CIVIL ENGINEERING DEPARTMENT

M.TECH. GEO-INFORMATICS AND ITS APPLICATION

Course of Study & Scheme of Examination
2016-17

Maulana Azad National Institute of Technology,
Bhopal

SCHEME
MECH. IN GEOINFORMATICS AND ITS APPLICATIONS

FIRST SEMESTER

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
GI511	Basics of Mapping and Cartography	3	-	-	3
GI512	Basic Concepts of Photogrammetry	3	-	-	3
GI513	Principles of Remote Sensing Technology	3	-	-	3
	Elective 1	3	-	-	3
	Elective 2	3	-	-	3
	Open elective1	3	-	-	3
GI514	Lab Practice 1	-	-	3	2
GI515	Seminar 1	-	2	-	2
				Total credits	22

SECOND SEMESTER

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
GI521	Space Geodesy and GNSS based Mapping	3	-	-	3
GI522	Basic Concepts of GIS	3	-	-	3
GI523	Digital Processing of Remotely Sensed Data	3	-	-	3
	Elective 3	3	-	-	3
	Elective 4	3	-	-	3
	Open elective 2	3	-	-	3
GI524	Lab Practice 2	-	-	3	2
GI525	Seminar 2	-	2	-	2
				Total credits	22

LIST OF ELECTIVES

GI531 Remote sensing and GIS for Environmental Engineering
GI532 Microwave Remote Sensing
GI533 Air Borne Laser Terrain Mapping
GI534 Hyper spectral Remote Sensing
GI535 Remote sensing and GIS for and Water resources

GI536 Change detection using remote sensing
GI537 Remote sensing and GIS for earth sciences
GI538 Digital Photogrammetry
GI539 Remote sensing and GIS for agriculture & forestry

LIST OF OPEN ELECTIVES

GI551 Probability and Statistical Methods
GI552 Advanced Soft Computing Techniques
GI553 Geoinformatics in urban mapping and management
GI554 Concepts of database systems

GI555 Geoinformatics Applications in Engineering Projects and Utility Management
GI556 Remote sensing and GIS for Disaster Management

THIRD SEMESTER

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
GI611	Major Project Dissertation Phase- I	-	-	-	23
				Total credits	23

FOURTH SEMESTER

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
GI648	Major Project Dissertation Phase- I	-	-	-	23
				Total credits	23

SYLLABUS

M.TECH IN GEOINFORMATICS AND ITS APPLICATIONS
FIRST SEMESTER

GI511 BASICS OF MAPPING AND CARTOGRAPHY

Principles and classifications of surveying, basic concepts and terminology. Linear measurements, Conventional symbols, different types of scales and preparation of maps. Measurement of angles and Directions: Different types of compasses for the measurement of bearings, compass traversing and closing error adjustments.

Leveling: Principle, terminology and instrumentation, reduction of levels, Classifications of leveling, profile leveling, cross-sectioning and reciprocal leveling. Contouring: Definition terminology & methods. Uses of contour maps.

Angles and Directions with Theodolites: construction, use and adjustment, traversing, latitude and departure, traverse computations and plotting, balancing of traverse, calculation of traverse area and omitted measurements.

Computation of area: Area computations from field notes and plotted plans using graphical methods and planimeter.

Computation of volumes: Formulae for the calculation of cross-sectional area and volume and Mass Haul diagram. Electronic total station: Principle, Components and working.

References
1. Plane Surveying- A. M. Chandra, New Age International.
2. Surveying and Leveling-Part-I & IIT- P. Kanetkar and S. V. Kulkarni, Vidyarthi Griha Prakashan.

GI512 BASIC CONCEPTS OF PHOTOGRAMMETRY

History and development:- Types of aerial photo, Classification of aerial cameras, Scale, Overlaps, Stereoscopy, Concepts, Viewing and measuring systems, Image and object co-ordinates, floating mark, parallax equation, height information, Tilt , Rectification , Displacement. Flight planning, computation for flight plan, photo control, cost estimation, aerial mosaics, types.

Concepts of interior, relative, absolute orientation, object, image relation, linearization, effect of orientation elements , scaling and leveling , analytical procedures , map compilation using

stereo plotters. Introduction to digital photogrammetry, Elements of Aero triangulation and analytical method, strip and block adjustment, Terrestrial photogrammetry.

