Course Overview

Medical Instrumentation

Course code :	**LMT303**
Course title:	**Medical Instrumentation**
Level/semester:	**Third Semester**
Credit hours:3	**Theoretical: 2**
	Practical: 2

1- Introduction
2- Principle of instrumentation
- Properties of light
- Dispersion of light
- Measurement of light

3-Absorption methods in the visible and ultraviolet
- ❖ The nature of radiant energy
- ❖ The absorption process
- ❖ Nomenclature
- ❖ Fundamental laws of absorbance
  - The Bouguer or Lambert law
  - The beer law
  - The combined from beer`s law
  - Deviation from beer`s law
  - Photometric error
- ❖ Visual colorimetric methods
  - The dilution method
  - The standard series method
- ❖ Photometric instruments
  - Radiant energy sources
  - The optical system
  - The wavelength selectors
  - Filters
  - Monochromators
- ❖ Light - sensitive devices
  - Vacum-tube photocells (photoemissive cells)
  - Barrier –layer cells (photovoltaic cells)
  - Photomultiplier tubes
- ❖ Commercial instruments
  - Photometric methods
  - Absorption spectra

- Determination of concentration from absorbance by calculation
  Calibration curves
- Determination of concentration pH and pK

- Determination of the formula of a complex

    - The mole – ratio method
    - The method of continuous variations
    - Multicomponent analysis
    - Photometric titration

❖ Turbidimetry and nephelometry
- Principe
- Detection of scattered light
- Limitations
- Referactivity
- Applications

4- Infrared and raman spectrometry

❖ Infrared spectrometry
- Absorption of infrared radiation
- Principle of infrared instrument design
    - Soureces
    - Detectors
    - wavelength
- sample handling
- use in analysis

❖ Raman spectrometry
- Theory
- Principle of raman instrument
- Application and comparison

5- Analytical flame spectrometry
- The production of an atomic vapor
    - The premix burner
    - The analytical flame
    - Atomization
- Spectroscopic observation of the atomic vapor
    - Atomic emission spectrometry
    - Instrumental aspects of emission spectrometry
    - Atomic absorption
    - Instrument aspects of atomic absorption
        - Hallow cathode discharge lamp
        - The role of the monochromator
        - Elimination of interfering flame emission

- Quantitative determination based on the spectroscopic observation of an atomic vapour
- Instrument calibration
- Interferences
- Comparison of atomic emission and atomic absorption

6- Chromatography
- Theory of chromatography
- Gas chromatography
- Instrument in gas chromatography
- Liquid chromatography
- Instrumention inliquid chromatography
- Thin-layer chromatography

7- Ion exchange
- Synthetic ion exchange materials
- Structure
- Mechanism of exchange
- Selectivity rules
- Distribution coefficients
- Applications

8- potentiometry
- Electrodes
- The basic principle
- The reference electrodes
- The ion selective electrodes

9-Radio isotope counters
- Beta isotope (14 c) counter
- Gamma isotope (125 c) counter
- Principles andmethods

10- Automation
- The common denominatrors of automated chemical analyzers
- A continuous flow analyzer
- A discrete sample analyzer
- A bath (centrifugal) analyzer

(PRACTICAL)

1. Estimation of $KMnO_4$ Spectrophotometrically
2. Determination of Cu++ ion in the given sample solution by aid of copper tetra amine complex ion spectrophotometrically
3. Determination of Iron as Iron thiocyanate specrophotonetrically
4. Determination OR Nitrate in the given sample solution spectrophotometrically pK_a
5. Determination of Pka value of phenolphathalin (spectrophotometrically)
6. Determination the dissociation constant of methyl orang (spectrophotometrically) (λ Max=440 nm)
7. Determination the ionization constant of bromothymol blue (spectrophotometrically)
8. Estimation of Ni++ ion as Nickel dimethylglyoxime
9. Determination of Ammonia using Nessler's reagent
10. Composition of complexes :
    a. Moe ratio method
    b. Method of continous variation
11. Determination of Normality of HCl using 0.1 N NaOH (using pH meter)
12. pH titration of unknown soda ash using pH meter
13. Determination potentiometricay the normzlity of the given HCl acid by titrating it with stander solution 0.1 N NaOH
14. Spectrophotometeric determination of eadon leaves using solvent extraction
15. Conductometeric titrations : Determination conductometerically the strength of HCl solution by titrating it with standerd NaOH
16. Determination of normality and strength of NH_4OH by titrating it with 0.1 N HCl by conductometric

17. Determination of normality and strength of HCl by titrating it against NH4OH by conductometric
18. Determination of the strength of agiven acetic acid solution by titrating it with 0.1 N NaOH (conductometric)
19. U.V. spectrophotometric determination of Asprin (using solvent extraction)
20. U.V. spectrophotometric determination of phenacetin
21. U.V. spectrophotometric determination of caffeine in APC tablets using solvent extraction
22. Determination of pk_a of bromothymol green .