

CA H 513: APPLIED ANALYSIS

Course Outcomes

- Enable the students to understand the basic principles of soil and fuel sampling and apply the suitable analytical method for their analysis.
- Gain a domain knowledge about quality control of drugs and pharmaceuticals and apply the suitable method for their analysis.
- Imbibe knowledge about various biomedical samples and their analysis.
- Gather knowledge on various types of poisons and estimation of poisonous materials.
- Describe the general methods of determination of various parameters of different food products.
- Learn about the different kinds of Food additives, adulterants and contaminants and their analysis.

UNIT-I: Soil and Fuel Analysis

[12 Hours]

Soil Analysis: Preparation of laboratory sample. Measurement of pH and conductivity, acidic and alkaline soil. Analysis of major constituents—Organic matter, nitrogen, sulphur, potassium and calcium. Analysis of trace elements—Copper, molybdenum, zinc and boron. Analysis of major constituents—Organic matter, nitrogen, sulphur, potassium and calcium.

Fuel Analysis: Definition and classification of fuels, Characteristics of fuels, sampling, proximate and ultimate analysis. Combustion calculations, Calorific value determination by Junker's gas calorimeter, Liquid fuels—Determination of flash point, fire point and aniline point. Knocking of fuels, Octane and Cetane numbers, carbon residues. Gaseous fuels—Analysis of Coal, water gas, producer gas, gas, and blast furnace gas; Calorific value determination by Junker's gas calorimetry.

UNIT-II: Drugs and Pharmaceutical Analysis

[12 Hours]

Importance of quality control, drugs and pharmaceuticals, Sources of impurities in pharmaceutical chemicals, Analytical quality control in finished/final products, Common methods of assay.

Analysis of common drugs: Analgesics—Aspirin, paracetamol; Anthelmintics—Mebendazole; Antiallergics—chlorpheniramine maleate; Antibiotics—Penicillin, chloramphenicol; Anti-inflammatory agents—Oxyphenbutazone; Antimalarials—Primaquine phosphate; Antituberculars—Isoniazid, Rifampin; Narcotics—Nicotine, morphine; Expectorants—Benadryl; Sedatives—diazepam; Vitamins—A, C, B₁, B₂, B₆, niacin & folic acid.

UNIT-III: Biomedical and Forensic Analysis

[12 Hours]

Composition of body fluids and detection of abnormal levels of certain constituents leading to diagnosis of disease; Sample collection and preservation of physiological fluids, Analytical methods for the constituents of physiological fluids (blood, serum, urine); Blood—Estimation of glucose, cholesterol, urea, haemoglobin and bilirubin; Urine—Urea, uric acid, creatinine, calcium

phosphate, sodium, potassium and chloride; Biological significance, analysis and assay of enzymes (pepsin, monoaminoxide, tyrosinase); Vitamins (thiamine, ascorbic acid, vitamin A) and Hormones (progesterone, oxytocin, insulin) [Chemical, instrumental and biological assays to be discussed wherever necessary].

Forensic analysis: General discussion of poisons with special reference to mode of action of cyanide, organophosphates and snake venom; Estimation of poisonous materials such as lead, mercury and arsenic in biological materials; Forensic Toxicology-Analysis of various types of poisons (corrosive, analgesic, hypnotic, narcotic, stimulants, paralytic, antihistamine).

UNIT-IV: Food Analysis

[12 Hours]

General methods for the determination of moisture, ash, crude protein, fat, crude fiber, carbohydrates, calcium, potassium, sodium and phosphates. Dairy products-composition of milk and milk products. Alcohols test, fermentation, dye reduction, methylene blue and resazurin tests. Analysis of fat content, minerals in milk and butter. Estimation of added water in milk.

Oils and fats: General composition of edible oils, Detection of purity, rancidity of fats and oil, Estimation of rancidity, Tests for common edible oils like groundnut oil, castor oil, cottonseed oil and mustard oil. Tests for adulterants like aregemone oil and mineral oils.

Beverages: Soft drinks, Alcoholic drinks, tea, coffee and fruit juices; Analysis of caffeine in coffee and tea, Detection of chicory in coffee and chloral hydrate in toddy; Estimation of methyl alcohol in alcoholic beverages.

Food additives, adulterants and contaminants: Food preservatives like benzoates, propionates, sorbates, bisulphites; Artificial sweeteners like saccharin, dulcin and sodium cyclamate; Flavours like vanillin, esters (fruit flavours) and monosodium glutamate; Artificial food colourants like coal tar dyes and non-permitted colours and metallic salts; Pesticide residues in food; Control of food quality-Codex alimentarices, Indian Standards.

References

1. Soils in our Environment, 8th edn., R. W. Miller and D. T. Gardiner, Prentice Hall (1998).
2. Chemistry for Environmental Engineering, 3rd edn., C. N. Sawyer and P. L. McCarty, McGraw Hill (1978).
3. A Text Book of Soil Analysis, T. C. Baruah and H. P. Barthakur, Vikas Publishing House Pvt. Ltd., New Delhi (1997).
4. A Textbook of Soil Chemical Analysis, 11th edn., P. R. Hesse, CBS Publishers and Distributors Pvt. Ltd. (2002).
5. Handbook of Petroleum Product Analysis, J. G. Speight, John Wiley and Sons (2015).
6. Fuels and combustion, 3rd edn., S. Sarkar, Universities Press (2009).