References

1. Geoinformation: Remote Sensing, Photogrammetry and Geographic Information Systems- Gottfried Konecny, CRCPress
2. Elements of Photogrammetry- Paul R.Wolf, McGraw-Hill
3. Photogrammetry, Vol 1&II - Karl Kraus, Walter de Gruyter

GI513 PRINCIPLES OF REMOTE SENSING TECHNOLOGY

Remote sensing definition & principles, components of remote sensing system, active and passive remote sensing, Spectral windows and spectral signatures and their significance, Radiometric quantities used in the collection of spectral signatures.

Remote sensing satellite orbits, image acquisition process, repeativity & related terminology, Geometry, radiometry and other characteristics of remotely sensed data products. Pre-processing of remotely sensed imagery and ground truth collection methods for various applications

Characteristics of photographic images and colour, tone, texture etc. photo-image interpretation keys. Digital image analysis techniques: False color Composite (FCC), vegetation Index map density slicing, digital image classification techniques and extraction of thematic information

Application of remote sensing in terrain investigation and advantages over conventional mapping techniques. Extraction of topographic information from remotely sensed data and generation of digital terrain model from stereo pairs of images. Resource mapping for engineering projects and various application in Civil Engg.

References

1. Remote Sensing and image interpretation- Lillesand T.M. and Kiefer R. W., Willey.
2. Introduction to remote sensing - J. B. Campbell, John Villey.
3. Introductory digital image processing- J. R., Jensen Prentice Hall.
4. Remote Sensing in Civil Engineering- Kennie, T. J. M. and Matthews M. C., Surrey University Press.

GI 514 LAB PRACTICE 1

List of experiments

1. Study of conventional and modern surveying equipments
2. Drawing of conventional symbols of maps
3. Study and use of Prismatic Compass for plotting of ground objects
4. Study and use of Theodolite for plotting of ground objects
5. Study of the given stereo pairs of aerial photographs for the geometric elements and determination of area , scale and distances
6. Visual Interpretation of given stereo pairs of aerial photographs for the Drainage Pattern, Phsiography of the area, Landuse/Landcover pattern etc.
7. Use of stereoscope for the analysis of stereo pairs of aerial photographs.
8. Position and Navigation data collection using hand-held GPS receiver
9. Introduction to basic operations of Erdas Imagine softaware like data export/ import, satellite image reading and manipulations
10. Georeferencing of remote sensing satellite images
11. Digital remote sensing image Classification using ERDAS Imagine software

GI515 SEMINAR 1

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SECOND SEMESTER

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GI521 SPACE GEODESY AND GNSS BASED MAPPING

Definition & fundamentals of Geodesy, Development, Applications in space geodesy, Geoids and Ellipsoid**.** Map projection-necessity and classification, properties of commonly used map projection. Global & Local Datum& datum transformation . GPS , different segments , space, control and user segment , satellite configuration , GPS signal structure , orbit determination and orbit representation, Anti spoofing and selective availability, task of control segment , GPS receiver- main receiver component- example of GPS receiver.

GNS observables & GNSS survey methods & data analysis. Mobile mapping system for GIS database

References

1. GPS satellite surveying- Alfred Leick,.Wiley
2. GPS Theory, Algorithms and Applications- GuochengXu, Springer

3. Introduction to GPS, the global positioning system- Ahmed ei-rabbany,Artech House

4. GPS: Theory & Applications progress in astronautics and aeronautics- Bradford W. Parkinson, James J., Spilker AIAA, 1996.

GI522 BASIC CONCEPTS OF GIS

Basics of Geographic Information System (GIS) , Definition, Evolution & Components. GIS data input devices like scanner, digitizer, GPS, Remote sensing etc. Manual and semi-automatic line following digitization.

Data Model: Raster Data Model, Grid , Tessellations.

Digital Elevation Models: Generation, Representation, Applications. Spatial and attribute data visualization and query, Vector data analysis tools and Raster data analysis tool. Buffering, overlays, distance measurements and pattern analysis. Open GIS consortium, Customization in GIS , Object Oriented GIS ,WebGIS, Introduction to popular GIS software like ArcGIS and Q-GIS.

References

1. Principles of Geographic Information Systems for land Resources Assessment- P.A. Burrough, Wiley.
2. Geographic Information Systems A Management Perspective - Stan Arnoff, WDL Publications.
3. Fundamentals of Spatial Information Systems-Robert Laurini and Derek, Thompson Academic Press.
4. Geographical Information Systems, Vo. I and II -Paul Longely, M.F. Goodchild, et.al, Wiley.

