M.Tech. Geo-Engineering course

An applicant for admission into the M.Tech. Geo-Engineering should have at least a second class with not less than 55% marks degree in either: B.E. / B.Tech. in any Engineering OR Master’s degree in science.

In the available number of seats, 50% are reserved for B.E./B.Tech. applicants. If sufficient number of eligible applicants is not available in either of the two groups, the eligible applicants from the other group are given admission, to fill all the available seats in M.Tech. (Geo-Engineering).

1. A) A regular course of study means attendance is not less than 75 per cent of lectures, practical, drawing exercises, workshop and practical and field and project work, if any, in such semester in such subject, according to the scheme of Instruction to be notified by the Head of the Institution, provided that in special cases for sufficient cause again the Vice-Chancellor may on the recommendation of the Principal, condone the deficiency in attendance, not exceeding 10 per cent, for reasons of ill-health when the application is submitted at the time of the actual illness and is supported by an authorized Medical Officer approved by the Principal.

B) However, in the case of students, who participate in activities, such as NCC, Inter-University Tournaments, National Tournaments, Inter University Courses. NSS and any such other activities deemed genuine by the Head of the Department Concerned, the period of their absence for the above purpose can be condoned by the Principal on the recommendation of the Head of the Department.

2. A) There shall be a written examination at the end of each of the first two semester in the subjects offered in the respective semesters.
B) The candidates are required to submit, at the end of the fourth semester, three copies (as prescribed) of the dissertation on or before a date to be notified by the University from time to time, accompanied by three copies of a short summary, all of which will be retained by the University.

C) At the end of the third semester and fourth semester, an evaluation of the dissertation there shall be viva-voce (preliminary) for 100 marks (1) and (2) a viva voce for 100 marks on the dissertation and related subjects.

D) Marks for sessional work shall be allotted by the Teaching Staff of the college on the basis of class work, slip tests, practical works, etc., and the list of marks shall be sent to the Registrar, before the commencement of the written examination.

E) For taking the examination in the theory in any subject candidates shall be required to obtain a minimum of 50 per cent in sessional work in that the subject, failing which, they shall be required to repeat the course in that subject in the semester in which it is offered again for study.

F) Candidates who fail to secure the minimum prescribed marks in that subject will be permitted to continue the studies in the next semester. They shall, however, be required to pass the examination in the subjects in which they have failed, in the subsequent examination.

G) Candidates who have secured not less than 40 per cent in any of the theory papers and not less than 50 per cent of the total maximum marks of the theory paper and sessionals put together shall be declared to have passed the examination in that subject. In the case of subjects in which no written examination is prescribed, candidates should secure 50 per cent of the marks allotted to each of these subjects.

3. A) The evaluation of project work / Research work will be done by conducting viva voce examination at the end of fourth semester by a Board of Examiners consisting of:

1. Head of the Department
2. Chairman, Board of Studies
3. The Internal Research Director
4. One or two experts from outside the Department / University nominated by the Vice-Chancellor.

The dissertation shall be either "recommended"(with grades A, B, C), or "Not recommended"(with grade F stands for failed).

4. Candidates who have passed all the subjects of the course and secured not less than 60 per cent of the aggregate of marks, shall be declared to have passed in first class. All the remaining successful candidates shall be declared to have passed in second class.
5. Candidates who fail in the subjects of any semester will be deemed to have been conditionally promoted. They shall however, have to appear and pass only in the subjects in which they have failed. Candidates have to take the examination in the subjects in which they have failed during these semesters, when the University conducts the examinations in those subjects.

6. The marks obtained will be converted to grades on a 10 point scale and then to Semester Grade point Average(SGPA) and subsequently Cumulative grade point average is awarded at the end of the course by University.
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III- SEMESTER

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I-SEMESTER

GE 1.1 - Mathematics and Statistics

Unit-1
Fundamentals: Sets and Subsets, Sequences, Operations on Sets; Counting sequences, and subsets (permutations and combinations) Algorithms and Psudocode: Induction and Recursion: Division in the integers: Matrices

Unit-2
Relations and Digraphs; Product sets & Paths in Relations & Digraphs; Properties of Relations; Equivalence Relations; Computer Representation and Digraphs; Manipulation of Relations; Transitive closure and Warshall's Algorithm.

Unit-3
a) Functions;
   Functions - The Pigeonhole principle; Permutations

b) Trees & Languages
   Trees; Labeled Trees; Language; Context free languages and derivation trees. Ambiguity in context free grammar.

Unit-4
1) Measurement of Central Tendency, Mean, Mode, Median, Geometric mean and Harmonic Mean.
2) Measures of variations - Range, Quintile deviations, Mean deviation, Standard deviation and variance, Coefficient of variations.
3) Probability concepts - Additions and multiplication laws, Basic problems on these laws. Concept of random variables and probability distribution.
Unit-5
1) Theoretical distribution; Binomial, Poisson and normal with application.
2) Correlation Analysis - Introduction, Karl Pearson's Coefficient of Correlation, Auto Correlation.
3) Regression Analysis - Linear regression analysis; Curve fitting concept of multiple regression analysis.

