DEPARTMENT OF GEO-ENGINEERING

SCHEME OF INSTRUCTION AND SYLLABUS

M.Tech. (REMOTE SENSING)

(With effect from 2019-20 admitted batch)

DEPARTMENT OF GEO-ENGINEERING

COLLEGE OF ENGINEERING

ANDHRA UNIVERSITY

VISAKHAPATNAM-3

OBJECTIVES :

The course is designed to fulfill the following objectives

1. To provide exposure to students in gaining knowledge on concepts and applications leading to modeling of earth resources management using Remote Sensing

2. To acquire skills in storing, managing digital data for planning and development

3. To acquire skills in advance techniques such as hyper spectral, thermal and LiDAR scanning for mapping, modeling and monitoring.

PROGRAM OUTCOMES :

PO1. Fully equipped with concepts, methodologies and applications of Remote Sensing Technology.

PO2. Prepare the candidates for National and Global Employability

PO3. Acquire skills in handling instruments, tools, techniques and modeling while using Remote Sensing Technology

PO4. It empowers the candidate with confidence and leadership qualities.

PO5. Ability to analyse and interpret remote sensing data using various software and tools for image processing, classification, and visualization.

PO6. Understanding of the principles and techniques of remote sensing and GIS , including the theoretical and practical aspects of data acquisition, processing, and analysis.

PROGRAM SPECIFIC OUTCOMES:

PSO1. Ability to design and conduct independent research projects in remote sensing, including the formulation of research questions, data collection, analysis, and interpretation.

PSO2. Knowledge of the applications of remote sensing and GIS in various fields, such as agriculture, environmental monitoring, urban planning, and natural resource management.

PSO3. Awareness of the ethical, legal, and societal implications of remote sensing, including privacy and security issues, data access and ownership, and the responsible use of remote sensing data.

M.Tech. Remote Sensing course:

AnapplicantforadmissionintotheM.Tech.RemoteSensingshouldhaveatleastasecondclasswithnotless than55%marksdegreeineither:

B.E./B.Tech.inanyEngineering

OR

Master's degreeinscience

Intheavailablenumberofseats,50%arereservedforB.Sc.(Ag.)/B.E./B.Tech.

Applicants. If sufficient numberof eligibleapplicantsisnotavailablein eitherofthetwogroups,the eligible applicantsfromtheother group aregivenadmission,to fillall theavailable seatsinM.Tech. (Remote Sensing).

1. A) A regular course of study means attendance is not less than 75 per cent of lectures, practical, drawing exercises, workshop and practical and field andproject 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 specialcasesforsufficientcauseagaintheVice-Chancellormayontherecommendationofthe Principal,condonethedeficiencyinattendance,notexceeding10percent, for reasons of illhealth when the application is submitted at the time of the actual illness and is supported by an authorized Medical Officer approved by thePrincipal.

B) However, in the case of students, who participate in activities, such as NCC, Inter- University Tournaments, National Tournaments Inter UniversityCourses. 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 becondonedbythe Principal on therecommendationof the Head of theDepartment.

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)TheCandidateshouldchooseone electivefromElective-1andElective-2in thefirst andsecondsemester.

C) Thecandidatesarerequiredtosubmit,attheendof thefourthsemester,threecopies(asprescribed)ofthedissertationonorbeforeadatetobenotifiedbythe Universityfromtimetotime,accompaniedbythreecopiesof ashortsummary, allofwhichwill be retainedbytheUniversity.

D) Attheendofthethirdsemesterandfourthsemester,anevaluationofthedissertationthereshallbeviva-voce(preliminary)for100marks(1)and(2)avivavoce for100markson thedissertation andrelatedsubjects.

E) MarksforsessionalworkshallbeallottedbytheTeachingStaffofthecollegeonthebasisofclasswork,sliptests, practicalworks,etc.,andthelistofmarks shall besent totheRegistrar,before thecommencement ofthe writtenexamination.

F) Fortakingtheexaminationinthetheoryinanysubjectcandidatesshallberequiredtoobtainaminimumof50per centinsessionalworkinthatthesubject,failingwhich,theyshall berequiredtorepeatthecourse inthat subjectin thesemester inwhichitisofferedagainforstudy.

G) 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 requiredto pass the examinationin thesubjectsin whichtheyhavefailed,in thesubsequent examination.

H) 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 theorypaper 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

isprescribed,candidatesshouldsecure 50 percentofthemarksallotted toeach of thesesubjects.

3. A) The evaluation of Project work / Research work will be done by conducting viva voce examination at the end of third and fourth semester by a Board ofExaminers consistingof:

1. HeadoftheDepartment
2. Chairman,BoardofStudies
3. TheInternalResearchDirector
4. Oneortwoexperts fromoutsidetheDepartment/UniversitynominatedbytheVice-Chancellor.

Thedissertationshallbeeither"recommended"(withgradesA,B,C),or"Notrecommended"(withgradeFstandsforfailed).

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 havepassedin firstclass.

Alltheremainingsuccessfulcandidatesshallbedeclaredtohavepassedinsecondclass.

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 passonly 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 theUniversityconductsthe examinationsin 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 CumulativeGradePoint Average isawarded at theendof the course byUniversity.