GI523 DIGITAL PROCESSING OF REMOTELY SENSED DATA

Basic terminology of image storage and analysis, commercial image processing system software. Geometric and radiometric correction, establishing, spatial transformation, model using GCP's, intensity interpolation techniques (nearest neighbor, bilinear and cubic convolution).Image enhancement transformation and classification terminology and techniques. Image histogram, mean, standard deviation, variance, covariance matrices. Pattern recognition, boundary detection and representation, textural and contextual analysis. Classification accuracy assessment. Hybrid training, Non- parametric, and sub-pixel classification, Hyper – spectral image analysis and feature based classification.

References

1. Physical Principles of Remote Sensing- W.G.Rees, Cambridge University Press.
2. Remote sensing models & methods for image processing- Robert Shcowebgerdt, Elsevier.
3. Digital Image Processing- Rafael C. Gonzalez,Pearson Education India.
4. Remote Sensing Digital Image Analysis-John A.Richards, Springer.

GI524 LAB PRACTICE 2

Practical exercises on the use of GPS for field data collection and GIS data storage & analysis techniques

GI525 SEMINAR 2

DEPARTMENT ELECTIVE

GI531 REMOTE SENSING & GIS FOR EVIRONMENTAL ENGINEERING

Resource development in remote areas-Impacts of anthropogenic activity- Solid Waste management- Carbon footprints and sinks, carbon trading, carbon credits and marketing using RS and GIS. , Indian and international status. Soil classification & mapping. Impact of agricultural and industrial activity on soil properties. soil salinity/alkalinity, erosion studies, Applications of GIS in assessing soil salinity, erosion productivity etc.

Creation and maintaining water supply network, sewerage network using GIS. Case studies. Aquifer Vulnerability Intrinsic and specific vulnerability.

Remote Sensing technique to monitor, air pollution due to industrial activity, modeling using GIS case Studies.

References

1. Integrated Solid Waste Management Techobanoglous -George, Hilary Theisen,Samuel Vigi, McGraw-Hill
2. GIS for sustainable development- Michele Campagna, CRCPress

GI532 MICROWAVE REMOTE SENSING

Introduction, basic concepts, terminology and sensors in MWRS. Radar basics, radar interaction with earth surface and vegetation, surface scattering theory. radar equation, fading concept, measurement and discrimination, physical mechanisms and empirical models for scattering and emission, geometry of radar images, radar return and image signature, resolution concepts, sar, speckle in radar imagery, concept of roughness, geometry of targets, resonance, dielectric constant, surface and volume scattering, signal penetration and enhancement.

Polarimetry and SAR interferometry, scatterometer and its applications in agriculture, forestry, geology, hydrology, ice studies, land use mapping and ocean related studies, military and surveillance applications, search and rescue operations, ground and air target detection and tracking.

References:

1. Microwave remote sensing vol-1,vol-2- Ulaby,F.T.,Moore,K.R. and Fung,Artech House Publishers.
2. Principles and applications of Imaging - Floyd. M. Handerson Anthony, J.Lewis, Wiley.
3. Air and space borne radar systems-An introduction- Philippe Lacomme and Eric Normant, Elsevier.
4. Introduction to microwave remote sensing- Iain H.woodhouse,CRCPress

GI533 AIR BORNE LASER TERRAIN MAPPING

LASER, LiDAR – Principles and properties – Different LiDAR system – Applications – Advantages, Disadvantages – Space borne and airborne LiDAR missions – Typical parameters of a LiDARsystem.Principle of Laser Altimetry – Components of the system – GPS, IMU LASER, LiDAR data formats – Terrain Mapping Laser Configuration – Ocean bathymetry Laser Configuration - Limitations of the system. GPS and IMU data processing – Strip Adjustment – Geometric Correction – Data quality enhancement – Digital Surface Model – Filtering – Ground Point Filtering – Digital Elevation Model.

Hydrology, Disaster Mitigation and Management – 3D city models – Telecommunication Modeling – Urban planning – Coastal Zone Bathymetry Mapping – Feature extraction, vectorisation – Surface and land use classification.

Orthophoto rectification using LiDAR – Integrated LiDAR and Digital Photogrammetry Techniques – Integration of LiDAR DEM with other hyper spectral data.

