**Course Name: Geomatics**

**Number of credits: 4 ECTS**

**Period: Spring semester**

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| Coordinator | **Dr Akhlaq Amin Wani** |
| Credits | 4 (2+1) ECTS |
| Lecturers | **Dr. Akhlaq Amin Wani, Dr. Aasif Ali Gatoo, Dr. Shah Murtaza Mushtaq** |
| Level | Bachelors |
| Host institution | Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir (SKUAST-K) |
| Course duration | 18 Weeks |

**Summary**

This is a 4 ECTS course which is provided as compulsory course to B.Sc. (Hons) Forestry students during their 4 year degree program. The course prepares students for careers as leaders in understanding Remote Sensing (RS) and Geographical Information System (GIS) and Applications of RS and GIS in monitoring and managing forest resources.

**Target student audiences**

Bachelor of Science Forestry (Hons.) students during their 4 year degree program.

**Prerequisites**

Prior knowledge of handling computers and basic knowledge in Forestry

**Aims and objectives**

The main course objective is to make students understand the basics of remote sensing and Geographical Information System and Global Positioning System (GPS). It is further aimed at developing among students the skills to use remote sensing and GIS based software.

**General learning outcomes:**

On completion of this course, the students would:

* Gain a wider understanding of basic principles of remote sensing and GIS
* It will enable the students to explore and handle different satellite datasets for specific applications in forests and vegetation landscapes.
* The students will enhance abilities and skills for mapping and monitoring of changes associated with forest and urban green spaces for effective policy making and management.

**Overview of sessions and teaching methods**

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| **Unit** | **Syllabus** |
| **Unit 1:** | Remote sensing - classification based on source: Active and passive remote sensing; Aerial and space remote sensing; Interaction of electromagnetic radiation with atmosphere and earth surface; Aerial photographs – types; Photo interpretation - Satellite remote sensing - platforms and sensors; Satellite systems. Indian Remote Sensing Programme. Visual and digital image processing. |
| **Unit 2:** | Application of satellite based remote sensing techniques in forestry - vegetation mapping using satellite imagery-NDVI; Forest cover monitoring and damage assessment; Microwave remote sensing. |
| **Unit 3:** | Introduction to GIS. Differences between GIS and conventional cartography. Spatial and non-spatial data- Integration of attribute data with spatial data. Spatial data - Raster and Vector data-Thematic over lays in GIS- topology building and calculation of area and length etc. |
| **Unit 4:** | Application of GIS in forestry – using imageries and integration with GIS data. Maps-its projection-Toposheet and Map reading. |
| **Unit 5:** | Global Positioning System (GPS), applications in resource inventory, Global Navigation Satellite System, Galileo, GLONASS, QZSS, Compass, IRNSS etc., GAGAN |
| **Practical** | Preparation maps; Visual interpretation of satellite imagery; Forest cover mapping and land use mapping. Digital image processing. Introduction to various GIS software – Q-GIS, ERDAS, Arc GIS etc. Hand on exercises on Vegetation Indices, Vegetation Index (VI), Normalized Differential Vegetation Index (NDVI), Soil Adjusted Vegetation Index (SAVI) etc. Exercises in viewing, editing, overlay. Visit to the GIS labs at State level. GPS handling. |
| **Individual Assignment** | Individual exercise on Image interpretation:   * Satellite data handling (multiple data sets) * Visual interpretation and development of interpretation key for LULC classification. |
| **Group Assignment** | Group exercise on map generation:   * Generation of LULC map for specific region and interpretation.   Generation of Forest density map for natural and urban forest areas |
| **Self Study** | Understanding the basic and modelling of geoinformatics on provided teaching materials and related literature.  Preparation/processing of geographical data to be used in class activities |

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| **Learning methods** | * In class lecture * Online tutorials * Lab/Field exercises * Project-Based Learning * Assignments * Presentations |

