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:** General Meteorology
Complementary education: Yes Excursion : Yes Lab, Seminar, Workshop : No		**Number of hours**: 32	**Specialist lecturer to teach**: Climatologist

Objectives:

Familiarity with Meteorology

Syllabus:

1. Change of Seasons
2. Effect of The Sun on Atmospheric changes
3. Atmospheric Thermodynamics
4. Adiabatic Rules
5. Heat Transfer in the Atmosphere
6. The structure of The Atmosphere
7. Steam and Effects on The Energy transfer
8. Atmospheric systems
9. Cloud physics
10. Common Atmospheric Phenomena
11. Cloud Types

references

- General Aerology, Robert Mizer
- Principles of Aerology, Dr. Bahlool Alijani and Dr. Kaviani, Samt Publication, 1374

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 application of remote sensing in Meteorology
Complementary education: Yes Lab : Yes Excursion, Seminar, Workshop : No		**Number of hours**: 48	**Specialist lecturer to teach**: Remote Sensing Expert

Objectives:

Familiarity with Kinds of satellite images and how to interpret

Syllabus:

1. History and application of remote sensing in Meteorology studies
2. Physical properties of atmospheric phenomena Associated to remote sensing
3. Principles and Physics of Electromagnetic spectrum Associated to appropriate spectral ranges for atmospheric phenomena
4. Principles and Types of appropriate platforms and sensors for atmospheric phenomena studies
5. Images analyzing techniques and extracting atmospheric phenomena
6. Multi spectral Image processing and extracting Atmospheric phenomena Information

references

- Image in Weather forecasting, Cambridge University Press, 1995
- Mobasheri Mohamad reza, 2002, Satellite Meteorology and now casting, WMO, RMTC
- Satellite Remote Sensing In Climatology, Calecton Andrew M., London, Belhaveb Press, 1991

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 Meteorology
Complementary education: Yes Lab : Yes Excursion, Seminar, Workshop : No		**Number of hours**: 48	**Specialist lecturer to teach**: Remote Sensing Expert

Objectives:
Familiarity with Kinds of satellite images and how to interpret

Syllabus:

1. The interaction of the electromagnetic spectrum with Atmospheric Phenomena
2. Determining Cloud texture using Satellite Images
3. Determining different kind of fronts using Satellite Images
4. Estimation of cloud temperature
5. Cloud height
6. Atmospheric Phenomena Forecasting
7. Extracting Meteorology Parameters using Satellite Images
8. Appropriate Sensors for satellite Meteorology and Platforms
9. Appropriate Bands for extracting Information

references

- Image in Weather forecasting, Cambridge University Press, 1995
- Mobasheri Mohamad reza, 2002, Satellite Meteorology and now casting, WMO, RMTC
- Satellite Remote Sensing In Climatology, Calecton Andrew M., London, Belhaveb Press, 1991

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:** GIS application in Satellite Meteorology
Complementary education: Yes Lab : Yes Excursion, Seminar, Workshop : No		**Number of hours**: 48	**Specialist lecturer to teach**: Geographic Information System Expert

Objectives:

Familiarity with using remote sensing and geospatial information system in Aerology

Syllabus:

1. Metrological parameters forecasting using by GIS
2. Metrological patterns analysis with spatial parameters
3. Investigation about spatial and temporal dynamic of air masses
4. Air pollution management by GIS
5. Investigation about global warming and its pattern using by GIS
6. Assessment about climate pattern maps error
7. Preparation of spatial data infrastructure for development ofIntegrated database in metrology
8. Using of Web GIS and LBS in informing about metrology
9. Using of GIS in climate pattern determination foragricultural use.

references

- Farajzadeh Manouchehr, 1384, Climatology Techniques, Samt Publication
- Dobesch, Hartwing: Dumolard, Pierre: Dyras, Izabela, 2007, Spatial Interpolation for climate data: the use of GIS in climatology and meteorology, ISTE

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:** Satellite Meteorology 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 Aerology studies modeling with geographic information system

Syllabus:

1. Weather forecasting using by GIS
2. Weather Spatial changing modeling
3. Metrological crisis modeling
4. Snowmelt modeling based on metrological parameters
5. Micro climate modeling in precision agriculture
6. Climate-Associated disease modeling using by GIS

references

- Farajzadeh Manouchehr, 1384, Climatology Techniques, Samt Publication
- Dobesch, Hartwing: Dumolard, Pierre: Dyras, Izabela, 2007, Spatial Interpolation for climate data: the use of GIS in climatology and meteorology, ISTE