

ANDHRA UNIVERSITY



Regulations and Syllabus relating to
Master of Technology (M.Tech.) Degree Courses (Part Time – Self finance)

1. GEO-ENGINEERING (w.e.f. the admitted Batch of 2008-2009)

Admission requirements for M.Tech. (Geo-Engineering)

An applicant for admission into the Master of Technology degree course in Remote Sensing is required to have passed, at least in second class with not less than 55% marks, in either:

B.E./B.Tech. in any Engineering

OR

Master's degree in science

A) A regular course of study means attendance is not less than 75 per cent of lectures Preference will be given to the Candidates who have qualified in Graduate Aptitude Test in Engineering (GATE) held for the purpose of admission into Post graduate Course in Engineering.

1. 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 3 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, mid semester, 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 percent 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 third semester by a Board of Examiners consisting of :

- i. Head of the Department
- ii. Chairman, Board of Studies
- iii. The Internal Research Director
- iv. One or two experts from outside the Department / University nominated by the Vice-Chancellor.

The dissertation shall be either "recommended", or "Not recommended".

v. 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.

vi. 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.

M.Tech Course Geo-Engineering (Part-time)
Scheme of Instructions /Examinations as per credit system w.e.f. admitted batch 2007-2008.

Code No.	Name of the course	Periods per week		Examination Duration/ Hours	Max. marks		Credit
		Lectures	Lab.		Semester end examination	Sessional	
I SEMESTER							
GEP 101	Mathematics & Statistics	4	-	3	70	30	4
GE P102	Computer Fundamentals	4	-	3	70	30	4
GE P103	Computer programming in 'C'	-	6	3	70	30	3
GE P104	Map Analysis	-	6	3	70	30	3
II SEMESTER							
GE P201	Earth Systems	4	-	3	70	30	4
GE P202	Principles of Photogrammetry and Photo Interpretation	4	-	3	70	30	4
GE P203	Principles of Remote Sensing	4	-	3	70	30	4
GE P204	Geographic Information System	4	-	3	70	30	4
GE P205	Photo interpretation and Remote Sensing	-	6	3	70	30	3
GE P206	Geographic Information system	-	6	3	70	30	3
III SEMESTER							
GEP 301	Geo-exploration Techniques	4	-	3	70	30	4
GEP 302	Geo-Engineering Investigations	4	-	3	70	30	4
GEP 303	Water Resources	4	-	3	70	30	4
GEP 304	Watershed Management	4	-	3	70	30	4
GEP 305	Geo-exploration techniques	-	6	3	70	30	3
GEP 306	Water Resources	-	6	3	70	30	3
IV SEMESTER							
PROJECT/ DISSERTATION WORK AND VIVA-VOCE							12
Total Credits							70

Course No. GEP 101 - Mathematics and Statistics

Unit-1

Fundamentals: Sets and Subsets, Sequences, Operations on Sets; Counting sequences, and subsets (permutations and combinations) Algorithms and Pseudocode: 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; Representation of special grammars and Languages; Tree searching; Undirected Trees

Unit-4

Measurement of Central Tendency, Mean, Mode, Median, Geometric mean and Harmonic Mean.

Measures of variations - Range, Quintile deviations, Mean deviation, Standard deviation and variance, Coefficient of variations.

Probability concepts - Additions and multiplication laws, Basic problems on These laws. Concept of random variables and probability distribution.

Unit-5

Theoretical distribution; Binomial, Poisson and normal with application.

Correlation Analysis - Introduction, Karl Pearson's Coefficient of Correlation, Andro Correlation.

Regression Analysis - Linear regression analysis; Curve fitting concept of multiple regression analysis.

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.Guptas

Course No. GEP 102 - Computers Fundamentals

Unit-1

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

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

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, Summary, Review Questions.

Unit-2

Binary Arithmetic, Complement representation, Boolean functions, Registers, 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, Summary, Review Questions. 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, Summary, Review Questions.

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: Design and Analysis. Computer Graphics: Fundamentals of Computer Graphics.

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. GEP 103 - Computer Programming in 'C' Practical

1. Introduction
2. Control structures
3. Arrays
4. Functions
5. Storage classes
6. Pointer variables
7. Structures and Union
8. Command line Arguments
9. File Handling
10. Processor Devices & Data structures using C

Course No. GEP 104
Map analysis Practical

- a. Study of topographic maps
 - b. Morphometric analysis of a drainage basin
 - c. Slope analysis of a drainage basin
 - d. Rainfall analysis
 - e. Estimation of Evaporation and Evapotranspiration
 - f. Determination of various meteorological instruments and data collection.
- Visit to meteorological data collection platform (INSAT)

Course No. GEP 201 - Earth Systems

Unit-1

- a) Earth - Orbit, Rotation, Time
- b) Oceans - Depth, Bottom, Relief
- c) Oceans - Temperature, Salinity, Density
- d) Oceans - Waves, Tides, Currents
- e) Climate and the atmosphere - scope, origin and nature, composition & vertical division of the atmosphere.