**Course outline**

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|  | **UNIT 1** |
| **Week1** | Remote sensing - classification based on source: Active and passive remote sensing |
|  | Aerial and space remote sensing; Interaction of electromagnetic radiation with atmosphere and earth surface |
| **Week2** | Aerial photographs – types; Photo interpretation |
|  | **Practical:** Preparation maps; Visual interpretation of satellite imagery; Forest cover mapping and land use mapping. |
| **Week3** | Satellite remote sensing - platforms and sensors |
|  | Satellite systems. Indian Remote Sensing Programme |
| **Week4** | Visual and digital image processing; |
| **Week5** | **Practical:** Digital image processing. Introduction to various GIS software – Q-GIS, ERDAS, Arc GIS etc. |
|  | **Mid Term Exam** |
|  | **UNIT 2** |
| **Week6** | Application of satellite based remote sensing techniques in forestry |
|  | vegetation mapping using satellite imagery-NDVI |
| **Week7** | Practical: Hand on exercises on Vegetation Indices, Vegetation Index (VI), Normalized Differential Vegetation Index (NDVI), Soil Adjusted Vegetation Index (SAVI) etc |
| **Week8** | Forest cover monitoring and damage assessment |
|  | Microwave remote sensing |
|  | **UNIT 3** |
| **Week9** | Introduction to GIS. |
|  | Differences between GIS and conventional cartography |
| **Week10** | Spatial and non-spatial data- Integration of attribute data with spatial data |
|  | Spatial data - Raster and Vector data-Thematic over lays in GIS |
| **Week11** | Topology building and calculation of area and length etc |
| **Week12** | **Practical:** Exercises in viewing, editing, overlay. |
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|  | **UNIT 4** |
| **Week13** | Application of GIS in forestry – using imageries and integration with GIS data |
|  | Maps-its projection |
| **Week14** | Toposheet and Map reading. |
|  | Visit to the GIS labs at State level. |
| **Week15** | **UNIT 5** |
|  | Global Positioning System (GPS) |
| **Week16** | Applications in resource inventory |
|  | Global Navigation Satellite System |
| **Week17** | Galileo, GLONASS, QZSS, Compass, IRNSS etc., GAGAN |
|  | **Practical:** GPS handling |
| **Week18** | **Practical Exam/Assignment submission/Presentation** |
|  | **End Tem Exam** |

**Literature**

**Compulsory**

Joseph, G. (2005). Fundamentals of Remote Sensing-Second edition. Universities Press.

Lillesand, T.M. and Kiefer, W.R.(1994).Remote sensing and Image Interpretation, Fourth edition. John Wiley & Sons, Inc., USA.

Environment System Research Institute, (1999). GIS for Everyone. Redlands, CA:ESRI.

**Recommended**

Campbell, J.B. (2002). Introduction to Remote Sensing-Third edition. Taylor and Francis, London.

Jackson, M.J. (1992). Integrated Geographical Information Systems. International Journal of Remote Sensing, 13(6-7): 1343-1351.

Obi Reddy, G.P. and Sarkar, D. (2012). RS and GIS in Digital Terrain Analysis and Soil Landscape.

**Course workload**

The table below summarizes course workload distribution:

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| --- | --- | --- | --- |
| **Activities** | **Learning outcomes** | **Assessment** | **Estimated workload (hours)** |
| **In-class activities (32 hours)** | | | |
| Lectures | Understanding theories, concepts, methodology and tools in Geomatics. | Class participation | 16 |
| Moderated in-class discussions | Understanding various policy and management contexts and common problems in communication in Geomatics. | Class participation and preparedness for discussions | 05 |
| Reading and discussion of assigned papers for seminars and preparation for lectures | Familiarity with and ability to critically and creatively discuss key concepts, tools and methods as presented in the literature | Class participation, creative and active contribution to the discussion | 05 |
| Group presentation | Ability to interpret data, to analyze the audience, and use the concepts, tools to understand Geomatics. | Quality of group assignments and individual presentations | 06 |
| **Practical (Lab and Field) (64 hours)** | | | |
| Practical | Ability to perform lab experiments and use field based equipment after demonstration of tools and procedures by the instructor. | Class/Field participation for data generation and preparedness for field project works | 64 |
| **Independent work (60 hours)** | | | |
| Self-Study | Familiarity with and ability to critically and creatively discuss key concepts, tools and methods as presented in the literature |  | 35 |
| Individual Assignment/Presentation | Ability to individually interpret data, analyze the audience, and use the concepts, and tools, to understand Geomatics. |  | 10 |
| Group Assignment/Presentation | Ability to interpret data, analyze the audience, and use the concepts, and tools, to understand Forest Geomatics. | Quality of group assignments and individual presentations | 15 |
| ***Total*** |  |  | ***156 Hours*** |

**Grading**

The students’ performance will be based on the following:

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| --- | --- |
| **Mode of assessment** | **% of marks** |
| Mid Term (Objective and Written) | 30 |
| Practical/Assignments (Discussion) | 20 |
| End Term (Objective and Written) | 50 |
| **Total** | **100** |

**Evaluation**

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| **% secured** | **Grade** |
| <50% | Fail |
| 50% and above | Pass |