

## Record as per format MSRIT F-702

### Lesson Plan

Department: CHEMICAL ENGINEERING

Semester: IV

Subject Code & Subject: CH 46 & INSTRUMENTAL METHODS OF ANALYSIS

Prepared by: B.M. Nagabhushana

Preparation Date: 07-02-2007

Reviewed by: Dr. G.K. Ramachandra

Review Date: 08-02-2007

Contact hours: 4 Hours/ Week

No. of hours/ session required.: 52

Max. Final Exam Marks: 100

Max. Internal Assessment Marks: 25

Duration of Final Exam. :3 Hours

| Lesson No./code | Topic  | Duration |
|-----------------|--|----------|
| 1 SP -1         | Introduction, Syllabus, Text books, Sessional tests  | One hour |
| 2 SP -2         | Nature and interaction of electromagnetic radiations, energies   | One hour |
| 3 SP -3         | Atomic and molecule transition, selection rules, spectral width  | One hour |
| 4 SP -4         | Factors influencing position and intensity of spectral lines   | One hour |
| 5 ES -1         | Quantitation aspects of absorption measurements, beer's law and limitations, terminology associated with electron spectroscopy | One hour |
| 6 ES -2         | Types of absorption bands, and theoretical interpretation  | One hour |
| 7 ES -3         | Effect of solvent and structure on $\lambda$ max   | One hour |
| 8 ES -4         | Instrumentation, qualitative and quantitative analysis, structure determination  | One hour |
| 9 NMR-1         | NMR, types of nuclei, theory of population of NM energy levels, chemical shifts  | One hour |
| 10 NMR-2        | Mechanism of shielding, spin-spin coupling, rules governing the interpretation of first order spectra                          | One hour |
| 11 NMR-3        | Low and high resolution NMR  | One hour |
| 12 NMR-4        | Instrumentation, application to structure elucidation of simple organic molecule   | One hour |
| 13 MS-1         | Mass spectroscopy, basic theory, instrumentation mass spectrometer   | One hour |
| 14 MS-2         | Methods of generation of positively charged ions, mass analysers   | One hour |
| 15 MS-3         | Resolving power, molecular ion peak, base peak, metastable peak, modes of fragmentations                                       | One hour |
| 16 MS-4         | Application of mass spectrometry in qualitative and quantitative analysis  | One hour |
| 17 FP-1         | Flame photometry and atomic absorption spectroscopy  | One hour |
| 18 FP-2         | Principle, flames and flame spectra, variation of emission intensity with flame, metallic spectra in flame, flame ground.      | One hour |
| 19 FP-3         | Role of temperature in absorption emission and fluorescence  | One hour |
| 20 FP-4         | Comparative study of flame emission spectroscopy (FES), AAS.   | One hour |
| 21 FP-5         | Instrumentation, application   | One hour |
| 22 FP-6         | Qualitative and quantitative determination of alkali and alkaline earth metals   | One hour |
| 23 NT-1         | Nephelometry and turbidometry  | One hour |
| 24 NT-2         | Theory, effect of concentration, particle size and wave length on scattering instruments                                       | One hour |
| 25 NT-3         | Instrumentation and application of Nephelometry and turbidometry   | One hour |
| 26 ET-1         | Electrochemical techniques, electrode potential, Sign convention   | One hour |
| 27 ET-2         | nature, measurement , effect of concentration, SEP, calculation, limitation  | One hour |
| 28 ET-3         | Cell potential, thermodynamic, liquid junction potential, effect of current  | One hour |
| 29 ET-4         | Polarization, sources, over voltage  | One hour |
| 30 ET-5         | Concentration polarization mechanism of mass transport   | One hour |
| 31 ET-6         | Potentiometric methods, reference electrodes, Hydrogen electrode, calomel electrode, silver-silver chloride(s) electrode       | One hour |

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|----------|---|----------|
| 32 ET -7 | potentiometric titration and application  | One hour |
| 33 ET-8  | Membrane electrode, Introduction  | One hour |
| 34 ET-9  | Classification of properties, principle design theory of ion selective electrodes   | One hour |
| 35 ET-10 | Membrane potential, selectivity, crystalline liquid membrane and enzyme electrode   | One hour |
| 36 IR -1 | Theory of IR absorption, types of vibrations  |          |
| 37 IR -2 | Theoretical number of fundamental modes of vibrations and group frequencies, factors affecting group frequencies and band shapes. | One hour |
| 38 IR -3 | Instrumentation – FITR instrument and its advantages, sample handling techniques  | One hour |
| 39 IR -4 | Qualitative applications of IR, application of IR to structural elucidation of simple organic molecules                           | One hour |
| 40 CG-1  | Introduction to chromatography  | One hour |
| 41 CG-2  | General description, definition, terms and parameters used in chromatography  | One hour |
| 42 CG-3  | Classification of chromatographic methods   | One hour |
| 43 CG-4  | Working principle   | One hour |
| 44 CG-5  | Instrumentation and application of HPLC   | One hour |
| 45 CG-6  | Application   | One hour |
| 46 CG-7  | Gas chromatography (GC)   | One hour |
| 47 CG-8  | Instruments and methods   | One hour |
| 48 CG-9  | Thin layer chromatography   | One hour |
| 49 CG-10 | Conclusion  | One hour |
| 50 PG-1  | Polarography, theory of classical polarography, polarographic measurements, polarograms   | One hour |
| 51 PG-2  | Polarographic current and concentration relationships. Factors influencing the diffusion currents                                 | One hour |
| 52 PG-3  | Half wave potential, instrumentation and application  | One hour |

**Internal Assessment Details:** Three tests are conducted in the subject each for a maximum of 25 marks as per University regulations. Best two performances were taken and added. The average of this total adjusted to the next whole number (eg. 21.3 rounded off to 22) will be the internal marks.

**Text Books:**

1. Jaffery, G.H.J., et. Al., *Vogel's Text Book of Quantitative Inorganic analysis*, ELBS 5<sup>th</sup> Edn.1998
2. Braun R.D., *Introduction to Instrumental analysis*, McGraw Hill Book Co.
3. Ewing G.W., *Instrumental methods of Chemical Analysis*, McGraw Hill International Edn.
4. Skoog, D.A., *Principles of Instrumental Analysis*, 3<sup>rd</sup> Ed. Saunders College publishing 1985.
5. Chatwal, Anand, *Instrumental Methods of Chemical Analysis*, Himalaya Publishing 1985.

**References:**

1. W.H. Willard, L.L. Merritt and J.A. Dean, *Instrumental Methods of Analysis* 7<sup>th</sup> Edition 1988.
2. Principles of Electro analytical Methods, T. Riley and C. Tomilison, John Wiley and sons.
3. Instrumental Methods of Chemical Analysis, B.K. Sharma.

**Notes:**

| Term                     | Section | Staff                      | HOD Signature with date |
|--------------------------|---------|----------------------------|-------------------------|
|                          |         | Name & Signature with date |                         |
| 12-02-2007 to 09-06-2007 |         | Dr. G.K. Ramachandra       |                         |
|                          |         | Mr. B.M. Nagabhushana      |                         |