

Interdisciplinary Department of Remote Sensing and GIS Applications

M.Sc. (Remote Sensing & GIS Applications)

Semester-II

Contact hours: 56

Session: 2016-2017

Credits 4

Paper-6

Digital Image Processing

Unit – I

Introduction to Digital Image Processing (DIP); The Origin of Digital Image Processing; Digital Image Fundamentals – Steps Involved; Components of Image Processing System– Hardware and Software Considerations. Elements of Visual Perceptions, Digital Image Data Formats, Image Sensing and Acquisition.

Unit – II

Overview of Software Tools in Image Processing; Open Source Image Processing Software; Image Enhancement Techniques; Gray Level Transformations; Histogram Processing; Enhancement Using Arithmetic/Logic Operation; Density slicing; Geometric Corrections; Image Registration – Definition, Principle and Procedure; Radiometric Correction;

Unit – III

Basics of Spatial Filtering; Convolutions and Morphology (High Pass, Low Pass, Laplacian; Gaussian; Sobel; Roberts, Erode, Dilate); Adaptive Filtering (Lee, Frost, Gamma, Kuan); Image Sharpening; Principal Component Analysis; Minimum Noise Fraction (MNF) Transformation; Color Image Processing; RGB Color Model; Generation of FCC's; Image transformation – Intensity Hue Saturation (HIS).

Unit- IV

Pattern Recognition and Image Classification; Image Segmentation; Unsupervised Classification – advantage, disadvantage and limitations. Supervised Classification - training site selection, Classifiers used in supervised classification – Minimum distance to mean, Parallelepiped, maximum likelihood, Classification Accuracy Assessment; Band Ratios; NDVI : utility and applications.

Suggested Books:

1. R.C.Gonzalez and Richard E. Woods. : Digital Image Processing. Prentice-Hall, New Jersey
2. Image Interpretation in Geology. Allen and Unwin
3. Gibson, P.J. 2000: Digital Image Processing. Routledge Publication
4. Gupta, R.P., 1990: Remote Sensing Geology. Springer Verlag.
5. Joseph George, 2003: Fundamentals of remote sensing. Universities Press

6. Lillesand, T.M., and Kieffer, R.M., 1987: Remote Sensing and Image Interpretation
7. Nag P. and Kudrat M. 1998: Digital Remote Sensing. Concept Publications
8. Pratt.W.K. 2004: Digital Image processing. John Wiley
9. Sabins, F.F., 1985: Remote sensing Principles and interpretation. W.H.Freeman and company

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Paper-7

Thermal and Microwave Remote Sensing

Unit I

Basic concept of thermal infrared remote sensing- Kinetic heat, temperature, radiant energy and radiant flux. Thermal radiation laws- Stephen Boltzmann law, Wien's displacement law, emissivity, Kirchoff's radiation law. Thermal infrared atmospheric windows. Thermal properties of terrain.

Unit II

Active microwave system components. Slant range versus ground range RADAR image geometry. Relief displacement, image foreshortening, layover, shadows and speckle. Synthetic aperture radar system, surface roughness characteristics. Electrical characteristics and relationship with moisture content.

Unit III

SAR remote sensing- Seasat, Shuttle Imaging Radar series, RADARSAT, ERS-I, JERS-1, Almaz-1, RISAT, RADAR interferometry, topographic mapping, velocity mapping. Light detection and ranging (LIDAR) sensor system, accuracy, penetration capability and measurements.

Unit-IV

Thermal infrared images and applications in vegetation/forestry, water resources, forest fires, volcanic eruptions. Recent advances in thermal infrared remote sensing: advantages and limitations.

Suggested Books:

1. Remote sensing of the Environment by J R Jenson
2. Lillesand, T.M., and Kieffer, R.M., 1987: Remote Sensing and Image Interpretation, John Wiley and sons
3. Sabbins, F.F., 1985: Remote sensing Principles and interpretation. W.H.Freeman and company

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Paper 8

Earth Systems

Unit I

Concept of Earth System - Atmosphere, hydrosphere, lithosphere, biosphere and cryosphere. Basic components of earth as a planet - movement, gravity, seismicity, magnetic fields. Internal structure of the earth. Weathering and Erosion-types and features. Concept of plate tectonics and continental drifts.

Unit II

Earth's climate and its components. Global climatic changes-causes and effects. Earth's heat budget and global warming. Monsoon system in India. Factors affecting monsoon. jet stream.

Unit III

The Atmosphere – composition and structure of the atmosphere, Importance of atmosphere to human life, Green house gases. Oceans – surface configuration of ocean floor, Salinity and temperature. Circulation of oceanic currents. Flora and fauna of ocean.

Unit IV

Cycles in the earth system - hydrologic cycle, carbon cycle, biogeochemical cycle and rock cycle. Earth system science organization (ESSO): components, principle and operations. Early warning systems. Application of remote sensing in monitoring components of earth systems.

Books:

1. Kent Condie-Earth as an Evolving Planetary System-Academic Press (2004).
2. Lee R. Kump,James F. Kasting,Robert G. Crane-The Earth System-Pearson (2009).
3. Trewartha, G.T. , & Horn, L.A. , Introduction to climate, International Studies, 1990.
4. Hussain, Majid., Fundamentals of Physical Geography, Rawat Pub., Jaipur, 2001.

