Syllabus for Remote Sensing And Geographic Information System (MSc Course)

Prerequisite Courses: None	**Unit Type**: theoretical	**Number of Units:** 2	**Course Title:** Research Methodology For Remote Sensing And Geographic Information System
Complementary education: yes Lab, excursion, Seminar : No Workshop: yes		**Number of hours**:32	**Specialist lecturer to teach**: Expert of Remote Sensing And Geospatial Information System

Objectives:

Familiarity with methods of research and steps

Syllabus:

1. Definitions, phenomena, research principles and know-how
2. Research subject fields in RS/GIS
3. Subjective research approaches
4. Documenting research procedures
5. Data gathering methods
6. Data analysis methods
7. Research start-up
8. Implementing a sample evaluating plan
9. Current state of researches in GIS/RS

references

- Hafeznia Mohammad Reza, 1377, An Introduction to research method in humanity science, Samat publication
- Liaghat Gholam Hosein, 1377, Research method in engineering science, Iran industrial and scientific investigation organization

Syllabus for Remote Sensing And Geographic Information System (MSc Course)

Prerequisite Courses: None	**Unit Type**: theoretical	**Number of Units:** 2	**Course Title:** Principle and Physics of Remote Sensing
Complementary education: No Lab, excursion, Seminar, Workshop : No		**Number of hours**:32	**Specialist lecturer to teach**: Remote Sensing Expert

Objectives:

Familiarity with fundamentals of remote sensing including physics of remote sensing, types of platforms and sensors

Syllabus:

1. Introduction (definition, history and application of RS)
2. Remote sensing physics (Electromagnetic spectrum, electromagnetic radiation laws, spectral reflectance curve, digital imagery, satellite imagery(optical, thermal and radar), spatial, spectral, radiometric and temporal resolution)
3. Optical remote sensing systems (cameras and aerial photography, multi spectral scanning systems, thermal distortions in optical imaging system, geometric imagery)
4. Microwave imaging (Active and passive radar remote sensing, radar history, radar basics, viewing geometry and spatial resolution, radar image distortions, target interaction and image appearance)
5. Satellite sensors (optical satellite sensors, radar satellite sensors, other satellite sensors)
6. Image analysis (Visual interpretation, digital processing)

references

- Mobasheri Mohammad Reza, 1386, Fundamentals of remote sensing physics and satellite technology , Khaje Nasir Toosi publication
- Corran Poul, 1985 , principle of remote sensing
- Jensen John R, 2000 , Remote Sensing of the Environment
- Stewart Robert H, 1985, Methods of Satellite Oceanography

Syllabus for Remote Sensing And Geographic Information System (MSc Course)

Prerequisite Courses: Principle and Physics of Remote Sensing	**Unit Type**: theoretical and practical	**Number of Units:** 2	**Course Title:** Advanced digital image processing
Complementary education: Yes Lab : Yes excursion, Seminar, Workshop : No		**Number of hours**: 48	**Specialist lecturer to teach**: Remote Sensing Expert

Objectives:

Familiarity with digital images processing including atmospheric, geometric and radiometric corrections

Syllabus:

1. The basic components of remote sensing systems
2. Atmospheric correction, determination of sensor fault and other sources of radiometric error
3. Geometric error correction using ground control points, mathematical modeling and orbital parameters of the sensor
4. Geometric correction methods
5. Types of filters for processing images
6. Fourier analysis and its applications, and image filtering based on Fourier analysis
7. Principles of pattern recognition, satellite images interpretation and classification techniques, advantages and limitations of visual interpretation and digital classification, thematic mapping techniques using visual interpretation of data
8. Extracting information from satellite images (numerical methods in the classification of satellite data, supervised methods, unsupervised methods, the hybrid method classification, the concept of classes and spectral information)
9. Clustering algorithms used in image processing
10. Supervised classification algorithms
11. Modify the classification
12. Assessing classification accuracy, and methods of sampling

references

- Mizer Pol M, 1377, Computerized processing of remote sensing images, Samt publication
- Couran pol, 1373, Principles of Remote Sensing, Iran Remote Sensing Center Publication
- Alavipanah Seyed Kazem, 1382 , Application Of Remote Sensing in Earth Science, Tehran University Publication
- Bordick Haward, 1378, Digital Illustration, National Cartographic Center Publication
- Zeybary Mahmoud And Majd Alireza, 1380, Familiarity With Remote Sensing Technique And Application In Natural Resources, Tehran University Publication
- Jenson John R, 1986, Englewood Clffe, Introductory Digital Image Processing, N.J. Prentice-Hall Publisher

Syllabus for Remote Sensing And Geographic Information System (MSc Course)

