**HARD CORE COURSE: GYH-503: Fundamentals of Cartography, GIS & GNSS**

**Course Learning Outcomes:**

CO1: Understand the history and development of spatial technology.
CO2: Locate the significance of GIS in contemporary world.
CO3: Explore and generate GIS data from open source.
CO4: Analyze methodological aspects of GIS
CO5: Apply GNSS in different real-world situations

| Unit | Course Content | Teaching Hours |
|---|---|---|
| 1 | **Basic spatial perspective and GIS concepts:** GIS definitions, concept of spaces, approaches and components, history and development of GIS. Spatial & Non-spatial Data: Data information, data type, data sources, characteristics of spatial and non-spatial data, raster and vector data models, geographical matrix, data stream | 13 |
| 2 | **Data Collection & Management:** Data capture & geo-processing sources, input methodsfor spatial & non-spatial data, Editing: re-projection, geometrictransformation, geo- referencing. Map scale precision & accuracy. Database management system: Characteristics, components, data quality: Definition, components of geographic data quality. Accuracy, precision,error and uncertainty. Data assessment and evaluation. Linking spatial & non-spatial data. Database types: Hierarchical, network, relational and object oriented. | 13 |
| 3 | **Manipulation and Analysis of Data:** Measurement of lengths, perimeter and areas, queries, buffer analysis, topology, neighborhood operations, network operations, overlay analysis, location-allocation analysis problems, and surface analysis. Interpolation and its methods. | 13 |
| 4 | **Global Navigation Satellite System:** Concept, GNSS reference systems, components space segment, control segment, user segment. GNSS signal propagation and quality, GPS observations: Pseudo ranges, differential GPS, relative positioning, errors in GNSS observations, GPS surveying techniques -Static, rapid static, Pseudo kinematic, kinematic, real time kinematic (RTK). | 13 |

**Essential Readings:**


1. Abdul-Rahman, Alias, Pilouk, and Morakot (2008): Spatial Data Modelling for 3D GIS, Chang, K, Introduction to Geographic Information Systems. (5th Ed.), McGraw Hill.
2. Hanan Samet (2006): Foundations of Multidimensional and Metric Data Structures, Morgan Kaufmann Publishers.
3. Okabe, A., Boots, B., Sugihara, K. and Chiu, S. N (2000): Spatial Tessellations – Concepts and Applications of Voronoi Diagrams (2ndEd.), John Wiley and Sons.
4. Paul A. Longley, Michael F. Goodchild, David J. Maguire, David W. Rhind, Geographic Information Systems and Science, John Wiley & Sons Ltd.
5. Peter A. Burrough, Rachael A. Mcdonnell and Christopher D. Lloyd (2014): Principles of Geographical Information Systems, International Third Edition, Oxford University Press, United Kingdom,
6. Raper, J (2000): Multi-Dimensional Geographic Information Science, Taylor and Francis. Springer.
7.