Text Books
1) Statistics by S.P. Gupta
2) Statistical theory and methods by SANCHETIC and Kapoor
3) Statistics by S.C.Gupta

GE 1.2 Principles of Remote Sensing

Unit-I Basics of Remote Sensing
a) Overview of Remote sensing: Definition of Remote sensing
b) PLATFORMS AND SENSORS
   • Platforms: Types of platforms, ground, airborne, and space born platforms,
     Orbit of satellites, Kepler’s Law, satellite characteristics, satellites for Earth observations studies, and planetary missions (Chandrayana)
   • Sensors: Types and classification of sensors, imaging modes, Characteristics of optical sensors, sensor resolution-spectral, radiometric and temporal,
     Characteristics of detectors,

Unit-II a) Data reception, Data processing & Data generation
   • Ground station, Data generation, Data processing & correction
b) Radiometric and Geometric corrections
   • Radiometric corrections Random noise correction
   • Atmospheric correction, Geometric errors and corrections,
   • Distortion evaluated from tracking data, distortion evaluated from ground control Image correction.
c) Ground Investigation in support of Remote sensing
   • Uses of ground data, calibration correction, Interpretation of properties, Training sets, Accuracy evaluation, test sites
   • Ground truth Instruments and spectral signature,
   • Spectral Reflectance and spectral signature of vegetation
• Sources of RS data: Global and Indian data products

Unit-III : Visual Image Interpretation
• Introduction to Visual Interpretation, Basic principles of Visual Interpretation
• Elements of Visual Interpretation, Techniques of Visual Interpretation
• Interpretation Keys, Methods of searching and sequence of Interpretation
• Methods of analysis and Reference levels
• Computer compatible tapes – Band sequential format, Band interleaved by line format, Run-length encoding format.
• Hardcopy outputs – Generation of B/W and False Color Composites. Generally supported scales of the data products, Information about annotation of the products.

Unit-IV: Thermal Imaging system
• Radiation principles (Plank’s Law, Stephen Boltzman law), Interaction of EMR with earth surface, Wien’s displacement law, Kirchoff’s Law).
• IR - radiometers, Airborne and Satellite TIR scanner system
• Characteristics of IR images
  i) Scanner distortion, ii) image irregularities, iii) Film density and recorded iv) Temperature ranges
• Effects of weather on images
  i) Clouds, ii) Surface winds, iii) Penetration of smoke plumes
• Interpretation of thermal imagery
• Advantages of Thermal imagery

Unit-V Microwave Remote Sensing
• Introduction - Electromagnetic spectrum, Airborne and Space borne radar systems basis instrumentation.
• System parameters - Wave length, Polarization, Resolutions, Radar geometry.
• Target parameters - Back scattering, Point target, Volume scattering, Penetration, Reflection, Bragg resonance, Cross swath variation. Speckle radiometric calibration.
• Microwave sensors and Image characteristics, Microwave image interpretation
• Application : Geology, Forestry, Land use, Soils etc. Future trends and Research
• Physics of laser, laser interaction with objects. Types of LiDAR (Topographic, Bathymetric) platforms of LiDAR, components of LiDAR.
List of Text Books


GE 1.3 Principles of Photogrammetry and Photo interpretation

UNIT- I
Fundamentals of Photogrammetry and Photo interpretation – types of photographs; Vertical photographs – principal point; scale; Stereoscopy; Vertical exaggeration – factors involved and determination; Overlap, sidelap and flight planning

UNIT- II
Geometric elements of vertical aerial photographs; Relief Displacement on vertical aerial photographs; Parallax and parallax measurement – monoscopic and stereoscopic methods; Determination of horizontal ground length, direction and angles from photo coordinates;

UNIT - III
Aerial mosaics: comparison with maps; Elements of aerial photo interpretation – (a) landforms; (b) surface drainage patterns; (c) erosion features, (d) gray tones; (e) miscellaneous elements.

UNIT - IV
Digital Photogrammetry: definition and scope; Photographs and images; Geo-referencing – Interior orientation, exterior orientation; aerotriangulation – single frame and block triangulation - pass points, tie points; ground control points; Satellite photogrammetry

UNIT - V
3-D surface modeling – DEMs, DSMs and DTMs; Triangulated irregular networks; Gridded surfaces; interpolation methods; Contour representation; Terrain visualization; DEM user applications.
Textbooks
2. Elements of Photogrammetry, Paul R. Wolf, McGraw-Hill, 2000

GE 1.4 Earth Systems

Unit-1
a) Earth - Orbit, Rotation, Time
b) Oceans - Depth, Bottom relief
c) Oceans - Temperature, Salinity, Density of seawater
d) Oceans - Waves, Tides, Currents
e) Climate and the atmosphere – Origin, nature, composition and vertical division of the atmosphere.

Unit-2
a) Meteorological parameters and their measurements - Geographical, seasonal and vertical distribution of temperature, pressure, wind and precipitation.
b) Solar and terrestrial radiation: Distribution in clear, cloudy and average conditions. Mean heat balance.
c) Weather disturbances: Air mass and Front, Cyclone and anti-cyclone. Thunderstorm and tornado.
d) Weather analysis and Forecasting
e) Climate and agricultural factors in crop production.

Unit-3
a) Climate Change: Causes and Impacts
b) Monsoons: Concepts of the origin of monsoon - Indian Monsoons
c) Fundamental concepts of Geomorphology
d) Weathering, Mass wasting and erosion.

Unit-4
a) Wind and associated land forms
b) Seas and associated land forms
c) Land forms associated with faults and folds
d) Rivers and associated land forms
e) Glaciers associated land forms
Unit-5

a) Soil forming processes, Soil profile, Soil components.
b) Pedogenic regimes.
c) Classification of soils
d) Soils of India

List of Text Books
1. Structural Geology by Billings, M. 1984
2. Earth History & Plate Tectonics by Carl K. Seyfert, Leslie A. Sirkin
4. General Climatology by H.J. Crichfield
5. Physical Geology by Arthur Holmes
6. Physical Geography by Stahler
7. The Atmosphere by Frederick K. Lutgens and Edward J. Tarbuck

Syllabus for Elective Subjects

GE. 1.5. Elective 1.