Prerequisite Courses: None	**Unit Type**: theoretical and practical	**Number of Units:** 2	**Course Title:** Advanced Geographic Information System
Complementary education: Yes Lab : Yes excursion, Seminar, Workshop : No		**Number of hours**: 48	**Specialist lecturer to teach**: Geographic Information System Expert

Objectives:

Familiarity with kinds of spatial analysis in geographic information system and work with them

Syllabus:

1. An introduction to GIS and application of GIS
2. Data transformation (Vector-Raster and converting point, line and polygon layers in vector model)
3. Fundamental function in GIS include data operations, connectivity, overlay operations, scaler operation, reclassification and neighborhood operations
4. Advanced function in GIS include statistical modeling, multivariate analysis, correlation technique, time series analysis, Geostatistical analysis
5. Spatial exploratory data analysis

references

- Korilus Sara And Karor Steave, 1381, An Introduction to Geographic Information Systems, National Cartographic Center Publication
- Aronove Stane, 1375, Geographic Information Systems, National Cartographic Center Publication
- Melczewski Jacck, 2000, GIS And Multicriteria , John Wiley & Sons Publisher.
- Osullivan David and Unwin David, 2002, Geographic Information Analysis, John Wiley & Sons Publisher
- Fortheringham Stewrt, 1994, Spatial Analysis And GIS, Taylor & Francis Publisher

Syllabus for Remote Sensing And Geographic Information System (MSc Course)

Prerequisite Courses: Principle and Physics of Remote Sensing	**Unit Type**: theoretical and practical	**Number of Units:** 2	**Course Title:** Thermal Remote Sensing
Complementary education: Yes Lab : Yes excursion, Seminar, Workshop : No		**Number of hours**: 48	**Specialist lecturer to teach**: Remote Sensing Expert

Objectives:

Familiarity with Concepts Of Thermal Remote Sensing, Processing and Application of Thermal Images

Syllabus:

1. The importance and the history of thermal remote sensing
2. Process and characteristics of temperature
3. Thermal properties, energy balance, and radiative behavior of materials
4. Thermal infrared sensors
5. Reconstruction and interpretation of thermal infrared images
6. Applications of thermal remote sensing

references

- Alavi panah Seyed Kazem, 1385, Thermal Remote Sensing and Application in Earth Science, Tehran University Publication
- Dale A. Quattrochi, Jeffrey C. Luvall, 2005, Thermal Remote Sensing In Land Surface Processes

Syllabus for Remote Sensing And Geographic Information System (MSc Course)

Prerequisite Courses: Principle and Physics of Remote Sensing	**Unit Type**: theoretical and practical	**Number of Units:** 2	**Course Title:** Microwave and radar images
Complementary education: Yes Lab : Yes excursion, Seminar, Workshop : No		**Number of hours**: 48	**Specialist lecturer to teach**: Remote Sensing Expert

Objectives:

Learning How to Process and Functions of Radar Images

Syllabus:

1. Physics principles and characteristics of microwave remote sensing
2. Principles and types of active and passive radar
3. Principle of sending and receiving microwaves
4. Geometry and spatial resolution of radar imaging
5. Platform and radar sensors (RAR, SAR, AMI, SLAR, SIR)
6. Radar polarization and its applications
7. Radar image characteristic
8. Noise in radar images, and noise reduction method
9. Geometric correction of radar images
10. Synthetic Aperture Radar Systems
11. Types of Radar Images and Its applications
12. Principles of radar image processing and related software
13. Radar altimetry, three-dimensional data production (DEM)
14. Interferometry techniques and measuring changes in the earth's crust
15. Important applications of radar images (agriculture, soil, weather, etc.)
16. Lab Exercises: Processing radar images according to the above steps

references

- Pole Koran, 1373, Principle of Remote Sensing, Iran Remote Sensing Center Publication
- Steinberg, Bernard D., Microwave Imaging Techniques, 1991, New York, J, Wiley
- Introduction to Microwave Remote sensing, 2006, Taylor & Francis Group, Lain H. Woodhouse

Syllabus for Remote Sensing And Geographic Information System (MSc Course)

Prerequisite Courses: Advanced Geographic Information System	**Unit Type**: theoretical and practical	**Number of Units:** 2	**Course Title:** Database Management
Complementary education: Yes Lab : Yes excursion, Seminar, Workshop : No		**Number of hours**: 48	**Specialist lecturer to teach**: Geographic Information System Expert

Objectives:

Familiarity With Basic Concepts Of Databases And How to Create, Update and Output From Them

Syllabus:

