

ANDHRA UNIVERSITY



Regulations and Syllabus relating to
Master of Technology (M.Tech.) Degree Courses

In
GEO-ENGINEERING
(w.e.f. 2013-2014 admitted batch)

M.Tech. Geo-Engineering course

An applicant for admission into the M.Tech. Geo-Engineering course should have at least a second class degree with not less than 55% of marks in either:

B.E. / B.Tech. in any Engineering
OR
Master's degree in science

- 1) 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 fourth semester, there shall be (1) an evaluation of the dissertation, and (2) a viva voce 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) The evaluation of project work / Research work will be done by conducting viva voce examination at the end of third 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.

M.Tech. Geo-Engineering (Revised Syllabus)
Scheme of Instructions/ Examinations as per credit system w.e.f. admitted batch 2013-2014.

| Code No. | Name of the course | Periods per week | | Examination Duration Hours | Max. marks | | Credits |
|---------------------------------|--|------------------|------|----------------------------|--------------------------|-----------|---------|
| | | Lectures | Lab. | | Semester end examination | Sessional | |
| I SEMESTER | | | | | | | |
| GE101 | Mathematics & Statistics | 4 | - | 3 | 70 | 30 | 4 |
| GE 102 | Fundamentals of Computers | 4 | - | 3 | 70 | 30 | 4 |
| GE 103 | Principles of Photogrammetry and Photo interpretation | 4 | - | 3 | 70 | 30 | 4 |
| GE 104 | Earth Systems | 4 | - | 3 | 70 | 30 | 4 |
| GE 105 | Principles of Remote Sensing | 4 | - | 3 | 70 | 30 | 4 |
| GE 106 | Computer programming in 'C' practical | - | 6 | 3 | 70 | 30 | 3 |
| GE 107 | Photogrammetry and Photo interpretation practical | - | 6 | 3 | 70 | 30 | 3 |
| GE 108 | Remote sensing practical | - | 6 | 3 | 70 | 30 | 3 |
| II SEMESTER | | | | | | | |
| GE 201 | Geo-Exploration Techniques | 4 | - | 3 | 70 | 30 | 4 |
| GE 202 | Geo-Engineering Investigations | 4 | - | 3 | 70 | 30 | 4 |
| GE 203 | Geographic Information Systems | 4 | - | 3 | 70 | 30 | 4 |
| GE 204 | Environmental Studies | 4 | - | 3 | 70 | 30 | 4 |
| GE 205 | Electives 1. Water Resources Evaluation 2. Integrated Watershed Management | 4 | - | 3 | 70 | 30 | 4 |
| GE 206 | Geo-Engineering Practicals | - | 6 | 3 | 70 | 30 | 3 |
| GE 207 | Field work and data analysis | - | 6 | 3 | 70 | 30 | 3 |
| GE 208 | GIS Practicals | - | 6 | 3 | 70 | 30 | 3 |
| III and IV SEMESTERS | | | | | | | |
| Thesis / Dissertation / Project | | | | 30 | | | |

Course No. GE 101 - 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.

- 4) Theory of Sampling - Meaning of a sample, Universe, static and parameters. Sampling distribution, standard error. Different sampling techniques like scruple random sample, standard random sample, systematic, cluster and multi-storage sample.

Text Books

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

Course No. GE 102 - Fundamentals of Computers

Unit-1

Introduction to Computers / Data representation, Conversion of data. Memory organization, Different secondary storage devices and Magnetic media devices - Magnetic tape; CCTs, DATs, Cartridges, Magneto-optical disks, CDs (read and write) ZIP drives, PHDs (Pocket Hard Disks), Floppies and DVDs, Blue Ray Disc.

Data Representation - Representation of Characters in Computers, Representation of Integers, Representation of Fractions, Hexadecimal Representation of Numbers, Decimal to Binary Conversion, Error Detecting Codes.

Computer Memory - Memory Cell, Memory Organization, Read-only Memory, Serial Access Memory, Physical Devices used to Construct Memories, Magnetic hard Disk, Floppy Disk Drives, Magnetic Tape Drives, Flash Drives.

Unit-2

Binary Arithmetic, Complement representation, Boolean functions, Registers, Flip Flops, I/O Devices Types and Printers.

Processor - Structure of Instructions, Description of a Processor, A Machine Language Program. An Algorithm to Simulate a Hypothetical Computer.

