

## Instrumental Methods in Geoscience

1.1. Course Number: GE 514

1.2. Contact Hours: 3-0-0

Credits: 9

1.3. Semester Offered: 5<sup>th</sup> Year-Odd

1.4. Prerequisite: Basic knowledge of geology and Physics and Chemistry

1.5. Syllabus Committee Members: Dr. Alok Kumar Singh & Dr. Hemant Kumar Singh

**2. Objective:** This course is designed to give the student an understanding in the operation and care of instruments, principles and theory of instrument analysis and the correct operation of instruments

**3. Course Content:** Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topics	Lectures
1	Introduction to analytical chemistry	Qualitative and quantitative analysis. Classification of methods. Types of instrumental analysis. various instrumental techniques and laboratory safety, Laboratory operation and practices. Units of measurements. Laboratory notes. Errors and evaluation. Determination of accuracy. Statistical evaluation of data.	10
2	Geochemical Instruments	Petrological microscopes: Principles, Parts, Operation and application of Petrological microscope, Ore microscope and Scanning electron microscope. Preparation of thin section. Preparation of rock powder for chemical analysis. Rock digestion through acid treatment, Rock digestion through fusion with alkali salts, Basic concept, and techniques of Atomic Absorption Spectrometer (AAS), Mass spectrometer Inductively Coupled Plasma - Atomic Emission Spectrometer (ICP-AES). X-Ray Diffraction (XRD). X-Ray Fluorescence (XRF) and Differential Thermal Analysis (DTA), Scanning Electron Microscope (SEM), Rock Eval Analysis.	12
3	Geochemical sampling techniques	Sampling methods and principles, Types of sampling, Sampling interval. Heavy mineral separation methods. Flame photometer and UV spectrometer: Basic principles, Parts and operation and mechanism.	8
4	Geophysical Instruments	Geophone, gravimeter, Ultrasonic tester (P- wave and S-wave), Resistivity, Gamma Ray spectroscopy	10
<b>Total</b>			<b>40</b>

#### **4. Readings:**

##### **4.1. Textbook:**

- Dana, E.S., (1955), Text book of Mineralogy, John Wiley., Deer,
- W.A., Howie, R.A. and Zussman, J., (1996), The Rock forming Minerals-Longman.,
- Flint, Y., (1970), Basic crystallography, Mid Publishers.,
- Francis Rouessac and Annick Rouessac., (2007), Chemical Analysis (Modern Instrumentation Methods and Techniques) John Wiley & sons, 574p.,

##### **4.2. Reference books:**

- Madhu Arora., (2008), Analytical chemistry-Himalaya Publishing House, Mumbai., Phillips.
- Wm, R. and Griffen, D.T., (1996), Optical Mineralogy-CBS Edition.,
- Putnis, Andrew, (1992), Introduction to Mineral Sciences-Cambridge University Press.,
- Spear, F.S. (1993), Mineralogical Phase Equilibria and Pressure-Temperature-Time Paths-Mineralogical Society of America Publ.

#### **5. Outcome of the course:**

On successful completion of this course, students will be able to:

- gain knowledge on the application, advanced instruments to be used for analysis of water, rocks and minerals.
- understand the principles of how to prepare a sample for different analysis.
- understand the effects of different constituent in a process outcome.
- decide the dominant frequency characterize the substance from spectrum analysis.