A. Coastal Zone Management
B. Natural Disaster Management
C. Satellite Meteorology and Agriculture and Oceanography

A. Coastal Zone Management

Unit 1
Coastal and littoral zones – definitions and scope of study
Shore zone processes – waves, tides and currents
Coastal landforms;
River deltas: types of deltas and their morphological variations
Human activities and their impact on the delta-fringe coasts

Unit 2
Coastal wetlands – Mangrove swamps, marshes, lagoons, tidal channels/creeks and their significance in coastal stability and economic importance
Continental margins – forms and processes; territorial waters and Exclusive Economic Zone
Sea level changes – factors involved; effects of sea level oscillations on coastal zones
Sea-level rise and coastal vulnerability; Role of geoinformatics in assessment of coastal vulnerability to sea-level rise

Unit 3
Coastal Hazards:
Storm surges and Tsunamis
Origin, propagation and run-up of tsunamis;
Tsunami impact – role of coastal topography and vegetation;
Global warming and Sea-level rise - impact on coastal zones; coastal vulnerability assessment
Coastal hazard preparedness – coastal protection, education and awareness of coastal communities; Role of geoinformatics in assessment of coastal vulnerability to tsunamis

**Unit 4**
Human activity and coastal environment – deforestation, agriculture/aquaculture, pollution and coastal structures, and their effect on coastal zones
Coastal vegetation; shelter belts; coastal aquifers; freshwater-seawater interface
Morphology of Indian coasts

**Unit 5**
Coastal zone management – concepts, models and information systems
Coastal Regulations Zones (CRZ) and Coastal Management Zones (CMZ): Indian context
Application of remote sensing in coastal zone studies
Role of Geographic Information Systems in coastal zone studies

**Text books**
2. Deltas, Coleman, J.M., Continuing education Publication Co.Inc. 1976
5. Introduction to Marine Geology and Geomorphology, King, C.A.M., Edward Arnold, 1974
GE. 1.5.Elective 1.  

B. Natural Disaster Management

Unit-1

Various types of Natural Disasters - Cyclones, Floods and Tidal waves with most well known Indian examples, Classification of Disasters and nature of Impacts.

Unit-2

Various types of Natural Disasters - Earth quakes, land subsidence and Land slides, Forest fires, Drought with most well known Indian examples, Classifications and nature of impacts.

Unit-3

Vulnerability factors and Risk analysis of Natural disasters and Hazard estimations.

Unit-4

Natural disaster management plans, Shelterbelts, Special structures, Disaster preparedness and Mitigation.

Unit-5

Information needs of Disaster management, Remote Sensing Applications, GIS applications.

References

1. Krishna Prem & Bhanfari, N.M. (1967): Risk assessment due to strong Wing storms / Cyclones and preventive measures for Habitat Buildings; Proceedings volume 1 of International Conference on Habitat and sustainable Development, December 1-2-1997 organized by Institute of Engineers (India) and World Federation of Engineering Organisations.
GE. 1.5.Elective 1.

C. Satellite Meteorology  Agriculture and Oceanography

Unit-1

1. Fundamentals of Remote Sensing in Meteorology
2. Meteorological satellite characteristics and their orbits, TIROS, NIMBUS, NOAA, TIROS N, SEASAT, GOES, METEOSAT, INSAT, OCEAN SAT. Role of LANDSAT, SPOT and IRS in collecting meteorological, agricultural and oceanographic data.
4. Atmospheric temperature retrieval techniques and surface radiation studies.
5. Wind measuring techniques from satellite data.

Unit-2

1. Cloud classification techniques.
3. Interpretation of Satellite meteorological images for weather systems and cyclones.
5. Spectral behavior of different crops and vegetation in VIS, NIR, MIR, TIR and Micro-wave regions.

Unit-3


Unit-4

1. Principles of Remote Sensing of Sea
2. Visible wavelength ocean - color sensors: introduction to color sensors on Landsat, Coast zone color scanner (CZCS) on Nimbus, application and oceanographic uses of Land sat and CZCS data.
3. Introduction to infrared scanning radiometers, atmospheric correction and Sea - Surface temperature calibration techniques, interpretation and uses of SST data from satellites.
4. Passive microwave radiometers: Physical principles of passive microwave radiometry microwave radiometer design and oceanographic interpretation of microwave data.

Unit-5

1. Satellite altimetry of sea - surface topography: Application of altimetry to the study of ocean currents, tides, bathymetry and wave heights.
3. Introduction to Synthetic Aperture Radar, Principles of operation, SAR imaging of ocean waves, observations of ocean waves with Seasat SAR, Interpretation of ocean waves.
4. Introduction to microwave scatter meters, oceanographic application of scatterometer data. Application of wind and wave scatterometry.

