD | 3 | 3 | 3 | | | | |
| | | | 4-0-2 | 7 | CO1 | Apply organo silanes and phase transfer catalyst in organic synthesis | 1 | | | | | | To develop the synthesis of organic compounds |
| | | Organic Synthesis-2 | | | CO2 | Choose appropriate oxidizing agents in oxidative coupling reactions | 2 | | 2 | | | | |
| | | | | | CO3 | Choose appropriate reducing agents in reducing coupling reactions | 2 | | 2 | | | | |
| | **16 CY 2216** | | | | CO4 | Develop convergent and linear synthetic methods using disconnection approach | 2 | | 3 | 3 | | | |
| | | | | | CO5 | To analyze organic molecules from binary mixtures | | | 3 | | 2 | 2 | |
| 16 | 16 CY 2217 | *Techniques for modern industrial* | *4-0-3* | *7* | CO1 | Understand classical methods of purification techniques | 2 | | | | | | skills will be developedindividually, or in groups, through research ... education with other subjects |

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| | | *applications* | | | CO2 | Classify the different chromatographic methods for separation of chemicals | 2 | | | | | | |
| | | | | | CO3 | Explain theory, instrumental description of gas chromatography and HPLC | 2 | | | | | | |
| | | | | | CO4 | Understand the preparation of ion exchange resin in chromatographic applications. | 2 | | | | | | |
| | | | | | CO5 | To estimate organic compounds from the basic sources | | | 3 | | 3 | 3 | |
| 17 | 16 CY 2119 | Separation Techniques -I | 4-0-0 | 4 | CO1 | Understanding the concepts and applications of paper chromatography and thin layer chromatography | 2 | | | | | | understands the following terms: solvent extraction, chromatography, RF , centrifugation, simple distillation, fractional distillation, etc. Student acquires skills to perform experiments using the followingtechniques in the chemistry lab: Solvent extraction using separating funnel. Paper Chromatography. |
| | | | | | CO2 | Understanding the concepts and applications of Ion exchange | 2 | | | 2 | 2 | | |
| | | | | | CO3 | Understanding the Concepts of sampling of solids, liquids, gases in chromatography | 2 | | | | | | |
| | | | | | CO4 | Discuss the importance of analytical chemistry for industrial research and understand the concepts of solvent extraction | 2 | | | | | | |
| 18 | 16 CY 2120 | *Quality Control and Traditional Methods of* | 4-0-0 | 4 | CO1 | Understand the principles of Quality control in Analytical Chemistry | 2 | | | | | | Skills will be developed in quality practices and methods, |

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| | | *Analysis-I* | | | CO2 | Explain the various concepts of decomposition techniques in analysis | 2 | | | | | |
| | | | | | CO3 | Illustrate, discuss and apply the various principles behind the various Red-ox systems involved in the classical Volumetric methods of Analysis. | 2 | | | | | |
| | | | | | CO4 | Explain the various principles involved in the analysis of Organic Functional Groups | 2 | | | | | |
| 19 | 16 CY 2121 | Applied Analysis-I | *4-0-3* | *7* | CO1 | Understand the principles, methodology and adoptability various procedures for the analysis of Analysis of Iron, Manganese, Chromite , Phosphate and Aluminium Ores | 2 | | | 2 | | | To develop the skills in industrial applications |
| | | | | | CO2 | Discuss, explain and illustrate the applications of the general methods of analysis for finished products such as Steel, dolomite, fire clay, four spar and magnesite | 2 | | | | | | |
| | | | | | CO3 | Finding the adoptability by applying the general methods of analysis for Cement, Soaps, Oils and paints analysis | 2 | | | | | | |