Department of Geo-Engineering

M.Tech. Remote sensing

Scheme of Instructions and examination

(with effect from 2018-2019 academic year)

I-SEMESTER

Code No.	**CourseTitle**	**Scheme ofInstructions**			**SchemeofExaminations**			**Total**	**Credits**
		Lec	Lab	Total	Duration ofExam. (hrs)	Theory /Lab/Viva	Sessional		
RS1.1	Mathematics andStatistics	4	-	4	3	70	30	100	4
RS1.2	Principlesof RemoteSensing	4	-	4	3	70	30	100	4
RS1.3	Principlesof Photogrametry andPhotointerpretation	4	-	4	3	70	30	100	4
RS1.4	EarthSystems	4	-	4	3	70	30	100	4

RS1.5	Elective1 **A.** Coastal ZoneManagement **B.** Natural DisasterManagement **C.** SatelliteMeteorology,Agriculture andOceanography	4	-	4	3	70	30	100	4
RS1.6	Elective2 **A**. MathematicalMorphology inImage Processing**B.**Water ResourcesManagement C. Geoinformaticsfor Earth ScienceApplications	4	-	4	3	70	30	100	4
RS1.7	Lab:1Photogrammentry and Photointerpretation practicals	-	3	3	3	50	50	100	2
Rs1.8	Lab:2 Remotesensingandimageinterpretationpracticals	-	3	3	3	50	50	100	2
		24	6	30		520	280	800	28

II SEMESTER

CodeNo.	CourseTitle	Scheme ofInstructions			SchemeofExaminations			Total	Credits
		Lec	Lab	Total	Durationof Exam.(hrs)	Theory/Lab/Viva	Sessional		
RS2.1	Digital ImageProcessing andInterpretation	4	-	4	3	70	30	100	4
RS2.2	Remote Sensingapplications	4	-	4	3	70	30	100	4
RS2.3	Geographic InformationSystems	4	-	4	3	70	30	100	4
RS2.4	AdvancesinRemote Sensing	4	-	4	3	70	30	100	4

RS2.5	Elective 1**A.**Geoinformatics forEnvironmentalstudies **B**. WatershedManagement**C**.Urbanplanning and informationsystem	4	-	4	3	70	30	100	4
RS2.6	Elective 2**A**.DigitalPhotogrametry andMapping **B.** Geoinformatics forDisaster management**C**.Sapatial DatabaseandGISModeling	4	-	4	3	70	30	100	4
RS2.7	Lab.1DigitalImage processingpracticals	-	3	3	Viva-Voce	50	50	100	2
RS2.8	Lab.2GISpracticals	-	3	3	Viva-Voce	50	50	100	2
		24	6	30		520	280	800	28

IIIrd SEMESTER

Code No.	Course Title	Scheme of Examination	Total Marks	Credits
RS 3.1	Dissertation(Preliminary)	Viva - Voce	100	12

IVth SEMESTER

Code No.	Course Title	Csheme of Examination	Total Marks	Credits
RS 4.1	Dissertation (Final)	Viva - Voce	100	12

SEMESTER I

RS1.1-Mathematics and Statistics

COURSE OBJECTIVES:

• To familiarize the students with the foundations of probability and statistical methods.

• To explain the concepts in random variables and several distributions in engineering applications.

• To teach the concepts of correlation, regression and estimations and their properties.

- To explain the concept of testing of hypothesis for largesamples.

• To impart knowledge on small sample tests

COURSE OUTCOMES:

After completion of the course, the student will be able to

- classify the concepts of Data Science and its importance(L2)

• apply discrete and continuous probability distributions

- explain the association of characteristics through correlationand regression tools
- identify the components of a classical hypothesis test
- Use the statistical inferential methods based on small and large sampling tests

Unit-1 Fundamentals: Sets and Subsets, Sequences, Operations on Sets; Counting sequences, and subsets (permutations and combinations) Algorithms andPsudocode:Induction and Recursion: Divisionintheintegers:Matrices

Unit-2 RelationsandDigraphs;Productsets&PathsinRelations&Digraphs;PropertiesofRelations;EquivalenceRelations;ComputerRepresentationandDigraphs;Manipulation ofRelations; TransitiveclosureandWarshall'sAlgorithm.

Unit-3 a) Functions; Functions - The Pigeonhole principle; Permutations b) Trees & Languages Trees; Labeled Trees; Language; Context free languages andderivationtrees.Ambiguityincontext free grammar.

Unit-41)MeasurementofCentralTendency,Mean,Mode,Median,GeometricmeanandHarmonicMean.

2) Measuresofvariations - Range,Quintiledeviations,Meandeviation,Standarddeviationandvariance,Coefficientofvariations.

3) Probabilityconcepts-Additionsandmultiplicationlaws,Basicproblemsontheselaws.Conceptofrandomvariablesandprobabilitydistribution

Unit-51)Theoreticaldistribution;Binomial,Poissonandnormalwithapplication.

2) CorrelationAnalysis-Introduction,KarlPearson'sCoefficientofCorrelation,AutoCorrelation.

3) RegressionAnalysis -Linearregressionanalysis;Curvefittingconceptofmultipleregressionanalysis.