References:

1. Altimetry- Principles and Applications- Mathias Lemmens, CRCPress.
2. Digital Photogrammetry - Yves Egels and Michel Kasser, CRC Press.
3. Laser Manual of Aerial Survey, Primary Data Acquisation- Roger Read and Ron Graham
4. Digital Terrain Modeling: Principles and Methodology- Zhilin Li Qing Zhu, Chris Christopher Gold,CRC Press.

GI534 HYPERSPECTRAL REMOTE SENSING

History and Description of Hyper spectral Imaging, Electromagnetic Specrtum, Scientific Principles, Hyperspactral Sensing Concept, Limitations of Hyper spectral Remote sensing, Working Principle, Hyper Spectral Radiometry, Imaging Spectrometers, Hyperspectral Remote Sensing and the Atmosphere, Absorption Features, Information Extraction from Hyperspectral Information Extraction Approaches, Spectral Library: AVIRIS data, JPL data and USGS hyper spectral data classification, Application of Hyperion data in Agricultural, Environmental, Forestry, Geology, Mining and coastal mapping.

 References:

1.Hyperspectral Remote Sensing, Principles and Applications- Marcus Borengasser, William S. Hungate, CRC Press.

2.Introductory Digital Image Processing- Jensen, J.R.., Pearson.

3.Remote Sensing and Image Interpretation- Lillesand, T.M. and Kiefer, R.W.,Willey.

GI535 REMOTE SENSING AND GIS FOR HYDROLOGY AND WATER RESOURCES

Hydrological cycle, components of hydrology cycle, spectral properties of water, GIS application in surface water modeling & case studies. Watershed parameters, stream networks, watersheds morph metric analysis. Rainfall- runoff modeling, Mapping of snow covered area, snow melt runoff, flood forecasting, risk mapping and flood damage assessment soil moisture area drought forecasting and damage assessment, GIS application in aerial assessment , case studies

Project investigation, implementation, maintenance stage- location of storage/ diversion works, urban hydrology of canal and reservoir,   conjunctive use of surface and ground water, water harvesting structures, Development of information system for Natural resource management, case studies. Applications of Remote Sensing, GPS & GIS in water resources projects.

References

1. Satellite Remote Sensing for Hydrology and Water   Management- Eric C. Barrett, Clare H.Power, Taylor & Francis Ltd

2. Hydrologic and Hydraulic Modeling Supportwith Geographic Information Systems- Dr. David Maidment, Dr. Dean Djokic, Esri Press.

3. Hydrology: An Introduction   Trimble Environmental Hydrology- WilfriedBrutsaert Andy D. Ward andStanley W., CRCPress.

GI536 CHANGE DETECTION USING REMOTE SENSING

Definition and importance of Change detection, Land use Land cover, Classification of Multi temporal data sets, LULC classification system, Stages of land use land cover classification, General Methods of change detection for land use land cover, Change Detection Based on Remote Sensing Information Model.

Algebraic methods of Change Detection, principle components, post classification comparison, Multivariate alteration detection (Canonical correlation analysis, Orthogonality properties, Scale invariance, iteratively re weighted MAD, Correlation with the original observation, post processing), Decision thresholds and unsupervised classification of changes, Radiometric Normalization.

Image Fusion techniques of change detection, Change Vector analysis Technique, Change detection using remote sensing technology as a tool for Natural hazards planning and damage assessment.

Urban change detection mapping and analysis, Landslides, causes of landslides, Factors affecting, Detection of landslides using remote sensing and GIS techniques.

References

1. Remote sensing and image interpretation- Lillesand and Kiefer, Willey
2. Image analysis Classification and Change Detection in remote Sensing with algorithms for ENVI/ID Morton J Canty, CRCPress.
3. Remote Sensing and GIS accuracy Assessment- Ross Luneta and John G Lyon   CRC Press.
4. Spatial statistics for Remote Sensing- Alfred Stein, Freek Vander Meer and Ben Gorte – Kluwer,Springer.

GI537 REMOTE SENSING AND GIS FOR EARTH SCIENCES

Introduction – Rocks and Minerals, image characters of igneous, sedimentary and metamorphic rocks - Litho logical mapping using aerial and satellite data- Structural Geology, introduction, Mapping structural feature .

Elemental composition and nature of the spectra of rocks and minerals, Optimal spectral windows.   Geomorphic Landforms, Drainage network and patterns classification and

implications of drainage patterns, geomorphic mapping using, aerial and satellite data - Landform analysis in natural resources and management case studies.