Logic Circuits - Introduction. Switching Circuits, And / Or Operations, NOT operation, Boolean Functions, Postulates, Duality Principle, Theorems, Precedence of Operators, Venn Diagram, Truth Table, Canonical Forms for Boolean Functions, Logic Circuits, Parallel and Serial Adders, Physical Devices used to Construct Gates, Transistors, Integrated Circuits.

Unit-3

Operating System Concepts, Structures, Files, Directories, Process and Memory management.

Unit-4

Concepts of analysis of algorithms, fundamentals of data structures, arrays, stacks and queues.

Unit-5

Fundamentals of object oriented programming concepts, Computer Graphics: Fundamentals of Computer Graphics, Fundamentals of Multimedia and applications.

Text Books

1. Fundamentals of data structures by Horowitz F and Sahani S
2. Modern Operating Systems by Andres S Tanenbanm
3. Fundamentals of computers. V. Rajaraman

Course No. GE 103 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.

TEXT BOOKS

1. Aerial photographic interpretation, Lueder, D.R., McGraw Hill Book Co., 1959
2. Elements of Photogrammetry, Paul R. Wolf, McGraw-Hill, 2000
3. Remote sensing and Image interpretation, Lillesand and Keifer, John Wiley and Sons, 2000
4. Manual Photogrammetry, McGlone, C., Edward, M. and Bethel, J, American Society for Photogrammetry and Remote Sensing, Bethesda, Maryland, USA. 2005
5. Digital Elevation Model Technologies and Applications: The DEM user Manual, David F. Maune (ed), American Society for Photogrammetry and Remote Sensing, Bethesda, Maryland, USA, 2001
6. Leica Photogrammetry Suite – Orthobase and Orthobase Pro User Guide, Leica Geosystems, GIS & Mapping, Atlanta, USA, 2003.

Course No. GE 104 - 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
3. Geology of India & Burma by M.S. Krishna 6th, Ed.

4. General Climatology by H.J. Critchfield
5. Physical Geology by Arthur Holmes
6. Physical Geography by Stahler
7. The Atmosphere by Frederick K. Lutgens and Edward J. Tarbuck

Course No. GE 105 – Principles of Remote Sensing

Unit-I Basics of Remote Sensing

- a) **Overview of Remote sensing:** Definition of Remote sensing
Principles of Remote Sensing, Electromagnetic Radiation, Radiometric terms and definitions, Radiation Laws, EM spectrum, Sources of EM, Interaction of EM Radiation with atmosphere, and target, Atmospheric Windows, imaging spectrometry, Spectral signature of various land cover features
- 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-4 Thermal Imaging system

- Thermal Imaging System: Introduction - IR region of the Electromagnetic spectrum, Atmospheric transmission, Kinetic and radiant temperature, Thermal properties of materials, Emissivity, Radiant temperature. Thermal conductivity. Thermal capacity, thermal inertia, apparent thermal inertia, Thermal diffusivity.
- Radiation principles (Plank's Law, Stephen Boltzman law), Interaction of EMR with earth surface, Wien's displacement law, Kirchoffs Law).
- IR - radiometers, Airborne and Satellite TTR 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

1. Floyd, F. Sabins, Jr: Remote Sensing Principles and Interpretation, Freeman and Co., San Franscisco, 1978.
2. Illesand and Kiefere: Remote Sensing and Image interpretation, John qwiley, 1987.
3. Manual of Remote Sensing Vol. I&II, 2nd Edition, American Society of Photogrammetry.
4. Remote Sensing: The quantitative approach, P.H. Swain and S.M. Davis, McGraw Hill.
5. Introductory Digital Image Processing: A remote sensing perspective, John R. Jensen, Prentice Hall.
6. Imaging Radar for Resource Survey: Remote Sensing Applications, 3, W Travelt, Chapman & Hall.
7. Remote sensing Notes –Edited by Japan Associates of Remote sensing- JARS 1999

Course No. GE 106 - Computer Programming in 'C' Practical

1. Introduction
2. Control Statements
3. Arrays
4. Functions
5. Console Input/Output functions.
6. Pointer variables
7. Structures and Unions
8. Command line Arguments
9. File Handling in 'C'
10. Processor Devices & Standard library functions.