List of Text Books

4. Remote Sensing in water management in command areas, Govardhan, V.

Reference Books

5. Environmental satellites,; systems data interpretation and applications, Jimmie D. Johnson, Frances, C. Parmenter, Ralph Anderson, Department of Commerce, NOAA.
GE 1.6. Elective.2

A. Mathematical Morphology in Image Processing
B. Water Resources Management
C. Geoinformatics for Earth Science Applications

A. Mathematical Morphology in Image Processing

Unit 1: Introduction


Unit 2: Mathematical morphology transformations and algorithms


Unit 3: Morphology based Image Classification & Applications

Binary and Grey level image segmentation-Skeletization by Zone of Influence Technique-Watershed segmentation technique-Watersnakes and PDE based-Textural segmentation-Applications of segmentation techniques in remotely sensed data classification-Segmentation of SPOT, RADARSAT, ERS SAR, and IRS data-Morphology based noise removal techniques for Microwave remote sensing data analysis-Granulometries for feature analysis Morphology for DEM analysis and terrain characterization

Unit 4: Shape Representation by morphology and shape description

Exact dilations-Distance-transformations-Exact distance transforms through exact dilations-Voronoi Diagrams (Graph Theory)-Scale space skeletonization-Multi-scale morphological transformations-Shape Characterization-Perimeter-area-Centroid-Maximal and minimal distances to centroid-Distance to the boundary-Diameter-Maximum chord-Polygonal approximation based shape decomposition-Pattern spectrum procedure.
Unit 5: Recent Advances in Mathematical Morphology in Image processing and analysis

Fuzzy Morphology-Watersnakes and PDE based morphology, Energy minimization concepts-Theoretical graylevel morphology-Lattice theory-Discrete topology and metrics for image processing-nonliner image filtering-connected operators-geometrical scale space-topographical segmentation-random sets and geometrical probability-integral geometry and geometrical measures-morphology applications in image sciences.

References:

Suggested Reading
1. Gonzalez, Digital Image Processing

GE 1.6. Elective.2

B. Water Resources Management

Unit-1 (Watershed Concept)

a) Issues in watershed management - land degradation, agricultural productivity, reservoirs sedimentation, depletion of bioresources, floods and droughts. Principles and approaches - principles of watershed management, different approaches in watershed management; Problem oriented approach, three dimensional approaches, integrated approach, steps in watershed management.

b) Watershed characteristics - size, shape physiography, slope, climate, drainage, landuse, vegetation, geology, soils, hydrology, hydrogeology, socio-economics. Linear aspects of channel systems - Aerial aspects of drainage basins.

Unit-2 (Land Management)

a) Survey, layout; Preparation and Development. Contour demarcation, Bush clearance, updating, stone picking and packing, leveling, shaping and consolidation, fencing, ploughing; soil and soil moisture conservation. Soil survey; conservation measures. Contour techniques, ploughing, furrowing, trenching and staking, Gully
control. Pervious check dams. Burshwood dam, Rockfill dam, Gabion; Impervious check dams.

b) Land capability classification, land degradation and problem soils. Reclamation of saline soils, alkaline soils, saline soils, acidic soils, sulphide soils; sediment yield modeling and watershed prioritization. The universal soil loss equation, sediment yield index method, statistical regression model, the European soil erosion model; Site selection from conservation measures.

Unit-3 (Water Management)

a) Surface water - Study of rainfall, estimation of run-off at micro catchments, stream gauging; Rainwater harvesting; catchment, harvesting, harvesting structures, Ground water - exploration of canal command areas, potential areas; integrated water resources management, conjunctive use.

b) Dry land Agriculture - Runoff agriculture, micro catchment forming, irrigation with saline water, reusing water, conserving water, sprinkler irrigation, drip irrigation, pot irrigation, other systems, reducing crop land percolation losses, reducing transpiration losses, selection of water use efficiency crops.

Unit-4 (Integrated Management)

a) Agriculture - Crop husbandry, soil enrichment, inter mixed and strip cropping, cropping pattern; sustainable agriculture, Hybrid and improved seeds; Biomass management, crop rotation, legumes, organic fertilization, spider farming, pastures and silvipastures; horticulture; tree culture; form forestry; bund utilization, boundary plantation; social forestry; Energy - Renewable resource, water power, solar energy wind power; biomass, fire wood, synthetic fuels, burning of municipal / garbage, ocean tides and waves.

b) Appropriate Technology - farm equipment; Contour methods; check dams, water catchment and harvesting; kunds, depression harvesting, harvesting below ground level, harvesting below stream bed level, ground water harvesting; low cost technology, water conservation, utilization of wasted natural resources, Novelities; Rural technological delivery systems, cultivating wasted lands, tree culture, farm forestry, silvipastures, horticulture, social forestry, afforestation, wonder ways.

Unit-5 (Monitoring and Evaluation)

a) People's Part - awareness, participation, Response; State and integrated approach, appreciation of the concept, training, transfer of technology, resource and development, Agro-industrial infrastructure; sustainable society, livestock, small animal farming, pisiculture, sericulture, Health and hygiene education, transport, cues.
b) Monitoring and Evaluation - purpose of monitoring and evaluation, nature of monitoring and evaluation - an interactive dynamic process, design of monitoring programs - determining information needs, setting information-need priorities, determining means of collecting information, Information management in monitoring programs; monitoring biophysical data, monitoring socio-economic data, monitoring project activities and outputs, design of evaluation procedures, types of evaluation, focus of evaluation, reporting evaluation results, insuring use of monitoring and evaluation information, a final word of caution.

Text Books and References


GE 1.6. Elective.2

C. Geoinformatics for Earth Science Applications

Unit – I: Remote sensing applications in lithological studies
Introduction; Scope for Geological applications in multispectral data, Thermal Data, Microwave data Mapping of Broad scale Lithological Units in General, Igneous, sedimentary and metamorphic rock, Identification of Mineral Assemblage, their physical properties mode of origin and mode of occurrence; Lithological mapping using aerial photos and satellite imagery, Digital analysis for lithological discrimination

Unit – II: Remote Sensing applications in structural analysis
Bedding and simple dipping strata, Folds, Faults, rift zones, Lineaments, Unconformity, Structural mapping – structural analysis through aerial- and satellite- data, digital techniques for structural analysis.

