B.Sc.-V/VI semester: Vocational Course in Chemistry (Credit 4: Theory 2 + Practical 2)

The vocational courses are proposed for those students who are aiming for their career in chemistry as chemist/scientist/analyst in chemistry laboratory, distilleries, pharma sector and other small-scale industries. This vocational programme has been designed to produce the experience trained graduate with knowledge of various laboratory equipments, procedures, safety precautions, handling of chemicals, solvents. This will also help them to maintain future scientific position in school/college, chemistry laboratories and in small industrial sectors. **Students can opt any one of the following papers either in semester Fifth or Sixth.**

B.Sc. V / VI Semester
Vocational Course in Chemistry-I (Paper 1)
(Credit 4: Theory 2 + Practical 2)
Title: Chemistry Laboratory Guidelines and Techniques
Theory (Credit 2)

Introduction of Chemistry Laboratory

General introduction of the chemistry laboratory, common instructions for safe working in chemical laboratories, Good Laboratory Practices (GLP), Good Manufacturing Practices (GMP). Laboratory design, Storage, ventilation, lighting, fume, cupboard, arrangement of the store, Safety provisions, Organization of practical work, Maintenance of laboratory, equipment Cleaning of laboratories and glasswares/plasticwares and preparation room. Classification of apparatus in store and laboratory.

Introduction of Chemistry Apparatus

Glass apparatus - Beaker, test tube, boiling tube, funnel, separating funnel, filtration flask, round bottom flask, flat bottom flask, condenser Liebig flask, watch glass etc. measuring conical or condenser, Petridis, desiccators. Volumetric Apparatus -Measuring cylinder, burette, pipette, volumetric flask, analytical balance, single-pan electronic balance/ electrical analytical balance, Micropipette, Three way Pipette Bulb etc.

Introduction of Chemistry Equipments

Clevenger apparatus, Buchner funnel, Soxhlet extractor, wire gauze, cork borers, filter pumps, crucible, mohr clip, pipe clay triangle, pestle and mortar, sprit lamp, spatulas, thermometer, pH meter, and laboratory centrifuge**.** Apparatus for heating and reaction: Magnetic Stirrer, Bunsen burner, water bath, oil bath hot plate, sand bath, hot air oven, heating mantle etc**.**

Practical (Credit 2)
Title: Chemistry Laboratory Guidelines and Techniques -Practical

1. Handling of common laboratory equipment
2. Preparation of solutions, indicators and reagents (e.g. ceric ammonium nitrate, 2,4-dintro phenyl hydrazine, Tollen's reagent, Fehling solution, etc).
3. Preparation of some organic compound and determination of their boiling point and melting point (e.g. ester derivative of benzoic acid, ester of alcohol like ethanol, butanol etc).
4. Cork boring experiment
5. Calibration of volumetric glassware

References:

- Vogel's Qualitative Inorganic Analysis, A. I. Vogel, Prentice Hall,.
- Vogel's textbook of chemical quantitative analysis, Longman Scientific
- Comprehensive Practical Organic Chemistry, V. K. Ahluwalia, & R. Aggarwal, Universities Press.
- Laboratory Manual of Organic Chemistry, R. K. Bansal, New Age Pub.
- Senior Practical Physical Chemistry, B. D. Khosla, R. Chand & Co.
- Chemistry Practical, O. P. Pandey, D.N. Bajpai, S. Giri, S. Chand.

B.Sc. V / VI Semester

Vocational Course in Chemistry-II (Paper 2)

(Credit 4: Theory 2 + Practical 2)

Title: Basics of Natural Products

Theory (Credit 2)

Basic Chemistry of Natural Products:

Introduction to primary and secondary metabolites and their applications. Simple structure and detection methods of Alkaloids, Terpenoids, Flavonoids, Steroids, Pigments, Lipids and Carbohydrates.

General Extraction and Isolation Methods:

Clevenger apparatus, Soxhlet Extractor, Percolation, Column Chromatography, Flash Chromatography, Preparative and Analytical HPLC.

Steps of the structure elucidation of synthetic and naturally occurring compounds.

Practical (Credit 2)

Title: Basics of Natural Products - Practical

1. Isolation and Purification of natural product (Caffeine from tea, Lactose and casein from milk)
2. To determine the saponification value of an oil/fat.
3. To determine the iodine value of an oil/fat.
4. Preparation of plant extract and phytochemical screening for alkaloids, glycosides, terpenoids and flavonoids by performing simple color tests.

References:

- Vogel's Qualitative Inorganic Analysis, A. I. Vogel, Prentice Hall,.
- Vogel's textbook of chemical quantitative analysis, Longman Scientific
- Comprehensive Practical Organic Chemistry, V. K. Ahluwalia, & R. Aggarwal, Universities Press.
- Laboratory Manual of Organic Chemistry, R. K. Bansal, New Age Pub.
- Senior Practical Physical Chemistry, B. D. Khosla, R. Chand & Co.
- Introduction to Computer Science by Perry Donham.

B.Sc. V / VI Semester
Vocational Course in Chemistry-III (Paper 3)
(Credit 4: Theory 2 + Practical 2)
Title: Laboratory safety and solution preparation
Theory (Credit 2)

Chemistry Laboratory Safety

Safety Data Sheet (SDS), Fire Hazards: Causes of fires, classification of fires, fire prevention protocols and measures, fire alarms, fire escapes, fire extinguishers and their uses. Classification of hazardous chemicals based on the information given on the labels.

Chemical Hazards: Classification and handling of hazardous chemicals, storage of chemicals, transfer from large containers

Gas Hazards: usage of LPG and CNG safer in the laboratory, detection, and handling of Gas Leakage, health hazards of gases. Uses of Helium, Nitrogen, and Carbon Dioxide gases in the laboratory. To learn the use of a carbon dioxide fire extinguisher.

Solution Preparation

Water as a solvent, types of water, solutions, components of a solution, types of solution, solubility, concentration of solutions: percentage, molarity, normality, molality (in ppm) calculation of masses and volumes for preparation of solutions solids, liquids.

Practical (Credit 2)
Title: Laboratory safety and solution preparation -Practical

1. Preparation of hydrogen sulphide (H_2S) gas using Kipp's apparatus.
3. Preparation of distilled and deionized water.
4. Purification of organic compounds by recrystallization (e.g. Benzoic acid etc)
5. Preparation of inorganic double salts.
6. Weighing of chemicals using analytical balance (e.g. preparing 1N solution, 1M solutions, etc).
7. Preparation of buffer solutions and determination of their pH Values (e.g. phosphate buffer, acetate buffer of varied pH, etc).

References:

- Vogel's Qualitative Inorganic Analysis, A. I. Vogel, Prentice Hall,.
- Vogel's textbook of chemical quantitative analysis, Longman Scientific
- Comprehensive Practical Organic Chemistry, V. K. Ahluwalia, & R. Aggarwal, Universities Press.
- Laboratory Manual of Organic Chemistry, R. K. Bansal, New Age Pub.
- Senior Practical Physical Chemistry, B. D. Khosla, R. Chand & Co.
- Chemistry Practical, O. P. Pandey, D.N. Bajpai, S. Giri, S. Chand.