Unit-2

- a) Meteorological parameters and their measurements - pressure, temperature, wind, precipitation, humidity, and radiation.
- b) Geographical, seasonal and vertical distribution of temperature, pressure, wind and precipitation.
- c) Solar and terrestrial radiation : Distribution in clear, cloudy and average conditions. Mean heat balance. Role of ozone, water vapour and carbon dioxide.
- d) Weather disturbances : Air mass and Front, Cyclone and anti-cyclone. Thunderstorm and tornado.

Unit-3

- a) Climate and agricultural factors in crop production.
- 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) Oceans 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 & Repolith, 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 Moriand Billings, 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

**Course No. GEP 202 - Principles of Photogrammetry and
Photointerpretation**

Unit-I

Fundamentals of Photogrammetry and Photointerpretation - types of photographs.
Vertical aerial photographs - Principal point, scale on photographs.

Stereoscopy

Vertical exaggeration - factors involved and determination

Overlap, Sidelap and flight planning.

Unit-II

Geometric elements of vertical aerial photographs.

Determining horizontal ground lengths, directions and angles from photo coordinates

Relief displacement on vertical aerial photographs

Parallax and parallax measurement - monoscopic and stereoscopic methods.

Unit-III

Aerial mosaics comparisons with maps.

Elements of aerial photointerpretation

- | | | |
|----------------------|----------------|------------------------------|
| (a) rock types | (b) land forms | (c) surface drainage pattern |
| (d) erosion features | (e) greytones | (f) Miscellaneous elements |

Unit-IV

Applications of aerial photo-techniques

Civil Engineering projects

Geological and Geomorphological investigations

Soil, agriculture and forest surveys

Unit-V

Elements of Cartography

Maps and their uses - scale on maps

Map projections - types of projection

Cartographic design - symbols and lettering

Interpretation of topographic maps - comparison with aerial photos and satellite imagery

Text Books

1. Lueder D.R., Aerial photograpshic Interepretation, McGraw-Hill Book Co., 1959
2. Principles and application of Photogeology by Shiv N. Pandy.
3. Remote Sensing and Image Interpretation by Lillesand/Kierfer.
4. Map work and Practical Geography: Raghunandan Tilak & L.R.S. Kanaujia, Central Book Depot, Allahabad.
5. R.L. Sing: Elements of Practical Geography.
6. Robinson, A.H. & R.D. Sale: Elements of Cartography, John Wiley & Sons.
7. Raisz : Principles of Cartography, John Wilens McGraw-Hill Book & Co.

Course No. GEP 203 - Principles of Remote Sensing

Unit-1

- a) Radiation : Solar radiation, Radiation terminology, Black body radiation, Electromagnetic Spectrum. Atmospheric effects, Atmospheric windows, Scattering and transmission. Reflectance and absorption in remote sensing.
- b) Multispectral instruments : Introduction to radiation instrument principles, Photon, Infrared and thermal detectors. Photomultipliers, Charge coupled devices, multispectral line scanners. Photographic systems, M-7 Airborne scanner, Landsat multispectral scanner (MSS & TM), IRS, ERS, NOAA and SPOT cameras, Skylab multispectral scanner.

Unit-2

- a) Data Acquisition: Analog digital conversion. Data flow in an information system. Calibration, data collection. Data flow in satellite system. Data flow in Aircraft system. Data flow in field spectral system.
- b) Data processing: Orbital mechanics for Geo, Sun synchronous and Conical orbits, path and row concepts for various existing satellites. Sources of Geometric and Radiometric errors. Radiometric corrects. Geometric corrections, Geo-coding resampling.

Unit-3

- a) Microwave Remote Sensing
 - i) Introduction - Electromagnetic spectrum, Airborne and Space borne radar systems basis instrumentation.
 - ii) System parameters - Wave length, Polarization, Resolutions, Radar geometry.
 - iii) Target parameters - Back scattering, Point target, Volume scattering, Penetration, Reflection, Bragg resonance, Cross swath variation. Speckle radiometric calibration.
 - iv) Radar - Geometry - Introduction, Mosaicing Stereoscope.
 - v) Application : Geology, Forestry, Land use, Soils etc. Future trends and Research
- b) Thermal Imaging system
- c) Ground measurements in support of Remote Sensing

Unit-4

- a) 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.
- b) IR - radiometers, Airborne and Satellite TTR scanner system
- c) Characteristics of IR images
 - i) Scanner distortion, ii) image irregularities, iii) Film density and recorded temperature range
 - d) Effects of weather on images
 - i) Clouds, ii) Surface winds, iii) Penetration of smoke plumes
 - e) Interpretation of thermal imagery
 - f) Advantages of Thermal imagery

Unit-5

- a) Fundamentals of Image Interpretation - Techniques and Elements of image interpretation, size, shape shadow, tone, texture, pattern, site association. Techniques of Image interpretation. Visual requirements of image interpretation and equipment required. Interpretation of photographic image, passive microwave imagery, visible non-photographic imagery. Radar imagery, performances test in image interpretation.
- b) Data formats :

Computer compatible tapes - Band sequential format, Band inter leaved 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.