Unit- III: Remote sensing application in geomorphology
Nature and type of landforms like denudational, structural, fluvial, marine, Aeolian, glacial and volcanic

Unit – IV: Remote sensing application in geological investigations
**Unit- V: Engineering and Sub-surface exploration & Disaster Assessment**

Engineering geological Investigations: river valley projects, dams and reservoirs, route location (high ways and Rail ways) canal and pipeline alignments; neotectonism, seismic hazard and damage assessment, local ground condition, disaster assessment, volcanic and geothermal Energy applications, volcanic mapping and monitoring, identification of coal fires; environmental geology Resistivity, aeromagnetic and electromagnetic survey for subsurface explorations

**Textbooks**

Ravi P.Gupta, Remote sensing Geology-Springer Publisher,Al Books Co.in.

**GE 1.7 Photogrammetry and Photo interpretation Practical**

PG.1. Testing stereo vision
PG.2. Use of Lens stereoscope and Mirror stereoscope
PG.3 Determination of vertical exaggeration
PG.4. Use of Parallax Bar for height calculation from aerial photographs
PG.5. Calculation of scale of the photographs, Marking Principal point and conjugate principal point on the stereopairs
PG.6. Preparation of aerial mosaics
PG.7. Interpretation of aerial photographs for identification of landforms of fluvial, Aeolian, glacial, coastal, volcanic and arid processes
PG.8. Identification of tectonic elements from aerial photographs
  Digital photogrammetry – digital image matching and collection of mass points
  Construction digital terrain models
PG.9. Application of DTMs – contour generation; fill; fly though; slope and aspect; viewshed analysis; watershed and drainage extraction; volumetric analysis; preparation of orthoimages.

**GE 1.8 Remote Sensing and Image Interpretation Practical**

RS.P1 Study of Satellite Image Annotation (information) LANDSAT, SPOT and IRS and Referencing Scheme (Analogue)
RS.P2 . Study of Digital Referencing Scheme (NRSC/Digital globe/space imaging etc).
RS.P3 Understanding of Spectral Response Pattern of different Land cover objects 1 & 4
RS.P4 Study of Given Area in B/W IR, Colour and IR colour Photographs (IKONOS IIRS area)
RS. P5 Study of Satellite Imagery (B/W) in Different bands and Visual Interpretation
  (Landsat 6 band data for Visakhapatnam)
RS.P6- Study of Thermal Image, Interpretation of Various Features-
RS.P7- Study of Radar (Microwave) Imagery and Interpretation of Features
RS.P8- Study of Radar And SAR (Microwave) Imagery And Interpretation of Features-
RS.P9 . Interpretation of Cultural Details From high resolution imagery
RS.P10 . Digital Interpretation and preparation of Land use Map at 1:50,000 scale
RS.P11. Field exercise on visual Image interpretation and validation using ground data
II-SEMESTER

GE 2.1 - Geo-Exploration Techniques

Unit-1
a) Geophysical Exploration Techniques
b) Electrical Methods
   i. Introduction
   ii. Self potential method
   iii. Equipotential and line potential methods
   iv. Direct current - Resistivity method

Unit-2
a) Seismic method
   i. Fundamentals of Principles
   ii. Theory of Refraction shooting.
   iii. Reduction of Seismic observations
   iv. Seismic operations
   v. Seismic field operation and interpretation
   vi. Acquisition of seismic data in water covered areas

Unit-3
i. Fundamentals of quantitative log interpretation.
ii. Spontaneous potential curve
iii. Resistivity logging
iv. Gamma-ray logging
v. Determination of lithology and porosity
vi. Determination of Resistivity and Permeability

Unit-4
a) Geological Techniques
b) Geomorphological Techniques
c) Geohydrological Techniques
d) Hydrological Techniques

Unit-5
a) Soil Mechanics
b) Clay Minerals and Soils
c) Laboratory and in-situ tests of soil Drilling Techniques
d) Feasibility report

List of Text Books
1. Application of surface geophysics to ground water Investigations by A.A.R. Zhody.
3. Log Interpretation by Schlumberger.

**GE 2.2 - Geo-Engineering Investigations**

**Unit-1**
Introduction
Geo-Engineering investigations for dams and reservoirs
Geo-Engineering investigations for tunnels
Geo-Engineering investigations for Air fields
Geo-Engineering investigations for Highways and Railway lines

**Unit-2**
Geo-Engineering investigations for coastal and offshore structures
Geo-Engineering investigations for canals and bridges
Geo-Engineering investigations for major industries,
Thermal and Nuclear Power stations

**Unit-3**
Introduction to Rock Mechanics
Physical properties of rocks: Mineral composition, rock structure, texture
Classification of rocks: Litho logical classification, engineering classification, R Q D and core recovery of rock
Theoretical basis of rock mechanics - elasticity and plasticity
Methods of rock exploration - geological, geophysical and drilling

**Unit-4**
Geo-Engineering Case Studies
D.B.K. Railway tunnel alignment
Visakha Steel Plant site investigations
Geophysical Techniques for Terrain Evaluation
Terrain Evaluation for Urban Planning

**Unit-5**
Geo-Engineering Investigations for river valley projects: case studies of
Nagarjunasagar Dam, Srisailam Dam and Farakka Barrage project.
Dam-failure investigations

**List of Text Books**
2. Engineering Geology Publications of G.S.I.
GE 2.3 - Geographic Information Systems

Unit-1: Fundamentals of GIS

a) Introduction to GIS, Understand the difference between GIS and information system in general, GIS components and function of GIS: hardware software requirement of GIS, data types and spatial data models, idea of conceptual, logical and physical models, RDBMS, data base normalization Representation of real world via vector and raster representation model.
b) Definition of a map Geographic data in the computer. File and data processing, data base structures, perceived structures and computer representation and geographical data. Raster data structure, Vector data structures for geographical entities.