1. Information and database technology (definition, history, application, database models)
2. The relational model (concept, relation database design process and relation database laws)
3. JSP queries (examples and power of jsp queries, parametric and inner nested queries, queries using set operators)
4. World modeling and spatial databases(raster, vector, geodatabase)
5. Database design(need analysis, conceptual, logic and physical design, spatial data management in GIS)
6. Database software(inserting, updating, management, programming)
7. Practical exercise (database design using by a database software)

references

- Miranda Li Pao, 1380, Storing And Retrieval Of Information, Ferdosi Mashhad University Publication
- Jenifer Rolie, 1380, Principle of Geographic Information System, Samt Publication
- Hagon Rex, 1990, A Practical Guide To Database Design, Prentice Hall,.
- Grauer Robert, 1992, Database Management Using dbase IV and SQL, Mc Graw-Hill
- Jones J.A., 1997, Database In Theory and Practice,,ITP Publisher

Syllabus for Remote Sensing And Geographic Information System (MSc Course)

Prerequisite Courses: Advanced Geographic Information System	**Unit Type**: theoretical and practical	**Number of Units:** 2	**Course Title:** Digital Terrain Modeling
Complementary education: Yes Lab : Yes excursion, Seminar, Workshop : No		**Number of hours**: 48	**Specialist lecturer to teach**: Geographic Information System Expert

Objectives:

Familiarity with how to collecting, creating digital height models and their application.

Syllabus:

1. Introduction (definition, concepts and elements of DTM)
2. Surface representation (Models in DTM generation, DTM generation using by surveying, photogrammetry, remote sensing data and digitized contours)
3. Interpolation methods (Trend surface analysis, spline, local interpolation methods(TIN based and Grid based)), kriging(ordinary, universal, indicator and co kriging))
4. DTM analysis , visualization and procedure (slope, aspect, contour, hillshade, viewshade, shaded relief DTM images, perspective view, drainage line)
5. DTM application (discussion about DTM application in ortho photo generation, resource management, transportation, civil, hydrology and volume calculation)
6. Practical exercise (DTM generation, visualization and analysis in a GIS software environment)

references

- Baro, Geographic Information System, Samt Publication,1387
- Li Zhilyn , 1386, Digital Terrain Modeling (Principles and Methods).
- Unwin David J., 1994, Visualization in Geographic Information System, John Wiley Publisher.

Syllabus for Remote Sensing And Geographic Information System (MSc Course)

Prerequisite Courses: None	**Unit Type**: theoretical	**Number of Units:** 2	**Course Title:** Principle of environmental hazards management
Complementary education: Yes Excursion : Yes Lab, Seminar, Workshop : No		**Number of hours**: 32	**Specialist lecturer to teach**: Geographer

Objectives:

Learning how to identify natural hazards and principles of management

Syllabus:

1. Concepts and definitions (hazard, disaster,…)
2. Scope of assessment of natural hazards
3. Principle of natural hazards types and their categories
4. Literature review of natural hazard studies in Iran and world
5. Structure and Mechanism of earth hazards such as earthquake, tsunami, landslide and land subsidence
6. Structure and mechanism of climate and hydrological hazards such as flood, drought, storm and ocean hazards
7. Natural hazards identification techniques
8. Natural hazards zoning methods
9. natural hazards risk analysis models
10. natural hazard risk mitigation and management techniques
11. basis of hazards mitigation and their control methods
12. disaster concepts and disaster management strategy

references

- Natural Hazards, Keyt esmith, Samt,1382
- Natural Hazards Analysis, John Pine, Auerbach Publication, 2003,304p
- Global Warning, Natural Hazards, and Emergency Management, George Haddow, Jane A Bullock, Kim Haddow, CRC Press, 2008, 304p
- Flood Hazard Management, John W Handmer, Routledge, 1987,297p
- Geologic Hazards, Roy E Hunt, CRC Press, 2007, 323p
- Landslide Risk Management, Oldrich Hunger, Robin Fell, Rejean Couture, Erik Eberhardt, Taylor & Francis, 2005, 776

Syllabus for Remote Sensing And Geographic Information System (MSc Course)

Prerequisite Courses: Principle and Physics of Remote Sensing Advanced digital image processing	**Unit Type**: theoretical and practical	**Number of Units:** 2	**Course Title:** Basic of RS application in Environmental Hazardous Management
Complementary education: Yes Lab : Yes Excursion, Seminar, Workshop : No		**Number of hours**: 48	**Specialist lecturer to teach**: Remote Sensing Expert

Objectives:

Learning how to process and application of remote sensing images in natural hazards studies

Syllabus:

1. History and application of remote sensing images in Environmental hazardous detection studies.
2. Physical phenomena of environmental hazardous concern to RS data
3. Principle and physics of electromagnetic waves contain sufficient spectrum frequencies to detect environmental hazardous.
4. Methods and types of sufficient Platform and Sensors for Environmental hazardous studies.
5. Detection and surveillance Methods of environmental hazardous in Radar, thermal and visible images.
6. Analysis techniques of images and hazardous zones extraction.
7. Remote sensing tools lunched on the ground platforms for environmental hazardous surveillance.
8. Multispectral processing and hazardous zones data extraction.
9. Practical work: Processing of types of images based on above instructions.