Different types of Geophysical Surveys, Planning Geophysical surveys using satellite data. Introduction, Integration of all relevant primary and secondary data using GIS in Surface and groundwater studies - Engineering Geology, Mineral exploration and Petroleum exploration, Disaster Management studies like Droughts, Floods-Case studies.

References

1. Remote Sensing principles and interpretation- Sebins, F. ,Waveland PrInc.
2. Engineering and General Geology- Parbin Singh, S K Kataria& Sons.
3. Image interpretation in Geology- Drury, S.A., Routledge.
4. Fundamentals of GIS- Michael N. Demers, Wiley.

GI538 DIGITAL PHOTOGRAMMETRY

Evolution of digital Photogrammetry, comparison of analog, analytical & digital systems – advantages.

Digital cameras- geometric problem of CCD image –types of CCD systems - use of CCD scanner in high resolution satellites, SPOT, MOMS, IRS, IKONOS and Quickbird.

Image Generation - Data procuring concepts –Display modes - Image measurements.

Review of space resection & intersection - interior & exterior orientation - Automatic tie point generation - Automatic Block triangulation, feature collection and plotting annotation - editing – various formats of map data.

DEM Generation - accuracy of DEMs, Orthorectification - regular & irregular data collection methods - contour generation - satellite photogrammetry principles – missions - stereo image products - issues - stereo satellite missions.

References
1. Digital Photogrammetry: A Practical Course- Wilfried Linder,Springer
2. Fundamentals of Computational Photogrammetry- Ghosh, Sanjiv.kscribd
3. Image Sensors and Signal Processing for Digital Still- Cameras Junichi Nakamura, CRC Press.
4. Digital Terrain Modeling: Principles and Methodology- Zhilin Li, Qing Zhu, Chris Gold,CRC Press.

GI539 REMOTE SENSING AND GIS FOR AGRICULTURE & FORESTRY

Introduction , Spectral properties of crops, crop canopy , identification & inventory, Yield modeling , crop production forecasting through digital analysis, crop condition assessment and monitoring, land use and land cover analysis, Microwave RS for crop inventory & case studies. Detection of pest & diseases, Flood mapping and Assessments of crop loss , Remote sensing capabilities & contribution for drought management, Land degradation due to water logging & Salinity,   crop stresses reflectance properties of stressed plants and stress detection. Introduction, Forest taxonomy ,   inventory of forestlands , forest types and density mapping using RS techniques, Forest stock mapping, factors for degradation of forest, Delineation of degraded forest - Forest change detection and monitoring , Forest fire mapping & damage assessment , LiDAR remote sensing for Forest studies.

RS & GIS for drawing out action plans, water shed approach, precision forming, case studies.

References

1. Wetland & Environmental application of GIS- John G. Lyon, Jack MCcarthy,CRC Press.
2. Hyper spectral RS of tropical and sub -tropical forest- MargarebKalacska, G., Arturosanchez.
3. Advances in land RS: System, modeling invention and applications- ShunlinliangSpringer.
4.Soil mineralogy with environmental application, Library of congress - Joe Boris dexon

OPEN ELECTIVES

GI551 PROBABILITY AND STATISTICAL METHODS

One dimensional random variables: Random variables - Probability function – moments – moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Functions of a Random Variable, weighting of observations.

Two dimensional random variables: Joint distributions– Marginal and Conditional distributions – Functions of two dimensional random variables – Regression Curve – Correlation.

Estimation theory: Unbiased Estimators – Method of Moments – Maximum Likelihood Estimation - Curve fitting by Principle of least squares – Regression Lines, Propagation of systematic and accidental errors, theory of least squares and its application to adjustment problems.

Testing of hypotheses: Covariance matrix – Correlation Matrix – Multivariate Normal density function – Principal components – Sample variation by principal components – Principal components by graphing.

Multivariate analysis: Sampling distributions - Type I and Type II errors - Tests based on Normal, t, Chi-square and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

References

1. Probability and statistics for Engineering and the Sciences- Jay L. Devore, Cengage Learning.
2. Applied multivariate methods for data analysis- Dallas E Johnson et al, S. Chand.
3. Probability and Statistics for Engineer Richard Johnson- Miller & Freund, Pearson.

GI552 ADVANCED SOFT COMPUTING TECHNIQUES

Artificial Neural Systems – Perceptron – Representation – Linear separability – Learning – Training algorithm – The back propagation network – The generalized delta rule – Practical considerations – BPN Geomatic applications.