Unit-2 Data input and Quality verification

a) Data input, verification, storage and output: Data input, data verification, and correction and storage data output; data user interfaces.
b) Data Quality, Errors and Natural Variation: Sources of error, Errors resulting from natural variation of from original measurements. Errors arising through processing, problem; and errors arising from overlay and boundary intersections. Errors resulting room rasterizing a vector map. Errors associated with overlaying two or more polygon networks. The nature of boundaries. The statistical nature of boundaries. Combining attributes from overlaid maps.

Unit-3 DEM & Map Projections

a) Digital Elevation Models: The need of DEMs, methods of representing DEMs. Image methods, data sources and sampling methods for DEMs. Products that can be derived from a DEM. Automated landform delineation from DEMs.
b) Map projections in GIS

Unit-4 Data Analysis

a) Vector & Raster based analysis: Attribute data analysis, Integrated spatial and attribute data analysis: Single and multi layer raster and vector analysis, map overlay, spatial join, buffering analysis, network analysis, that is optimum path,( cost/time/distance, Travelling sales man problem, Dijkstra’s algorithm, geometric networks) Raster data analysis: Local, Neighborhood and regional operations.
c) Methods of Spatial interpolation. The available methods for interpolation, global methods of interpolation, location interpolators, optimal interpolation methods using spatial auto covariance. Extensions of krigging to large areas. Comparing krigging with other interpolation techniques. Choosing a Geographic Information System. Designing the needs for GIS.

Unit-5 Technological trends in GIS

a) Tools for Map analysis: Single maps, Map reclassification, operations and attribute tables, spatial topological and geometric modeling and operations on spatial Neighborhood. Tools for map Analysis: Map pairs, map overlay and map modeling correlation between two maps. Tools for map analysis: Multiple maps, types of models, Boolean logic models, Index overlay models, Fuzzy logic methods.

b) GIS customization, Data warehousing, cloud GIS, data mining, OLAP, SDSS, distributed, parallel and GPU, spatial data infrastructure,(i.e. integration and standards etc., ) Free and open source tools and web resources, Introduction to spatial decision problems, GIS and decision support system, over view of Internet GIS , Location based services.

List of Text books


Web Sites

2. www.earthmapping.com/
GE 2.4 - Environmental Studies

UNIT 1 - Environmental Concepts
1) Environment – meaning, scope, components of environments
2) Ecosystems – Concept, components, evolution and development. Types and classification of ecosystems
3) Primary and Secondary production, food chains, food pyramid and energy flow
4) Biogeochemical and nutrient cycles - hydrological and material cycles

UNIT II - Environmental Pollution
1) Air pollution – Sources of pollution, effects on humans. Global effects- greenhouse effect, acid Rain, global warming and heat island effect. Effects on vegetation and materials, air pollution control
2) Water pollution – Sources of water pollution, water as an ecological factor and its role in the biosphere, water pollution control
3) Soil pollution – Sources of soil pollution, effects of soil pollution, soil pollution Control

UNIT III – Human Activities and Environmental Degradation
1) Human population and environment
2) Impact of human land use practices on environment
3) Deforestation and environmental change
4) Urbanization and industrialization. Urban environmental problems- air, water, noise, nuclear, thermal pollution and human health hazards

UNIT IV - Environmental Impact Assessment (EIA)
1) Need of EIA, EIA procedure, Environmental impact statement an procedure
2) EIA methodologies- Adhoc method, Check list method, Matrix method, Overlay method, Network method and Benefit-cost ratio method
3) Environmental impact assessment for Irrigation, Industrial, Airport, Transport and Thermal projects
4) Assessment of impacts on socioeconomic environment

UNIT V – Environmental Analysis
Application of Remote sensing and GIS in Environmental analysis
1) Change detection and mapping- vegetation change, erosion and deposition
2) Detection of air and water pollution
3) Encroachment and wetland degradation
4) Disaster management-cyclones, floods and droughts, earthquakes and volcanic eruptions
## List of Text Books

1. Ecology and Environment, P.D. Sharma, Rastogi Publications
2. Environmental Science, M. Chandra Sekhar, The HI-TECH Publishers
3. Environmental Studies, R.Rajagopalan, Oxford University Press
7. Pollution Control and Conservation, Kovacs, M.(ed), Ellis Horwood Ltd., Budapest, 1985
9. Preventive and Social Medicine, Park & Park, Banarasidas
R.S.2.5 Elective-I

A. Water Resources Evaluation
B. Engineering Geology & Groundwater
C. Urban Planning and Information Systems

A - Water Resources Evaluation

Unit-1
Quantitative geomorphology of drainage basins and channel networks.
Runoff Hydrology of Urban areas

Unit-2
Hydrology of Agricultural lands
Hydrology of Forest lands and Range lands
Hydrology of arid and Semi-arid regions Floods

Unit-3
Groundwater Potential areas in India
Aquifer Properties and ground water flow
Well Hydraulics

Unit-4
Sea water intrusion
Ground water basin management and conjunctive use
Ground water pollution and legislation

Unit-5
Planning for water resources development in Rural and Urban areas with reference to Indian continent. Water balance studies

List of Text Books

Hand book of Applied Hydrology by Ven Te Chow
Groundwater by H.M. Raghunath
Water Resources Engineering by R.K. Linsely & J.B. Franzini
R.S.2.5 Elective-I

B. Engineering Geology and Groundwater

Unit-I
Engineering Geology and Mass Movement Modelling:
Engineering properties of rock and soil, Strength and failure behavior of rock and soil, Rock mass classification, Construction materials, R.S. application in engineering geology mapping. Mass movement types and classifications of landslides, Landslide characteristics, causes and processes; R.S. applications for mapping and monitoring of landslides; Landslide hazard and risk modelling, Seismicity and precipitation induced landslide modelling, Landslide hazard mitigation and management.

