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 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.
<table>
<thead>
<tr>
<th>Code No.</th>
<th>Name of the course</th>
<th>Periods per week</th>
<th>Examinations</th>
<th>Max. marks</th>
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Course No. GEP 101 - Mathematics and Statistics

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

Unit-2
Relations and Digraphs; Product sets & Paths in Relations & Diagraphs; 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.

Text Books
1. Statistics by S.P. Gupta
2. Statistirical 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, Cartridges, 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.

Unit-3
Operating System Concepts, Structures, Files, Directories, Process and Memorare management.

Unit-4
Concepts of analysis of algorithms, fundamentals of data structures, arrays, stacks and queues.

Unit-5

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.

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 Morian and Billings, 1984
2. Earth History & Plate Tectonics by Carl K. Seyfert, Leslie A. Sirkin
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. Panday.
5. R.L. Sing: Elements of Practical Geography.
Course No. GEP 203 - Principles of Remote Sensing

Unit-1

Unit-2

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.
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
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
b) Data formats:
Computer compatible tapes - Band sequential format, Band inter laved 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

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.

Unit-2
b) Digital Elevation Models: The need of DE Ms, 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 imput, data verification, correction and storage data output; data user interfaces.

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.

**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

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**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: Lithological 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.

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
2. Groundwater by H.M. Raghunath

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)
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 silvastures; 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, 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.


**Text Books and References**


**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 failing 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.
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.

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.