FUZZY LOGIC**:** Fuzzy sets and Fuzzy reasoning – Fuzzy matrices – Fuzzy mebership functions – Operators Decomposition – Fuzzy automata and languages – Fuzzy control methods – Fuzzy decision making

NEURO – FUZZY MODELING:Adaptive networks based Fuzzy interface systems.

References

1. Neural Networks – Algorithms Applications & Programming Techniques - James Freeman A. and David Skapura M.Addison, Wesley.
2. Fuzzy Logic with Engineering Applications- Timothy J.Ross, Wiley.
3. Artificial Neural Networks- Yegnanarayana B.,PHI Learning Pvt. Ltd.
4. Fundamentals of Neural Networks - LqureneFausett

GI553 GEOINFORMATICS IN URBAN MAPPING AND MANAGEMENT

Remote sensing for detection of urban features. Introduction & basic terminology. Digital image processing techniques – Case studies. Segmentation of Built-up areas – Classification algorithms – Land use/ Land cover mapping – change detection – high resolution remote sensing – case studies.

Regional, Master and detailed development – Use of remote sensing and GIS in plan preparation – Urban information system – Web GIS – case studies.

Mapping transportation network –Alignment planning – Traffic and parking studies – Accident analysis – case studies. Urban growth modeling – Expert systems in planning.

References

1. GIS for the Urban Environment- Juliana Maantay, John Ziegler, John Pickles Esri Press
2. GIS Environmental Modeling and Engineering- Allan Brimicombe, CRC Press
3. Spatial Analysis: Modeling in a GIS Environment- Paul Longley, Michael Batty, Wiley

GI554 CONCEPTS OF DATABASE SYSTEMS

Relational Databases: Introduction to relational data models and SQL. Advanced SQL and Query languages. Database design, Database design and ER model, relational database design. Database storage and querying, Indexing and hashing Query processing and optimization, Database Transaction management Transactions, concurrency control and recovery system Spatial and temporal data and mobility, case studies on Oracle, IBM DB2 Universal database and Microsoft SQL server

References

1. Database system concepts- AviSilverschatz, Henry F. Korth, S. Sudrashan, C.J.McGraw-HillPearson

GI 555 GEOINFORMATICS APPLICATIONS IN ENGINEERING PROJECTS AND UTILITY MANAGEMENT

Forestry, Utilities : Water utility applications , Electric utility Application, Telecommunication: Tower spotting, route optimization for meter reading for utilities, Other utilities.

Vehicle Tracking: Automatic vehicle location (AVL), Components of AVL:

Mobile mapping - Web GIS: Architecture of Web GIS, Map server, Web GIS applications.

References

1. Geographic Information Systems and Science Paul Longley, Michael F. Goodchild et al, Wiley.

2. GIS Tools for Water, Wastewater, and Stormwater Systems- UzairM.Shamsi ASCE Press

3. Introduction to Geographic Information Systems for Public Health- Alan L, MD Melnick Aspen Publishers.

4. GIS Environmental Modeling and Engineering- Allan Brimicombe.CRC Press.

GI556 REMOTE SENSING AND GIS FOR DISASTER MANAGEMENT

Basic concepts and principles, Hydrological and geological disasters, characteristics crisis and consequences

Needs and approach towards prevention , principles and components of mitigation Disaster legislation and policy, Insurance , Cost effective analysis ,Utilization of resource , Training , Education , Public awareness , Role of media.

Slope stability of Ghat roads, Structural safety of Dams, Bridges, Hospital, Industrial structures , Low cost housing for disaster prone areas , Cyclone shelter projects and their implications , Reconstruction after disasters: Issues of practices.

Remote sensing in Hazard evaluation, Zonation, Risk assessment, Damage assessment, Land use planning and regulation for sustainable development.

Vulnerability analysis of infrastructure and settlements. Pre-disaster and post disaster planning for relief operations, Potential of GIS application in development planning, Disaster management plan, Case studies

References

1. Geometrics Solutions for Disaster   Management- S Zzlatanova, Andrea F. Jonathanli, Springer.

2. Mitigation of Natural Hazards & Disasters- C.EmdadHaque, Springer.

3. Disaster Recovery Planning and Services- Gerard, BlokdijkEmereo Publishing.

4. Large Scale Disasters: Prediction, Control and Mitigation- Mohamed Gad, Wiley.