4) TheoryofSampling-Meaningofasample,Universe,staticandparameters.Samplingdistribution,standarderror.Differentsamplingtechniqueslikescruplerandomsample, standard randomsample,systematic, cluster andmulti-storage sample.

TextBooks

1) StatisticsbyS.P.Gupta
2) StatisticaltheoryandmethodsbySANCHETICandKapoor
3) StatisticsbyS.C.Gupta

RS1.2 Principles of RemoteSensing

COURSE OBJECTIVES

The Objective of the course is to

- Introduce the concept of remote sensing and its principles.
- Expose the various remote sensing platforms and sensors and to introduce the elements of data interpretation.
- Impart knowledge on data reception and corrections.
- Introduce thermal and microwave remote sensing techniques and their applications.

COURSE OUTCOMES

After completion of the course the student will be able to understand

- The characteristics of electromagnetic radiation and its interaction with earth features.
- The types and configuration of various satellites and sensors.
- The elements of data interpretation.
- Gain knowledge in Thermal and microwave remote sensing techniques.

Unit-I BasicsofRemoteSensing:a) **OverviewofRemotesensing:**DefinitionofRemotesensing PrinciplesofRemoteSensing,ElectromagneticRadiation,Radiometrictermsanddefinitions,RadiationLaws, EMspectrum,SourcesofEM,InteractionofEMRadiationwithatmosphere, andtarget,AtmosphericWidows,imagingspectrometry,Spectralsignatureofvariousland covefeatures

a) PLATFORMS AND SENSORS * **Platforms:** Types of platforms, ground, airborne, and space born platforms, Orbit of satellites, Kepler's Law, satellitecharacteristics, satellites for Earth observations studies, and planetary missions (Chandrayana) * **Sensors:** Types and classification of sensors, imaging modes,Characteristics of opticalsensors,sensor resolution-spectral, radiometricandtemporal, Characteristics ofdetectors,

Learning outcomes:

- Summarize the basic concepts of remote sensing and electromagnetic radiation
- Identify different platforms and sensors use in remote sensing

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

Learning outcomes:

After completion of this unit the student will be able to

- Explain the concept of data generation and processing

- Explain various errors and corresponding corrections of satellite data

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 andFalseColor Composites.Generallysupportedscales ofthedata products, Informationabout annotationof the products.

Learning outcomes:

After completion of this unit the student will be able to

- Explain basic principles of image interpretation
- Identify band formats and various data products

Unit-4 Thermal Imaging system: * Thermal Imaging System: Introduction - IR region of the Electromagnetic spectrum, Atmospheric transmission, Kinetic andradiant temperature, Thermal properties of materials, Emissivity, Radiant temperature. Thermal conductivity. Thermal capacity, thermal inertia, apparent thermalinertia, Thermal diffusivity. * Radiation principles (Plank's Law, Stephen Boltzman law), Interaction of EMR with earth surface, Wien's displacement law, KirchoffsLaw). * IR - radiometers, Airborne and Satellite TTR scanner system * Characteristics of IR images i) Scanner distortion, ii) image irregularities, iii) Film density andrecorded iv)Temperature ranges * Effects of weather on images i) Clouds, ii) Surface winds, iii) Penetration of smoke plumes * Interpretation of thermal imagery *Advantages ofThermal imagery

Learning outcomes:

After completion of this unit the student will be able to

- Outline the concept of thermal remote sensing and related physical principles
- Identify various applications of thermal remote sensing

Unit-V Microwave Remote Sensing: * Introduction - Electromagnetic spectrum, Airborne and Space borne radar systems basis instrumentation. * Systemparameters - Wave length, Polarization, Resolutions, Radar geometry. * Target parameters - Back scattering, Point target, Volume scattering, Penetration,Reflection,Braggresonance,Crossswathvariation.Speckleradiometriccalibration.*Microwavesens orsandImagecharacteristics,Microwaveimageinterpretation * Application : Geology, Forestry, Land use, Soils etc. Future trends and Research * Physics of lager, laser interaction with objects. Types of LiDAR(Topographic,Bathymetric)platformsof LiDAR,componentsofLiDAR.

Learning outcomes:

After completion of this unit the student will be able to

- Explain principles of microwave remote sensing and its applications
- Explain the concept of LIDAR and its components

ListofTextBooks

1. Floyd,F.Sabins,Jr:RemoteSensingPrinciplesandInterpretation,FreemanandCo.,SanFranscisco,1978.
2. IllesandandKiefere:RemoteSensingandImageinterpretation,Johnqwiley,1987.
3. ManualofRemoteSensingVol.I&II,2ndEdition,AmericanSocietyofPhotogrammetry.
4. RemoteSensing:Thequantitativeapproach,P.H.SwainandS.M.Davis,McGrawHill.
5. IntroductoryDigitalImageProcessing:Aremotesensingperspective,JohnR.Jensen,PrenticeHall.
6. ImagingRadarforResourceSurvey:RemoteSensingApplications,3,WTravelt,Chapman&Hall.
7. RemotesensingNotes –EditedbyJapanAssociatesofRemotesensing-JARS1999

RS1.3Principles of Photogrammetry and Photointerpretation

COURSE OBJECTIVES

The Objective of the course is to

- Introduce basic concepts of Photogrammetry.
- Impart knowledge on aerial photographic measurements.
- Introduce elements of image interpretation.
- Impart knowledge on digital photogrammetry, DEMs and contours.