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| | | | | | CO4 | Explain and apply the various principles involved in the chemical and physicochemical analysis of Organic Functional Groups | 2 | | | | | | |
| | | | | | CO5 | Ability to analyse chemicals by clasical methods | 2 | | 3 | | 2 | 2 | |
| 20 | 16 CY 2122 | Instrumental Methods of Analysis - I | *4-0-3* | *7* | CO1 | Understand the concepts of excitation spectroscopic methods. | 1 | | | 2 | | | |
| | | | | | CO2 | Understand the basic concepts of rotational and vibrational spectroscopic methods. | 2 | | | 2 | | | |
| | | | | | CO3 | Illustration of the concept of Nuclear magnetic and ESR spectroscopy and their applications. | 3 | | | 2 | | | To develop the skills instrumental separation methods |
| | | | | | CO4 | Comprehend the basic knowledge of mass spectroscopy and X-ray spectroscopy to characterize the unknown molecules | 2 | | | 2 | | | |
| | | | | | CO5 | Ability to analyse chemicals by Instrumental methods | | | 3 | | 2 | 2 | |
| 21 | **16 CY2224** | Separation Methods – II | 4-0-0 | 4 | CO1 | Understanding the concepts and applications of paper chromatography and thin layer chromatography | 2 | | | | | | analytical problem is entirely new, there is no established method, and something has to be developed from the beginning |

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| | | | | | CO2 | Understanding the concepts and applications of Ion exchange | 2 | | | | | | |
| | | | | | CO3 | Understanding the Concepts of sampling of solids, liquids, gases in chromatography | 2 | | | | | | |
| | | | | | CO4 | Discuss the importance of analytical chemistry for industrial research and understand the concepts of solvent extraction | 2 | | | 1 | | | |
| 22 | 16 CY2225 | Applied Analysis – II | 4-0-0 | 4 | CO1 | Understand the principles, and methodology involved in precipitations and its titrations for assaying different ions. | 2 | | | | | | Think analytically, logically and critically. Pursue complex lines of reasoning. Recognize relations between mathematical principles and phenomena common in business, computing, biology, etc. Approach a problem flexibly, making use of a variety of special techniques |
| | | | | | CO2 | Discuss, explain and illustrate the Precipitations from Homogeneous Solutions. Their significance in Gravimetric determinations involving various complexing agents | 1 | | | 2 | | | |
| | | | | | CO3 | Discuss and apply the principles involved in the redox titrations involving Inorganic and Oranic redox reagents. | 2 | | | 2 | | | |
| | | | | | CO4 | Illustrate the principles and methodology involved in the analysis some selected drugs. | 2 | | | 1 | | | |

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| 23 | **16 CY2226** | Applied Analysis – II | *4-0-3* | *7* | CO1 | Under the principles and mythology involved in the analysis of non-ferrous alloys and Ferro alloys | 1 | | | | | | To develop the skills in Applied Analysis of Physical and Chemical Parameters |
| | | | | | CO2 | Discuss the principles and methodologies involved in the Analysis of Soil, Fertilizer and Fuel | 1 | | | | | | |
| | | | | | CO3 | Assessing the air quality with respect to primary and secondary pollutants | 2 | | | 1 | | | |
| | | | | | CO4 | Discuss and apply the principles involved in the kinetic methods of analysis and non-aqueous titrations. | 1 | | | 2 | | | |
| | | | | | CO5 | Ability to analyze ferrous and non ferrous | | | 3 | | 2 | 2 | |
| 24 | **16 CY2227** | Instrumental Methods of Analysis -II | *4-0-3* | *7* | CO1 | Discuss and understand the principles and instrumentation involved in the Flame photometry. Atomic Absorption Spectrometer, Inductively coupled plasma spectrometer and Arc and Spark spectrographic Direct analysis. | 2 | | | 2 | | | instrumental skills in chemical analysis will be developed |
| | | | | | CO2 | Discuss and apply the various principles and methodology in TGA, DTA and DSC | 2 | | | 2 | | | |

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| | | | | | CO3 | Discuss and apply the principles and methodology involved in Voltametry, polarography, Anode stripping voltametry and Coulometry. | 2 | | | 2 | | | |
| | | | | | CO4 | Discuss the principles and methodology in assaying the analytes using Ion Selective Electrodes and Radio chemical methods | 2 | | | 2 | | | |
| | | | | | CO5 | Analysis of chemicals by instrumental methods | | | 3 | | 2 | 1 | |
| | **16 CY2228** | Dissertation | 0-0-6 | 3 | | | | | | | | | To develop the research skills |