GE 107 Photogrammetry and Photo interpretation Practicals

Testing stereo vision

Use of Lens stereoscope and Mirror stereoscope

Determination of vertical exaggeration

Use of Parallax Bar for height calculation from aerial photographs

Calculation of scale of the photographs

Marking Principal point and conjugate principal point on the stereopairs

Preparation of aerial mosaics

Interpretation of aerial photographs for identification of landforms of fluvial, Aeolian, glacial, coastal, volcanic and arid processes

Identification of tectonic elements from aerial photographs

Digital photogrammetry – digital image matching and collection of mass points

Construction digital terrain models

Application of DTMs – contour generation; fill; fly through; slope and aspect; viewshed analysis; watershed and drainage extraction; volumetric analysis; preparation of orthoimages.

Course No. GE 108 - Remote Sensing - Practical

Study of Remote Sensing Imagery for :

1. Identification of geological, geomorphologic and cultural forms (IRSIA & 1B)
2. Water resources studies (TMIRS & SPOT)
3. Environmental Impact assessment (SPOT)
4. The student should select a theme for visual interpretation and prepare a practical report as one of the inputs to the practical examination assessment.

Course No. GE 201 - 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.
2. Seismic Methods in oil prospecting by L.L. Nettleton.
3. Log Interpretation by Schlumberger.

Course No. GE 202 - 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

1. Handbook of Geology in Civil Engineering by Robert F. Legget and Paul F. Karrow (McGraw Hill, 1983)
2. Engineering Geology Publications of G.S.I.

Course No. GE 203 - 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 from 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, Dijkstras's algorithm, geometric networks) Raster data analysis: Local, Neighborhood and regional operations.
- b) Methods of Data Analysis and Spatial Modeling: Introduction, definition of the database. Simple data retrieval. A general approach to map overlay, Cartographic modeling using natural language commands. Linking command sequences into cartographic models, advantages and disadvantages of cartographic modeling in land evaluation and planning.

- 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

1. Principles of Geographical Information System for Land Resource Assessment, P.A. Burrough, Clarendon Press, Oxford, 1986.
2. Geographic Information Systems, T.R. Smith & Piquet, London Press, 1985.
3. Principles of data base systems, J.D. Ullman, Computer Science Press.
4. Longly, Paul A., Goodchild, Michael F., Maguire, David J., and David W. Rhind.(2005) Geographic Information System and Science, @nd ed., John Wiley and sons, Toronto.
5. Marguerite, Maddm, (2009). Manual of Geographic Information system, ASPRS, 2009

Web Sites

1. <http://www.gespatialworld.net>
2. www.earthmapping.com/
3. <http://www.esri.com/>
4. <http://www.innovativegis.com/basis/>

Course No. GE 204 - 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- green house 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
- 4) Remote Sensing of the Environment – An earth resource perspective, John R. Jenson, Pearson Education (Singapore) Pvt. Ltd.
- 5) Modern Concepts of Ecology, H.D. Kumar, Vikas Publishing House Pvt. Ltd.
- 6) Environmental Impact Analysis: A new dimension in decision making, second edition, R. K. Jain, L. V. Urban and G.S. Stacy, published by Van Nostrand Reinhold Company
- 7) Pollution Control and Conservation, Kovacs, M.(ed), Ellis Horwood Ltd., Budapest, 1985
- 8) Biogeography, Robinson, H. ELBS, London, 1978
- 9) Preventive and Social Medicine, Park & Park, Banarasidas

Course No. GE 205.1(elective) - 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

Course No. GE 205.2(elective) Integrated Watershed 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; farm 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, pisciculture, 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

1. Watershed Management, J.V.S. Murthy - Publishers; New Age International (P) Ltd., New Delhi.
2. Space Technology Applications for Sustainable Developments at Watersheds, Technical Report, ISRO-HQ-TR-104-95, ISRO, Bangalore.
3. Watershed Management Project Planning, Monitoring and Evaluation; A Manual for the Asian Region - Asian-US Watershed Project - Forestry for sustainable Development Program. University of Minnesota, College of Natural Resources, St. Paul Minnesota, U.S.A.

Course No. GE 206 – Geo-Engineering Practicals

- 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 falling head methods
Direct Shear and triaxial shear test
Compaction and bulk density
Consolidation test

Course No. GE 207 – 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

Course No. GE 208 - Geographic Information Systems Practicals

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.

SEMESTERS III & IV 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)

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..