COURSE OUTCOMES

At the end of the course the student will be able to understand

- Photographic process and characteristics of tools used in photogrammetry.
- Concepts of stereoscopy and geometry of various types of photographs.
- The process of Planning photogrammetric operations.

UNIT- I Fundamentals of Photogrammetry and Photointerpretation – types of photographs; Vertical photographs – principal point; scale; Stereoscopy; Verticalexaggeration–factorsinvolved anddetermination; Overlap,sidelapandflight planning

Learning outcomes:

After completion of this unit the student will be able to

- Explain fundamentals of photogrammetry
- Identify different parameters of aerial photographs

UNIT-
IIGeometricelementsofverticalaerialphotographs;ReliefDisplacementonverticalaerialphotographs;Parallaxand parallaxmeasurement–monoscopic andstereoscopicmethods;Determinationofhorizontalgroundlength, directionandanglesfromphotocoordinates;

Learning outcomes:

After completion of this unit the student will be able to

- Measure parallax from vertical photograph
- Determine ground length, directions and angles from photo coordinates.

UNIT-III Aerialmosaics:comparisonwithmaps;Elementsofaerialphotointerpretation–
(a)landforms;(b)surfacedrainagepatterns;(c)erosionfeatures,
(d) graytones;(e)miscellaneouselements.

Learning outcomes:

After completion of this unit the student will be able to

- Compare aerial mosaics with maps
- Interpret earth surface features from photographs

UNIT-IV DigitalPhotogrammetry:definitionandscope;Photographsandimages;Geo-referencing–Interiororientation,exteriororientation;aerotriangulation– singleframe andblocktriangulation-pass points, tiepoints;groundcontrolpoints;Satellitephotogrammetry

Learning outcomes:

After completion of this unit the student will be able to

- Define digital and satellite photogrammetry
- Explain the concept of geo referencing and triangulation

UNIT -V3-Dsurface modeling–DEMs,DSMsand DTMs;Triangulated irregular networks;Gridded surfaces;interpolation methods;Contour representation;Terrainvisualization; DEMuser applications.

Learning outcomes:

After completion of this unit the student will be able to

- Explain DEMs,DSMsand DTMs
- Identify applications of DEMs

Textbooks

1. Aerialphotographicinterpretation,Lueder,D.R.,McGrawHillBookCo.,1959
2. ElementsofPhotogrammetry,PaulR.Wolf,McGraw-Hill,2000
3. RemotesensingandImageinterpretation,LillesandandKeifer,JohnWileyandSons,2000
4. ManualofPhotogrammetry,McGlone,C.,Edward,M.andBethel,J,AmericanSocietyforPhotogrammetryandRemoteSensing,Bethesda,MaryLand,USA. 2005
5. Digital Elevation Model Technologies and Applications: The DEM user Manual, David F. Maune (ed), American Society for Photogrammetry and RemoteSensing,Bethesda,MaryLand, USA, 2001
6. LeicaPhotogrammetrySuite – OrthobaseandOrthobaseProUserGuide,LeicaGeosystems,GIS&Mapping,Atlanta,USA,2003.

RS1.4-Earth Systems

COURSE OBJECTIVES

The objective of the course is to

- Introduce concept of Oceans, climate.
- Impart knowledge on meteorological parameters and their measurement.
- Give fundamental knowledge on Geomorphology.
- Impart knowledge on different landforms of earth.

COURSE OUTCOMES

At the end of the course the student will be able to

- Understand about ocean parameters and composition of atmosphere.
- Understand and measure meteorological parameters.
- Explain the concept of monsoon in Indian context.
- Identify different landforms.
- Understand soil forming process and classification of India soils.

Unit-1a)Earth -Orbit,Rotation,Timeb)Oceans-Depth,Bottom relief

b) Oceans - Temperature, Salinity, Density of seawater d) Oceans - Waves, Tides, Currents e) Climate and the atmosphere – Origin, nature, composition andverticaldivisionof the atmosphere.

Learning outcomes:

After completion of this unit the student will be able to

- Understand basic concepts of Earth, oceans
- Explain origin and composition of atmosphere

Unit-2a)Meteorologicalparametersandtheirmeasurements-Geographical,seasonalandverticaldistributionoftemperature,pressure,windandprecipitation. b) Solar and terrestrial radiation: Distribution in clear, cloudy and average conditions. Mean heat balance. c) Weather disturbances: Air mass andFront,Cycloneandanti-cyclone.Thunderstorm andtornado.d)WeatheranalysisandForecastinge)Climateandagriculturalfactors incropproduction.

Learning outcomes:

After completion of this unit the student will be able to

- Explain seasonal, geographical variations in temperature, wind and precipitation
- Identify different weather disturbances and weather forecasting methods

Unit-3 a) Climate Change: Causes and Impacts b) Monsoons :Concepts of the origin of monsoon-Indian Monsoons c) Fundamental concepts ofGeomorphologyd)Weathering, Masswastinganderosion.

