

Geoinformatics

- 1.1 Course Number: CS381
- 1.2 Contact Hours: 3-0-0 Credits: 9
- 1.3 Semester-offered: 3rd Year-Odd
- 1.4 Prerequisite: Introductory informatics; Programming;Data handling
- 1.5 Syllabus Committee Member: Dr. Sushum Biswas, Dr. Daya Sagar Gupta & Dr. Gargi Srivastava
2. **Objective:** Understanding the concepts of Geoinformatics Engineering and use them for oil and gas applications.
3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Conventional Surveying and Remote Sensing	Basic measurements, locating topographic details; Electronic distance measurement; Errors in distance measurement; Concept of direction, azimuth, meridian; Level surface; Leveling principles, determination of height, contouring; Earth surface, geoid, MSL, reference ellipsoid; Reference systems; Map projection, UTM projection. Remote sensing system; Physics of remote sensing, EMR characteristics and interaction in atmosphere and with ground objects; Sensor type's characteristics: types of resolution, FOV, IFOV, data products. Practical demonstration with instrument and software –MATLAB, Python, Image Processing and GIS software	10
2	Digital Image Processing; Machine Learning Algorithms for Image Classification and use in Oil and Gas Explorations	Image processing, interpretation elements; Classification: -Supervised and Unsupervised Learning: Decision Tree, Support Vector Machine, Linear Regression Model, KNN, K Mean, Nearest Neighbor, Box Classifier, GML, ANN etc; Geometric and radiometric distortions, Geo-referencing, resampling methods; Atmospheric errors and removal; Satellite orbits and characteristics; Use of technology for O & G exploration. Practical demonstration with instrument and software –MATLAB, Python, Image Processing software	16
3	GPS Technology and Use in Exploration	GPS:pseudo range and carrier phase measurements; Signal structure; GPS coordinate systems: WGS-84; GPS Errors; DOP; DGPS; Surveying with GPS; Practical	6

		demonstration with instrument and software –MATLAB, Python, Image Processing and GIS software	
4	GIS Technology and its Use in Oil Field Mapping, Pipeline Laying Out and in Reservoir Modeling	GIS: data- spatial and non-spatial, spatial data model: raster, tessellation, vector, ; Topology and topological models; metadata; Spatial data acquisition; Attribute data sources; Spatial and attribute data input; Data storage, GIS analysis functions: Retrieval, classification, measurement, neighborhood, topographic, interpolation, overlay, buffering, spatial join and query, connectivity, network functions, watershed analysis, watershed analysis etc., and their use in oil field application. Practical demonstration with instrument and software – MATLAB, Python and GIS software	10
		Total	42

4. Readings

4.1 Textbook:

Schofield, W., Engineering Surveying, Butterworth Heinemann, Oxford

Jensen, J., R., Introductory digital image processing: a remote sensing perspective, Prentice-Hall Inc.

Rhind, D., W., Maguire, D., J., Goodchild, F., M., Logley, S., P, Geographic Information System and Science, Wiley and sons

Hofmann-Wellenhof, B., Lichtenegger, H., and Collins, J., GPS Theory and practice, Springer

4.2 Reference books:

Arora, K., R., Surveying, Standard Book House, Delhi

Jensen, J., R., Remote sensing of the environment: An earth resource perspective, Pearson Education

- 5 Outcome of the Course:** The students will be able to learn the nuances of Geoinformatics Engineering. They will also learn how to use this computer based technique to solve O & G problem, in terms of exploration, mapping, pipeline layingout and reservoir modeling.