Unit-II
Engineering Geological site Investigations and Environmental Change Assessment:
Dam and Reservoir site selection: Criteria for suitable dam/reservoir site selection in different geological setting; R.S. based study for dam/reservoir site selection. Route alignment and trafficability analysis: Factors governing route alignment and RS based information for alignment/trafficability studies. Site investigation for building construction and waste disposal site location. Environmental impact assessment of dams and reservoir, reservoir rim area monitoring, land use/land cover change analysis, analysis of impact of drawdown and reservoir induced landslide assessment.

Unit-III
Principles of Groundwater and Groundwater Geology: Ground water flow, surface and ground water interaction; controls of ground water occurrence and movement. Ground water Geology: Hydrological properties of different rocks, structures, landforms, paleo-channels and their detection from remotely sensed data, hydro-geological classification of rocks in India.

Unit-IV
Ground Water Exploration and Resource Assessment: Ground water targeting in different geologic terrains using EO data and GIS techniques, geophysical methods for ground water exploration, run-off estimation, quantification of ground water resources, satellite gravity observations, ground water development.

Unit-V
Ground Water Quality, Modelling and Management: Ground water quality and pollution assessment, sea-water intrusion, land subsidence due to ground water withdrawal, ground water flow modelling (2D and 3D) and contaminant transport modelling, rain water harvesting, artificial ground water recharge, conjunctive use of water, ground water regulation and control.

Suggested Readings:

Books and Reports

R.S.2.5 Elective-I

C Urban Planning and Information Systems

Unit – I Introduction

Planning: background and principles; Need for planning; Urbanisation and its impact, Distribution of land use/land cover; Town planning in ancient India and new towns of India; Requirements and possible types of development of towns; Geoinformatics application in Urban Planning

Unit II Formulation of Plans

Objectives and contents; Regional plan; Perspective plan; Master plan; Development plan; Project (scheme) plan; Delineation of planning area; Trend analysis; Land suitability analysis; Land use planning; Zoning and principles of zoning; Building Bye-laws and its principles; Requirement of urban & regional planners; Remote sensing for different levels of development planning

Unit – III Housing

Importance of housing; urban housing demand and production; Slums and squatters; Housing problem in India; National Housing policy; Site analysis - Layout design; Housing projects / Slum housing; Urban renewal projects; Urban infrastructure planning
Unit – IV Transportation planning

Classification of urban roads; Traffic surveys: speed, time, delay surveys; Use of speed, journey time and delay studies; Traffic volume; Origin Destination surveys; Parking surveys; Utility of remote sensing in traffic and transportation studies

Unit – V Urban Information System

Information system: Land; Housing; Transportation; Infrastructure; Trends in mapping using remote sensing, GIS and GPS; Database creation for Infrastructure development Decision support system for urban and regional management

GE. 2.6 Elective-2

A. Digital Photogrammetry and Mapping
B. Geoinformatics for Resources Development and Disaster Management
C. Spatial Database Handling Modelling & GIS Implementating Architectures

A. Digital Photogrammetry and Mapping

Unit 1 : Geodesy and Surveying
Fundamentals of geodesy, Geodetic reference systems: ICRE, ITRF, Geoid and geoidal heights and undulations. Geodetic datum and datum transformation, Map projection and transformation. Techniques of ground survey (horizontal and vertical control, triangulation, traversing, leveling, GPS and Total Station surveying). Data integration from different sources (GPS, Total Station, High resolution satellites) for large scale mapping and cadastral surveys.

Unit-II

Unit-III: Aerial and Satellite Photogrammetry
Photogrammetric camera (digital), Imaging systems- Asynchronous imaging, multiline scanners, multiple camera/multi sensors, area scanners, panoramic linear array scanners, wide field camera, Imaging properties, Theory of orientation: (IO, RO and AO).

Photogrammetric Triangulation: Single image, Stereo-pair (two overlapping images), Strip triangulation, Block Adjustment of Independent Models (BAIM), Bundle Block Adjustment, Special cases (resection, intersection, and stereo-pair generation).

Satellite Photogrammetry: Orbital Parameters, Orbital Modeling, Data Processing for stereo generation (block triangulation, optimum control requirement), Space Resection and
Intersection, Solutions and differences in different sensor models for photogrammetric processing. Processing of IRS IC/ID, CARTOSAT, ASTER, ALOS PRISM, SPOT, IKONOS, Quick Bird etc.

**Unit IV: Close Range Photogrammetry**

**Unit V: Digital Cartography and Visualization**
Geo Spatial Data Base organization, Digital Cartography, Web Cartography, 3D Simulation and Visualization, Digital earth models and data dissemination services: contemporary approaches (Bhuvan and Google Earth) and future prospects.

**Suggested Readings:**

**Books and Reports**

6. Wolfgang Torge, W., Geodesy, 3rd edition

**Textbooks**

- Rangwala, Town Planning, Charotar Publishing House, Anand, India
R.S.2.5 Elective-2

B. Geoinformatics for Resources Development and Disaster Management

Unit I
Natural Resources Development: Introduction and Scope: role of Geoinformatics technologies aerial photographs; satellite remote sensing; GPS; and GIS in resource evaluation
Water resources – surface water and groundwater resources: mapping and monitoring of watersheds, tanks and reservoirs; hydrogeomorphic mapping and identification of groundwater potential zones Ocean resources: estimation of sea-surface temperature; primary productivity and potential fishing zones

Unit II
Soil and agricultural resources: Spectral behavior of soils; Mapping of soils using multispectral images; Evaluation of soil erosion prone zones through GIS; Remote sensing in Land use / land cover mapping; Crop area estimations; monitoring of crop vigour; Yield estimations.
Forest resources: mapping of forest types; estimations of timber volume; monitoring of forest health – forest pests, forest fires, Trends in deforestation and afforestation.