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Paper 9

Advanced Statistics for GIS and Spatial Data

Unit I

Regression Models: Review of vector and matrix algebra, Simple and Multiple linear regression, Residual analysis, Statistical inference in multiple regression.

Unit II

Multivariate Statistics: Multivariate random sample, Multivariate mean, standard deviation, and sample correlation coefficient with their geometric interpretation, the generalized variance, Distances in p-dimensional space, Multivariate normal distribution, Mahalanobis distance. Introduction to spatial variation.

Unit III

Multivariate inference and Principal Component Analysis: Inference about mean vector, testing the multivariate population mean, Finding Principal components, Interpretation of principal component loadings, scaling of variables, Fair-Share Stopping rules, Principal component score, Imaging related sampling schemes.

Unit IV

Discrimination and classification: Supervised Learning: classification for two populations, linear and quadratic discriminant analyses; Unsupervised Learning: Similarity and dissimilarity measures for observations and for variables and other objects; Clustering algorithm: Single linkage algorithm; Non-hierarchical Clustering Method: K-means Method.

Suggested Books:

1. Peter Bajorski (2012): Statistics for Imaging, Optics, and Photonics, John Wiley & Sons.
2. R.A. Johnson and D.W. Wichern (2013): Applied Multivariate Statistical Analysis, Pearson
3. Alfred Stein Freek Van Der Meer and Ben Gorte (2002): Spatial Statistics for Remote Sensing, Kluwer Academic Publisher
4. B. Everitt and T. Hothorn (2011): An Introduction to Applied Multivariate Analysis with R, Springer

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Semester II

Session 2016-17

RLM-3 (Lab-3) (Based on Papers 6 & 9) (2 Credits)

Georeferencing and image rectification using ERDAS/ENVI. Image processing of digital data. FCC preparation, sub-scene extraction, spatial filtering, band ratioing, PCI images. Histogram equalization, image sharpening, edge enhancement and stretching. Supervised and unsupervised classification. NDVI image.

Linear and multiple regression, Multivariate Inference, Principal component analysis, finding Mahalanobis distance, cluster analysis, linear and quadratic discriminant analyses

RLM-4 (Lab-4) (Based on Papers 7 & 8) (2 Credits)

Identification of objects and features on thermal images. Microwave images and their interpretation. Hyperspectral signatures of various features. Components of earth systems and their classification. Exercises on earth system science related topics.

Ability Enhancement (AE-2) (4 Credits)

Seminar presentation

Elective (Discipline Centric) E2 (4 Credits)

- (a) Geography of India
- (b) Mineral Resources of India

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Elective Paper (E2)

(Discipline Centric)

Geography of India

Unit I

Major geographical features of India. Bases of Physiographic divisions of India; Peninsular and Extra Peninsular India- its Evolution and Geological structure. Their physical and topographic characteristics.

Unit II

Drainage and water resources. Major river system of India and their morphological characters. Evolution of extra peninsular drainage and peninsular drainage, characteristics of their major river systems. Difference between peninsular and extra peninsular drainage systems.

Unit III

Natural vegetation - Factors affecting the growth and distribution of natural vegetation. Types of forests and its distribution, characteristics and economic importance. Deforestation and its consequences. Conservation and management of forests.

Unit IV

Soil structure, texture, reaction and profile. Factors determining the types of soil, distribution and characteristics. Major areas affected by soil erosion, soil erosion and conservation. Problems of soils and its measures of reclamation.

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Elective Paper (E2)

(Discipline Centric)

Mineral Resources of India

Unit I

Metallic and non-metallic minerals. Occurrence, distribution and reserves in India. Mineral resources in geological periods. Distribution of mineral deposits in space and time.

Unit II

Iron ore deposits, distribution, production and reserves. Copper ores and their distribution. Lead and zinc deposits. Gold and diamond deposits in India.

Unit III

Radioactive mineral deposits: occurrence, distribution and production of uranium and thorium. Coal resources: reserves, production and distribution. Oil and gas basins of India.

Unit IV

Manganese ore deposits, occurrence and distribution. Bauxite ore deposits, occurrence and distribution. Building stone, limestone, ceramics and gypsum deposits.

Books suggested:

1. India's Mineral resources by Krishnaswami
2. Ore deposits of India by Gokhle and Rao
3. Industrial minerals and rocks by Deb

Prof. Abdul Munir
Chairperson

Interdisciplinary Department of
Remote Sensing and GIS Applications
A.M.U., Aligarh
Tel. 4450 (Internal)

Ref. No. _____/RS

Dated _____

Director
Computer Centre,
Aligarh Muslim University,
Aligarh

This is to inform you that the Department of Remote Sensing and GIS Applications has no infrastructure facilities to carry out the classes of the students of M.Sc. (Remote Sensing and GIS Applications).

In view of the above, it is requested to kindly arrange a Projector to run the classes of the students of M.Sc. (Remote Sensing and GIS Applications) at the earliest possible. Your kind support is highly appreciated.

(Prof. Abdul Munir)
Chairperson