Learning outcomes:

After completion of this unit the student will be able to

- Explain causes and impacts of climate change
- Summarize the concept of geomorphology

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 landformse) Glaciersassociated land forms

Learning outcomes:

After completion of this unit the student will be able to

- Identify landforms associated with wind, seas, rivers and glaciers

Unit-5a)Soilformingprocesses,Soilprofile,Soilcomponents.b)Pedogenicregimes.c)Classificationofsoilsd)Soilsof India

Learning outcomes:

After completion of this unit the student will be able to

- Explain the concept of soil profile and soil forming process
- Recognize soils in Indian context

ListofTextBooks

1. StructuralGeologybyBillings,M.1984
2. EarthHistory&PlateTectonics byCarlK.Seyfert,LeslieA.Sirkin
3. GeologyofIndia&Burmaby M.S.Krishna6th,Ed.
4. GeneralClimatologybyH.J.Critchfield
5. PhysicalGeologybyArthurHolmes
6. PhysicalGeographybyStahler
7. TheAtmospherebyFrederickK.LutgensandEdwardJ.Tarbuck

Syllabus for Elective Subjects
RS.1.5.Elective1
(Choose any one of the following)

A. CoastalZoneManagement

B. NaturalDisasterManagement

C. SatelliteMeteorology,AgricultureandOceanography

A.CoastalZoneManagement

COURSE OBJECTIVE

The objective of the course is to

- Introduce the importance of Coastal zone management.
- Impart knowledge on coastal landforms and river deltas.
- Give knowledge on coastal wetlands and sea level changes.
- Impart knowledge on different coastal hazards.

COURSE OUTCOMES

At the end of the course student will be able to

- Understand the importance of coastal zone management.
- Gain knowledge on deltas and other coastal landforms.
- Identify different coastal wetlands.
- Understand sea level changes and different coastal hazards.
- Gain knowledge on remote sensing application in coastal zone management.

Unit 1 Coastal and littoral zones – definitions and scope of study Shore zone processes – waves, tides and currents Coastal landforms; River deltas: types ofdeltas and theirmorphologicalvariations Humanactivitiesand theirimpact on thedelta-fringecoasts

Learning outcomes:

After completion of this unit the student will be able to

- Define coastal and littoral zones
- Idnetify types of river deltas and coastal landforms

Unit 2 Coastal wetlands – Mangrove swamps, marshes, lagoons, tidal channels/creeks and their significance in coastal stability and economic importanceContinental margins – forms and processes; territorial waters and Exclusive Economic Zone Sea level changes – factors involved; effects of sea level oscillationsoncoastalzonesSea-levelriseandcoastalvulnerability;Role ofgeoinformaticsinassessmentofcoastalvulnerabilitytosea-level rise

Learning outcomes:

After completion of this unit the student will be able to

- Identify different types of coastal wetlands
- Explain the effects of sea level on coastal zones
- Descrive the role of geoinformatics in coastal vulnerability studies

Unit 3 Coastal Hazards: Storm surges and Tsunamis; Origin, propagation and run-up of tsunamis; Tsunami impact – role of coastal topography andvegetation; Global warming and Sea-level rise - impact on coastal zones; coastal vulnerability assessment Coastal hazard preparedness – coastal

protection,educationand awarenessof coastalcommunities;Roleofgeoinformaticsin assessmentof coastal vulnerabilitytotsunamis

Learning outcomes:

After completion of this unit the student will be able to

- Explain coastal hazards like Tsunamis and storm surges
- Recognize the effect of global warming on coastal zones

Unit 4 Human activity and coastal environment – deforestation, griculture/aquaculture, pollution and coastal structures, and their effect on coastal zones;Coastalvegetation;shelter belts;coastalaquifers; freshwater-seawaterinterface MorphologyofIndiancoasts

Learning outcomes:

After completion of this unit the student will be able to

- Infer the impact of human activities on coastal zones
- Understand the freshwater-seawater morphology in Indian coasts.

Unit 5 Coastal zone management–concepts, modelsand information systemsCoastal RegulationsZones(CRZ) and Coastal Management Zones(CMZ):IndiancontextApplicationofremotesensing incoastalzonestudies;RoleofGeographicInformationSystems in coastalzonestudies

Learning outcomes:

After completion of this unit the student will be able to

- Explain the concept of coastal zone management
- Summarize the applications of RS & GIS coastal zone studies

Textbooks

1. Geomorphology,Bloom,A.L.,Prentice-Hall,1978
2. Deltas,Coleman,J.M.,ContinuingeducationPublicationCo.Inc.1976
3. CoastalSedimentaryEnvironments,Davis,A.R.(Jr.),Springer-Verlag,1985.
4. BeachesandCoasts,King,C.A.M.,EdwardArnold,1972
5. IntroductiontoMarineGeologyandGeomorphology,King,C.A.M.,EdwardArnold,1974
6. ApplicationsinCoastalZoneResearchManagement,Martin,K.St.(ed),U.N.InstituteforTrainingandResearch,1993.
7. IntegratedOceanandCoastalManagement,Sain,B.C.,andKnecht,R.W.,UNESCOPublication,1998.
8. SubtleIssuesinCoastalManagement,Sudarshanetal.,(ed),IIRS,DehraDun,2000.
9. Tsunamis–casestudiesandrecentdevelopments,Satake,K.(ed),Springer,2005

RS.1.5. Elective1
Natural Disaster Management

COURSE OBJECTIVES

The objective of the course is to

- Introduce the concept of disasters and their classification.
- Impart knowledge on cyclones, earthquakes, Landsides.
- Explain the Components of disaster relief, disaster management policies.
- Impart knowledge on remote sensing and GIS applications in disaster management.