Unit III
Remote sensing techniques for identification of rocks and minerals; mapping of geological structures; surface manifestation of minerals and their identification; spectral properties of minerals; role of thermal and hyperspectral remote sensing in mineral exploration. Case studies

Unit IV
Geoinformatics in Disaster Management: introduction and scope Coastal Hazards: Storm surges and Tsunamis: Origin, propagation and run-up; Role of coastal topography, bathymetry and vegetation; Coastal hazard preparedness –Role of geoinformatics in coastal hazard mapping, risk and vulnerability assessment and evacuation analysis; coastal protection, education and awareness of coastal communities

Unit V
Geoinformatics applications in disaster mapping and mitigation; Risk zone mapping: earthquakes – identification of geological structures like faults; volcanic activity – thermal imaging for monitoring temperature changes; Geoinformatics analysis of potential zones for landslides; avalanches; and floods. Mapping of disaster affected areas for rescue and mitigation; damage assessment; GIS-based decision support systems for disaster management

Books and References:
Geomatics solutions for Disaster Management, Li, Zlatanova and Fabbri (ed), Springer, 2007
Successful response starts with a map: Improving Geospatial Support for Disaster Management by Committee on Planning for Catastrophe: A Blueprint for Improving Geospatial Data, Tools,
Applications of Remote Sensing in Agriculture, M.D. Steven and J.A.Clark, Butterworths, 1990

Tsunamis- to survive from tsunami, Susumu Murata et al., 2009 World Scientific Books

Reference


R.S.2.5 Elective-2

C. Spatial Database Handling Modelling and GIS Implementing Architectures

Unit-I

**Spatial Database Management System:**

Database overview, attribute data model, Spatial Data base, spatial Data Type and structures. **Spatial Database Design:** Conceptual data modelling, Concepts of UML, UML use case, Spatial data topological relationship.

Unit-II

**Spatial Database:**

Storage and Retrieval Concepts of spatial data storage, spatial Indexing, Basics of relational algebra, Data normalization, Spatial Query languages using extended SQL, spatial query processing and optimization.

Unit-III

**GIS Implementing Architectures:**

GIS Implementation architectures (desktop, client server, enterprise, mobile, web/cloud, web services from mobile platforms, spatial data acquisition / supply in distributed environment and security issues.

Unit-IV

Spatial Data Modelling 05 Spatial data modelling and its classification, spatial decision support system, spatial decision modelling concepts, AHP based modelling with case study, Agent based modelling with case study.

Unit-V

**Spatial Data Mining:** Overview of data mining, Concepts of Decision tree based approach with case study, Content based image retrieval concept with case study.

Suggested Readings:

Books and Reports


Journal Articles

GE 2.7 – Geo-Engineering Field Work and Data Analysis

a) Geoelectrical survey and computations
b) Seismic refraction and reflection data computations.

a) Laboratory determination of soil classification
b) Attenberg limits
c) Specific gravity

Lab, permeability by constant and failing head methods
Direct Shear and triaxial shear test
Compaction and bulk density
Consolidation test

Field work and data analysis

Ground water exploration & Management
Well monitoring
Well/bore well pumping tests
Selection of pumps
Safe yield determination
Identification of gray areas
Design of rain water harvesting structures

Geotechnical exploration
Subsurface litho logy
Bed rock mapping
Identification of buried pipes
Location of infiltration wells in the river bed

Mobile mapping through GPS
point mapping
linear mapping
polygon mapping
GE 2.8 - Geographic Information Systems Practical

1. Familiarity with D Base Commands including record updating and processing.
2. Theme representation by usage of graphics command resources data maintenance - Theme filling and retrieval and usage.

Exercise: Development / updating of data base management software packages for a selected practical problem using available GIS package.
   Arc-info, Arc-View practice and ILWIS software packages
   Creation of different spatial layers.
   Map analysis.

III-SEMESTER & IV- SEMESTER
Dissertation and Viva Voce

A) Dissertation

The student for the fulfillment of M.Tech Degree in Remote Sensing must carry out individual dissertation work. Candidates can do their work in the department or in any industry/research organization for two semesters (ie 3rd and 4th semesters)
At the end of the third semester and fourth semester, an evaluation of the dissertation by the processes of conducting viva-voce 1. (preliminary) for 100 marks (1) and (2) a viva voce for 100 marks on the dissertation and related subjects.

B) Evaluation procedure

Progress of the dissertation/ thesis work at the end of 3rd Semester will be evaluated by a committee consisting of Chairman, Board of Studies, Head of the Department and Thesis guide.

The Final thesis at the end of 4th Semester is evaluated through defence and Viva Voce examination will be conducted to the student by the external examiner and the internal research guide along with the Head of the Department and Chairman Board of Studies, on the topic of the dissertation carried out by the student the candidate may be recommended for award of a grade such as A (=Excellent); B (=Very Good); C (=Good); or F (=Not Accepted/Failed).

The prerequisite for submission of the M.Tech.thesis is that one should communicate his/her work to any referred journal or Publication in a conference.

For final result the dissertation credits are not added for CGPA.