List of Text Books

1. Floyd, F. Sabins, Jr: Remote Sensing Principles and Interpretation, Freeman and Co., San Francisco, 1978.
2. Illesand and Kiefere: Remote Sensing and Image interpretation, John wiley, 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.

Course No. GEP 204 - Geographic Information Systems

Unit-1

- a) Introduction to Data base systems - Data base system levels of abstraction in DBMS principles of data base. Model of real world. Introduction to data organization, information management system preliminary study of INGRES, ORACLE, RDBMS and DBASE.
- b) Introduction to Geographical Information Systems: Introduction maps and spatial information. Computer assisted mapping and map analysis. Geographic Information Systems. The components of geographical Information System. Future directions and trends in GIS.

Unit-2

- a) Data structures for Thematic maps. Data structures for Geographic Information Systems. Points, lines and areas. 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. Data structures for thematic maps - The choice between raster and vector.
- b) 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.

Unit-3

- a) Data input, verification, storage and output: Data input, data verification, correction and storage data output; data user interfaces.
- 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.

Unit-4

- a) 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.

- b) Classification methods: Classification, Multivariate analysis and classification, allocating individuals to existing classes. Expert systems for Geographical Information Systems. Classification methods in geographical information systems.

Unit-5

- a) 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. The procedure to following when setting up a geographical information system.
- b) 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.

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.

Course No. GEP 205 – Photo Interpretation and Remote Sensing - Practical

- a. Identification of Landforms of wind and Rivers - 4 stereo grams
 - b. Identification of landforms of glaciers and oceans - 4 stereo grams
 - c. Identification of landforms of volcanoes and arid cycle - 4 stereo grams
 - d. Parallax bar measurements of ground lengths, directions of photo coordinate
 - e. Determination of vertical Exaggeration
- Study of Remote Sensing Imagery for :
- f. Identification of geological, geomorphologic and cultural forms (IRSIA & 1B)
 - g. Water resources studies (TMIRS & SPOT)
 - h. Environmental Impact assessment (SPOT)
 - i. 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. GEP 206 - Geographic Information Systems(GIS) Practical

Familiarity with D Base Commands including record updating and processing.

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.

Course No. GEP 301 - 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. Fundamental 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

GEP 302 - 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, Srisaialam 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. GEP 303 - Water Resources Evaluation**Unit-1**

- a) Quantitative geomorphology of drainage basins and channel
- b) Runoff
- c) Hydrology of Urban areas

Unit-2

- a) Hydrology of Agricultural lands
- b) Hydrology of Forest lands and Range lands
- c) Hydrology of arid and Semi-arid regions
- d) Floods

Unit-3

- a) Groundwater Potential areas in India
- b) Aquifer Properties and ground water flow
- c) Well Hydraulics

Unit-4

- a) Sea water intrusion
- b) Ground water basin management and conjunctive use
- c) Ground water pollution and legislation

Unit-5

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

List of Text Books

1. Hand book of Applied Hydrology by Ven Te Chow
2. Groundwater by H.M. Raghunath
3. Water Resources Engineering by R.K. Linsely & J.B. Franzini

Course No. GEP 304 – Water Resources Management**Unit-1** (Waterhed 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, store 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. Previous 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, clopping 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 food 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, Silvapastures, 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. GEP 305 - Site Investigations Practicals

1. a) Geoelectrical survey and computations
b) Seismic refraction and reflection data computations.
2. a) Laboratory determination of soil classification
b) Attenberg limits
c) Specific gravity
3. Lab, permeability by constant and falling head methods
4. Direct Shear and triaxial shear test
5. Compaction and bulk density
6. Consolidation test

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. GEP 306 – Water Resources Evaluation Practicals

1. Morphometric analysis of a drainage basin.
2. Water balance studies.
3. Hydrograph analysis.
4. Stage Discharge computation.
5. Estimation of Run-off.
6. Estimation of ground water recharge.

4th Semester - Dissertation & Viva Voce

- (A) Dissertation : Individuals dissertation work must be carried out by the student for the fulfillment of M.Tech. Degree in Geo-Engineering.
- (B) Comprehensive Viva Voce : A Viva Voce will be conducted to the student by the external examiner and the Internal research guide and teachers who have taken class for M.Tech. Geo-Engineering on the topic of the dissertation carried out by the student and the subjects studied in the I and II Semesters.