COURSE OUTCOMES

After the completion of the course, the student will be able to

- Classify various types of disasters and explain disaster management cycle.
- Explain the vulnerability scenario of India with respect to various disasters.
- Demonstrate the significance of disaster relief components, institutional arrangements.
- Apply the knowledge of geo-informatics, communication system in disaster Management.

Unit-1 Various types of Natural Disasters - Cyclones, Floods and Tidal waves with most well known Indian examples, Classification of Disasters and nature ofImpacts.

Learning outcomes:

After completion of this unit the student will be able to

- Classify various types of disasters
- Explain cyclones and floods with Indian examples

Unit-2 VarioustypesofNaturalDisasters-Earthquakes,landsubsidenceandLandslides,Forestfires,DroughtwithmostwellknownIndianexamples,Classifications and natureof impacts.

Learning outcomes:

After completion of this unit the student will be able to

- Explain about earthquakes ,landslides and droughts

Unit-3 VulnerabilityfactorsandRiskanalysis ofNaturaldisastersandHazardestimations.

Learning outcomes:

After completion of this unit the student will be able to

- Classify vulnerability factors of natural disaster
- Analyze the risk factor of natural disasters.

Unit-4 Naturaldisastermanagementplans,Shelterbelts,Specialstructures,DisasterpreparednessandMitigation.

Learning outcomes:

After completion of this unit the student will be able to

- Explain disaster management cycle
- Identify different disaster management activities

Unit-5 Informationneeds ofDisastermanagement,RemoteSensingApplications,GISapplications.

Learning outcomes:

After completion of this unit the student will be able to

- Explain the role of Remote sensing and GIS applications in disaster management

References

1. Krishna Prem&Bhanfari, N.M.(1967):Riskassessmentdueto strong Wing storms/CyclonesandpreventivemeasuresforHabitat Buildings;Proceedings volume 1 of International Conference on Habitat and sustainable Development, Decembe4 1-2-1997 organized by Institute of Engineers (India) andWorldFederation of Engineering Organisations.
2. Vijay, P.B. Kurian, Jose and Mittal, A.K. (1997): An overview on the Earthquake mitigation sceanrio in India: Proceeding volume-1 of InternationalConference on habitat and Sustainable Development, December 1-2-1997 organized by Institute of Engineers (India) and World Federation of EngineeringOrganisations.
3. Mandal,G.S.(1995):TropicalcyclonesandtheirdamagepotentialstatusofWindEngineeringinIndia,IndianSocietyofWindEnergy(ISWE).
4. GovernmentofIndia(1997):MinistryofUrbanAffairsandEmployment:VulnerabilityAtlas-ApartofreportofExpertGroup.

RS.1.5. Elective1
Satellite Meteorology, Agriculture and Oceanography

COURSE OBJECTIVES

The objective of the course is to

- Introduce the basic concepts of Remote Sensing of atmosphere and satellite meteorology.
- Gain the knowledge on meteorological applications in weather forecasting aviation and trade applications.
- Familiarize the Indian Meteorological satellites and sensors.
- Impart knowledge on crop identification and assessment techniques.
- Introduce ocean remote sensing concept.

COURSE OUTCOMES

At the end of the course the student will be able to understand

- Concepts of satellite meteorology and satellite sensors useful for the same.
- The applications of meteorological studies in resource management, disaster management.
- Interpret meteorological satellites images for weather systems and clouds.
- Monitor ocean parameters through satellite images.

Unit-1 1. Fundamentals of Remote Sensing in Meteorology 2. Meteorological satellite characteristics and their orbits, TIROS, NIMBUS, NOAA, TIROS N,SEASAT, GOES, METEOSAT, INSAT, OCEAN SAT. Role of LANDSAT, SPOT and IRS in collecting meteorological, agricultural andeanographic data. 3.Measurement of Earth and Atmospheric energy and Radiation budget parameters from satellites. 4. Atmospheric temperature retrieval techniques and surfaceradiationstudies. 5.Windmeasuring techniquesfromsatellitedata.

Learning outcomes:

After completion of this unit the student will be able to

- Explain fundamentals of meteorological remote sensing
- List out different meteorological satellite and their characteristics
- Measure Atmospheric temperature and wind from satellite data

Unit-2 1. Cloud classification techniques. 2. Satellite Remote Sensing System of use in rainfall monitoring methods: Cloud indexing method, Life-historymethod and Bio-spectral methods. 3. Interpretation of Satellite meteorological images for weather systems and cyclones. 4. Remote Sensing techniques forestimationofsoilmoistureandevapotranspiration.5.SpectralbehaviorofdifferentcropsandvegetationinVIS,NIR,MIR,TIRandMicro-waveregions.