references

- Pole Kouran, 1373, Principles of remote sensing, Iran Remote Sensing Center Publication
- Processing remote sensing data for Flood Hazard Assessment, Volker Berkhahn, Sebastian Rath, And Erik Pasche. ASCE, 2005
- Introduction to Environmental Remote Sensing, Eric Chartes Barrett, Leonard Frank Curtis, 199,457p
- Interdiction to Microwave Remote Sensing, 2006, Taylor & Francis Group, Lain H. Woodhouse

Syllabus for Remote Sensing And Geographic Information System (MSc Course)

Prerequisite Courses: Principle and Physics of Remote Sensing Advanced digital image processing	**Unit Type**: theoretical and practical	**Number of Units:** 2	**Course Title:** Application of Remote Sensing in Environmental Risk Management
Complementary education: Yes Lab : Yes Excursion, Seminar, Workshop : No		**Number of hours**: 48	**Specialist lecturer to teach**: Expert of Remote Sensing

Objectives:

Familiarity with application of remote sensing images in natural hazards management

Syllabus:

1. Photogrammetric techniques for identifying high-risk zone
2. Image analysis techniques and linear phenomena extraction
3. Techniques to determine the risks from environmental hazards through remote sensing images
4. GPS and monitoring risky area centers
5. Radar remote sensing and its application in the detection of unstable slopes (landside & rock falling)
6. Radar remote sensing and its application in the detection of subsidence
7. Thermal remote sensing and its application in seismic studies
8. Field study techniques and remote sensing data control
9. Lab Exercises: Processing samples of Images according to the above steps

references

- Pole Kouran, 1373, Principles of remote sensing, Iran Remote Sensing Center Publication
- Advances in Environmental Remote Sensing F.Mark Danso, Stephen E. Plummer John Willey & Sons, 1996
- Mapping hazardous Terrain using remote sensing, R M Teeuw, GSL Special Publications, 2007, 184p
- Interdiction to Microwave Remote Sensing, 2006, Taylor & Francis Group, Lain H. Woodhouse
- Radar Interferometry, Ramon F.Hanssen, Kluwer academic publications, 2001,308p

Syllabus for Remote Sensing And Geographic Information System (MSc Course)

Prerequisite Courses: Advanced Geographic Information System Databases management Digital Terrain Models	**Unit Type**: theoretical and practical	**Number of Units:** 2	**Course Title:** Application Of GIS In Natural Hazards Management
Complementary education: Yes Lab : Yes Excursion, Seminar, Workshop : No		**Number of hours**: 48	**Specialist lecturer to teach**: Geographic Information System Expert

Objectives:

Familiarity with application of remote sensing and Geographic information system in natural hazards studies

Syllabus:

1. Introducing Types of Natural Disasters Such as earthquakes, Landslide, Liquefaction, Subsidence, rock fall
2. Identify effective factors in creation of natural disasters
3. Method for data preparation related to the natural disaster in GIS environment
4. The use of methods and multi-criteria decision algorithms on zoning of hazard and disasters
5. Investigation of information and conceptual errors in zoning of natural hazards

references

- Nayak S. Zlatanova S, 2008, Remote Sensing and Gis Technolgiest for monitoring and prediction of disaster Springer Press
- Uzair M. Shamsi, 2002, GIS Tools for Water, Wastewater, and Stormwater systems, ESRI Press
- Wang Fahui, 2006, Quantitative Methods and Application in GIS, CRC Press

Syllabus for Remote Sensing And Geographic Information System (MSc Course)

Prerequisite Courses: Advanced Geographic Information System Databases management Digital Terrain Models	**Unit Type**: theoretical and practical	**Number of Units:** 2	**Course Title:** Environmental Hazards management modeling in GIS
Complementary education: Yes Lab : Yes Excursion, Seminar, Workshop : No		**Number of hours**: 48	**Specialist lecturer to teach**: Geographic Information System Expert

Objectives:

Familiarity with natural hazards studies modeling with geographic information system

Syllabus:

1. Introduction to Environmental Hazards management modeling method in GIS
2. Using dynamic methods in hazard Identification
3. Design of Natural Disaster Warning Systems
4. Optimal management of natural disasters for loss reducing using Mobile GIS and Location based services

references

- Nayak S. Zlatanova S, 2008, Remote Sensing and Gis Technolgiest for monitoring and prediction of disaster Springer Press
- Uzair M. Shamsi, 2002, GIS Tools for Water, Wastewater, and Stormwater systems, ESRI Press
- Wang Fahui, 2006, Quantitative Methods and Application in GIS, CRC Press