

COURSE GUIDEBOOK

Department	Biology	
Module Title	Biological research design and data analysis	
Module Code	Biol-M3112	
Module number	11	
Course Title	Principles and Applications of GIS and Remote Sensing in Biology	
Course code	Biol3112	
Credit hours	2	
Course EtCTS	3	
Mode of delivery	Block I	
Target group	3 rd year, biology student	
Semester	I	
Course status	Elective	
Lecture Room		
course Prerequisite	None	Dr. K. S. Goudar
Instructors contact information	Office No	02
	Consultation hours	Thursday and Friday
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2. Course description

Definition of GIS; functions and benefits of GIS; components of GIS; data entry from different sources (aerial photos, survey results, etc), processing and analysis using GIS; concepts and definitions of GPS; data collection using GPS; remote sensing and the characteristics of satellite imagery; selection of images for particular purposes; GIS and remote sensing applications for biological studies; concepts of land use and land cover mapping.

3. Course objectives

By the end of the course, students should be able to:

- ✓ explain the principles, applications and trends of GIS and remote sensing.

- ✓ analyze data on vegetation and animal resources, watersheds, populations, cultural resources, terrains, natural hazards and land cover changes.
- ✓ apply vector and raster spatial data, particularly with regard to local issues.
- ✓ demonstrate the application of remote sensing.

4. Student workload

Students' activity	Hour
Lecture	16
Practical lab work	48
Independent reading	17
Total	81

5. **Teaching learning methods/Strategies:** Lecture, practical lab work, report, presentation, individual or group project, independent reading, assignments.

6. Tentative Course Schedule

WEEKS	TOPIC	References
Week 1	1. Introduction(1 hr) 2. Geographic information system (4 hrs) 2.1 GIS versus information management systems 2.2 Components of GIS 2.3 Definition of GIS data 2.4 Geographic data types 2.5 Data structure 2.6 Spatial data bases 2.7 Data source and input 2.8 GIS analysis 2.9 GIS – applications and its importance Assignment =5%	

Week 2	3. Coordinate systems and GPS (3 hrs) 3.1 Introduction 3.2 Geographic Coordinate Systems (DCS) 3.3 Map projections 3.4 Global positioning (GPS) Test I= 10%	
Week 3	4. Principles of remote sensing (5 hrs) 4.1 Introduction 4.2 Nature of electromagnetic radiation (EMR) 4.3 Energy interaction with the atmosphere 4.4 Energy interaction with the earth surface features 4.5 Spectral reflectance curve 4.6 Spectral response patterns 4.7 Data acquisition	
Week 4	5. Aerial photography (3 hrs) 5.1 Introduction 5.2 Photographic films and filters 5.3 The photographic process 5.4 Basic geometric characteristics of aerial photographs 5.5 Scale of aerial photographs 5.6 Distortion in air-photos Test II=10% Project work =15%	
Week 5	6. Visual interpretation (2 hrs) 6.1 Elements of air/space photo interpretation 6.2 Photo interpretation equipment 6.3 Photogrammetry (height interpretation) Field work report and presentation = 10%	

Week 6	7. Satellite remote sensing (5 hrs) 7.1 Background 7.2 Orbits of satellites 7.3 Types of scanning systems 7.4 Resolution of images 7.5 Polar orbit satellites	
Week 7	8. Digital image processing (5 hrs) 8.1 Transmission and storage of data 8.2 Common imagery file format	
Week 8	● Final practical exam=20% ● Final written exam= 30%	

9. Mode of Assessment criteria:

Tests	20 %
Assignments.....	5%
Project work and Presentation.....	15%
Field work and report presentation	10%
Final practical exam	20%
Final written exam.....	30%
Total	100%

10. Course policies:

Students are expected to actively participate in scientific learning process by doing the following course policies:

- Coming class on time
- Attend all class meetings and be cooperative with others
- Be prepared to learn and actively participate in field works and class discussion regarding the topic that is being covered.
- Do all assignments, group works, and presentations on time
- All students are expected to complete their own work to the best of their ability and cheating is strictly forbidden.
- Do not miss quizzes, assignments, exams and field trip unless you are forced due to health problems etc.
- If you miss one of the exams due to illness, and have a valid medical note, take responsibility to ask and complete any make up work in the event of an absence.
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11. Reference materials:

1. Bolstad, P. (2005). *GIS Fundamentals: First Text on Geographic Information System*. (2nd ed.) Eider Press.
2. Canada Centre for Remote Sensing (1998). *Fundamentals of Remote Sensing*. Natural Recourses. [Http://www.ccrs.nrcan.gc.ca/](http://www.ccrs.nrcan.gc.ca/)
3. Chang (2006). *Introduction to GIS. First Text on Geographic Information System*. (2nd ed.) Eider press, USA.
4. Dagnachew Legesse (2005). *Introduction to Remote Sensing and GIS*. A monograph, Department of Earth Sciences, Addis Ababa University, Addis Ababa.
5. Lillesand and Kiefer. (2000). *Remote Sensing and Image Interpretation*. (4th ed.) John Wiley and Sons.
6. Lillesand, T.M., (2004). *Remote Sensing and Image Interpretation*. John Wiley and Sons, Inc.
7. Longley, P. A., M. F. Goodchijid, D. J. Maguire, and D. W. Rhind (2005). *Geographic Information Systems and Science*. John Wiley and Sons, New York.
8. Lucas L. F., Janssen and Gerrit C. Humeman (2002): *Principles of Remote Sensing*. (2nd ed.) ITC Educational Textbooks Series.
9. Sabins, F. F. (1997). *Remote Sensing: Principles and Interpretation*. W.H. Freeman and Company, New York.
10. Thomas M. Lillesand, and Ralph W. Kiefer, (2000), *Remote Sensing and Image Interpretation*, (4th ed.) John Wiley and Sons, Inc. New York.

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Checked by Approved by

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