Learning outcomes:

After completion of this unit the student will be able to

- Describe various cloud classification techniques and rainfall monitoring methods

- Estimate soil moisture and evapotranspiration from remote sensing techniques

Unit-3 1. Principles of crop identification and area estimation, sampling techniques, vegetation indices and crop yield modeling using Remote Sensing. 2.Water management in command areas - monitoring, assessing crop water availability, demand and utilization pattern through Remote Sensing. 3. Crop stressassessment and monitoring - droughts and floods. 4. General concept of water resource assessment and irrigation water management, water logging and waterquality.

Learning outcomes:

After completion of this unit the student will be able to

- List out various principles of crop identification and yield monitoring using RS
- Explain the remote sensing applications in water resource monitoring

Unit-4 1. Principles of Remote Sensing of Sea 2. Visible wavelength ocean- color sensors: introduction to color sensors on Landsat, Coast zone colorscanner (CZCS) on Nimbus, application and oceanographic uses of Land sat and CZCS data. 3. Introduction to infrared scanning radiometers, atmosphericcorrection and Sea - Surface temperature calibration techniques, interpretation and uses of SST data from satellites. 4. Passive microwave radiometers: Physicalprinciplesofpassive microwaveradiometrymicrowaveradiometerdesignandoceanographicinterpretationofmicrowavedata.

Learning outcomes:

After completion of this unit the student will be able to

- Explain remote sensing principles of oceans
- List out different ocean monitoring satellites

Unit-5 1. Satellite altimetry of sea - surface topography: Application of altimetry to the study of ocean currents, tides, bathymetry and wave heights. 2. Activemicrowavesensingofsea-surfaceroughness:IntroductiontotheRemoteSensingofsea-surfaceroughness,radarreflectionfromseasurface,surfacefilmsandoil slicks, dynamical and artificial causes of sea surface roughness patterns. 3. Introduction to Synthetic Aperture Radar, Principles of operation, SAR imaging ofocean waves, observations of ocean waves with Seasat SAR, Interpretation of ocean waves.4. Introduction to microwave scatter meters, oceanographicapplicationofscatterometer data. Applicationofwind and wave scatterometry.

Learning outcomes:

After completion of this unit the student will be able to

- Explain the concept of satellite altimetry and its applications
- Define SAR and identify its applications in ocean related studies

ListofTextBooks

1. AppliedRemoteSensingC.P.L.O.,LongmanScientificandTechnicalPublishers.
2. IntroductiontoEnvironmentalRemoteSensing,E.C.Barrett&L.FCurtis,ChapmanandHall,London.
3. RemoteSensinginHydrology,Engman,E.T.andGurney,R.J.
4. RemoteSensinginwatermanagementincommandareas,Govardhan,V.
5. SatelliteOceanography-AnintroductiontooceanographersandRemoteScientists,I.S.Robinson,EllisHorwoodLimited,Chichester.

ReferenceBooks

1. ApplicationsofRemoteSensinginAgriculture.M.D.StevenandJ.A.Clark.
2. RemoteSensingmethodsandapplications,Hord,R.Michael.
3. Satellitemeteorology-Bramdi,HenoyWillnois;Airweatherservice,1976.
4. SatelliteMeteorology-Anintroduction,StanleyQ.KidderandThomas,H.VonderHaar-Oxlando,AcademicPress,1995.
5. Environmentalsatellites,;systemsdatainterpretationandapplications,JimmieD.Johnson,Frances,C.Parmenter,RalphAnderson,DepartmentofCommerce,NOAA.
6. TheuseofsatellitedatainrainfallmonitoringE.C.BarrettandD.W.Martin,Academic Press,NewYork.

RS.1.6. Elective.2

(Choose any one of the following)

A. MathematicalMorphologyinImageProcessing

B. WaterResourcesManagement

C. GeoinformaticsforEarthScienceApplications

A.MathematicalMorphologyinImage Processing

COURSE OBJECTIVES

The objective of the course is to

- Impart knowledge on the basics of mathematical morphology
- Introduce morphology transformations and algorithm for image processing
- Impart knowledge on morphology based classification and segmentation techniques
- Discuss recent advances in mathematical morphology and its applications

COURSE OUTCOMES

After completion of the course student will be able to

- Explain basics of mathematical morphology
- Gain knowledge in morphological algorithms for image processing
- Performs morphology based image classification and segmentation

Unit 1: Introduction Overview of mathematical morphology-Basic set theory and logical operations-Euclidean space- continuous and discrete space-ImageRepresentation-Imageandgreylevelimages-shapes-quantisation-shape-binaryimages-translation-rotation-scaling.MathematicalMorphology-BinaryMathematicalMorphology-Erosion, Dilation, Opening,Closing

Unit 2: Mathematical morphology transformations and algorithms Hit or Miss Transformation-Basic morphological algorithms-boundary extraction-regionfilling-Convex Hull-Thinning-Thickening- Medical axis transforms-Digital Skeletons- Grey Scale Mathematical Morphology-Greyscale Erosion-Grey Scale dilation-Grey Scale Opening and Closing-Application of grey scale morphology-(Non-Linear filtering techniques)-Morphological Smoothening-Morphological gradient-BlackandWhite Top- Hot transformations.

