**Programme: M. Sc.** Part-II (Analytical Chemistry)
**Course Code:** ACC-501
**Title of the Course:** Fundamentals of Chemical Analysis
**Number of Credits:** 3 **Effective from AY:** 2019-20

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| **Prerequisites for the course:** | Should have knowledge about difference between analytical chemistry and chemical analysis, role of analytical chemist, differences between conventional method of analysis and instrumental methods. | |
| **Course Objectives:** | 1. Introduction to the various chemical method of analysis, details of underlying principle of chemical methods, advantages and limitations<br>2. Application of chemical methods for qualitative and quantitative estimation | |
| **Course Outcomes:** | 1. Students should be in a position to understand basic principle behind different conventional method of analysis.<br>2. Student should understand the limitation of method of analysis, should be in a position to choose for appropriate chemical method for particular analysis<br>3. Students should be in a position to understand the basic chemistry on which the method of analysis based on. | |
| **Content:** | **1 Acid-Base Titrations**<br>Theory of acid-base indicators for Acid-Base titrations; colour change; range of indicator; selection of proper indicator; indicator errors; neutralization curves for strong acid-strong base, weak acid-strong base and weak base-strong acid weak acid-weak base titrations; poly functional acids and bases; titration curves for poly functional acids and bases; titration curves for amphiprotic species; determining the equivalence point; feasibility of acid - base titrations; magnitude of the equilibrium constant; effect of concentration; typical applications of acid-base titrations.<br>**2 Precipitation titrations**<br>Introduction; feasibility of precipitation titrations; titration curves; effect of titrant and analyte concentration on titration curves; effect of reaction completeness on titration curves; titration curves for mixture of anions; indicators for precipitation titrations; the Volhard, the Mohr and the Fajans methods<br>**3 Complexometric titrations**<br>The complex formation reactions; stability of complexes; stepwise formation constants; organic complexing agents; amino carboxylic acid titration; EDTA; acidic properties of EDTA; EDTA complexes with metal ions; equilibrium calculations involving EDTA in solution; condition of formation constants; EDTA titration curves; effect of other complexing agents on EDTA; factor affecting the titration curves; completeness of reaction; indicators for EDTA titrations; theory of common indicators; titration methods using EDTA- direct titration, back titration and displacement titration; indirect determinations; titration of mixtures; selectivity, masking and damasking agents; applications of EDTA titrations- hardness of water; magnesium and Al in antacids; magnesium, manganese and zinc in a mixture. | 10 hrs<br><br>3hrs<br><br>8hrs |

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| | **4. Basic concepts in Electrochemical Titrations**<br>Faradic and non-Faradic currents; reversible and irreversible cells; EMF series; standard electrode potential; Nernst equation; calculation of cell potential; effect of current; ohmic potential; polarization; decomposition potential; over voltage; concentration polarization; mechanism of mass transport; introduction to potentiometric methods<br>**5. Redox titrations**<br>Redox Titrations: Equilibrium constants for redox reactions- electrode potentials in equilibrium systems; calculation of equilibrium constants; redox titration curves- formal redox potentials; derivation of titration curves; factors affecting the shape of titration curves concentration; completeness of reaction; titration of mixtures- feasibility of redox titrations; detection of end point and redox indicators; structural aspect of redox indicators; specific and nonspecific indicators; choice of indicator; potentiometric end point detection; sample preparation- pre-reduction and pre-oxidation.<br>**6. Radioimmunoassay**<br>Radioimmunoassay; its principle and applications; instrumentation for radio bioassay; clinical application of the radioimmunoassay of insulin, estrogen and progesterone; receptor techniques of breast cancer; enzyme- linked immunosorbent assay; principles; practical aspects; applications.<br>**7. Gravimetric analysis**<br>Introduction; properties of precipitates and precipitating reagents; completeness of precipitates; super saturation and precipitate formation; particle size and filterability of precipitates; colloidal precipitates; crystalline precipitates; purity of the precipitate; co-precipitation, post precipitation; conditions for precipitation; fractional precipitation; precipitation from homogenous solution; organic reagent as precipitants-dimethyl gloxime, oxine, cupferon, salicyldoxime, washing of precipitates; drying and ignition of precipitates; calculation of results from gravimetric data; applications. | 3 hrs<br><br>4 hrs<br><br>3 hrs<br><br>5hrs |
| **Pedagogy:** | lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning. | |
| **References/ Readings** | 1. G. D. Christian, *Analytical Chemistry*, John Wiley, New York, 2004, 6th Ed.<br>2. D. A. Skoog, D. M. West & F. J. Holler, *Fundamentals of Analytical Chemistry*, Sounders College publishing, 2014, 9th Ed.<br>3. J. Mendham, R.C. Denney, J.D. Barnes & M. Thomas, *Vogel's Textbook of Quantitative Inorganic Analysis*, Pearson Education Asia 2000, 6th Ed.<br>4. D. Harvey, *Modern analytical chemistry*, The McGraw-Hill, 2000, 1st Ed.<br>5. G. H. Jeffery, J. Bassett, J. Mendham, R C. Denney, *Vogel's Text Book of Quantitative Chemical Analysis*, John Wiley, New York, 1989, 5th Ed. | |