Unit 3: Morphology based Image Classification & Applications Binary and Grey level image segmentation-Skeletization by Zone of Influence Technique-Watershed segmentation technique-Watersnakes and PDE based-Textural segmentation-Applications of segmentation techniques in remotely sensed dataclassification-Segmentation of SPOT, RADARSAT, ERS SAR, and IRS data- Morphology based noise removal techniques for Microwave remote sensing dataanalysis-Granulometriesfor feature analysis MorphologyforDEManalysisandterraincharacterization

Unit 4: Shape Representation by morphology and shape description Exact dilations-Distance-transformations-Exact distance transforms through exactdilations-VornoiDiagrams(GraphTheory)-Scalespaceskeletonization-Multi-scalemorphologicaltransformations-ShapeCharacterization-Perimeter-area-

Centroid- Maximal and minimal distances to centroid- Distance to the boundary-Diameter- Maximum chord-Polygonal approximation based shape decomposition-Patternspectrumprocedure.

Unit 5: Recent Advances in Mathematical Morphology in Image processing and analysis Fuzzy Morphology-Watersnakes and PDE based morphology,Energy minimization concepts-Theoretical graylevel morphology-Lattice theory-Discrete topology and metricsfor image processing-nonliner image filtering-connected operators-geometrical scale space-topographical sgmentation-random sets and geometrical probability-integral geometry and geometrical measures-morphologyapplicationsin imagesciences.

References:

1. J.Serra,ImageAnalysisandMathematicalMorphology,AcademicPress(London),1982,p.610
2. C.R.GiardinaandEdwardDougherty,MathematicalMorphologyinImageandSignalProcessing,PrenticeHall ,NewJersy,1988.

SuggestedReading

1. Gonzalez,DigitalImageProcessing
2. R.M.Haralick,andL.G.Shapiro,ComputerandRobotVision,AddisonWesley,Reading,v.1,1992,p.453-507.
3. TechnicalPeriodicals:IEEEGeoscienceandRemoteSensing,IEEEPatternAnalysis&MachineIntelligence ,IEEEImageProcessing,IEEESignalProcessing

RS.1.6. Elective2
Water Resources Management

COURSE OBJECTIVES

The objective of the course is to

- Expose student to different issues in water shed management.
- Impart knowledge on soil related studies.
- Impart knowledge on rainfall and run-off.
- Impart knowledge on integrated water management in Agriculture.

COURSE OUTCOMES

After completion of the course the student will be able to

- Understand importance of watershed management and characteristics.
- Estimate rainfall and runoff in catchments.
- Gain knowledge on integrated water management in Agriculture.

Unit-1(WatershedConcept) a)Issuesinwatershedmanagement-landdegradation,agricultural productivity,reservoirs sedimentation, depletionofbioresources, floods and droughts. Principles and approaches - principles of watershed management, different approaches in watershed management; Problemorientedapproach,threedimensionalapproaches,integratedapproach,stepsinwatershedmanagement.b) Watershedcharacteristics-size,shapephysiography, slope, climate, drainage, landuse, vegetation, geology, soils, hydrology, hydrogeology, socio-economics. Linear aspects of channel systems - Aerialaspects ofdrainagebasins.

Learning outcomes:

After completion of this unit the student will be able to

- Explain the principles of watershed management
- Describe watershed characteristics

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 capabilityclassification, land degradation and problem soils. Reclamation of saline soils, alkaline soils, saline soils, acidic soils, sulphide soils; sediment yield modeling andwatershedprioritization.Theuniversalsoillossequation,sedimentyieldindexmethod,statisticalregressionmodel,theEuropeansoilerosionmodel;Siteselectionfromconservationmeasures.

Learning outcomes:

After completion of this unit the student will be able to

- Explain basic soil surveying techniques

- Describe land degradation problem and its mitigation

Unit-3 (Water Management) a) Surface water - Study of rainfall, estimation of run-off at micro catchments, stream gauging; Rainwater harvesting; catchment,harvesting,harvestingstructures,Groundwater-explorationofcanalcommandareas,potentialareas;integratedwaterresourcesmanagement,conjunctiveuse.
b) Dry land Agriculture- Runoff agriculture, micro catchment forming, irrigation with saline water, reusing water, conserving water, sprinkler irrigation, dripirrigation,potirrigation,othersystems,reducingcroplandpercolationlosses,reducing transpirationlosses,selectionofwateruse efficiencycrops.

Learning outcomes:

After completion of this unit the student will be able to

- Estimate rainfall and run-off in micro catchments
- Explain dry land agriculture methods

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; treeculture; form forestry; bund utilization, boundary plantation; social forestry; Energy - Renewable resource, water power, solar energy wind power; biomass, firewood, synthetic fuels, burning of municipal / garbage, ocean tides and waves. b) Appropriate Technology - farm equipment; Contour methods; check dams, watercatchment and harvesting; kunds, depression harvesting, harvesting below ground level, harvesting below stream bed level, ground water harvesting; low costtechnology, water conservation, utilization of wasted natural resources, Novelities; Rural technological delivery systems, cultivating wasted lands, tree culture, farmforestry,silvipastures, horticulture, social forestry,afforestation, wonder ways.

Learning outcomes:

After completion of this unit the student will be able to

- List out different farming techniques

Unit-5 (Monitoring and Evluation) a) People's Part - awareness, participation, Response; State and integrated approach, appreciation of the concept, training,transfer of technology, resource and development, Agro-industrial infrastructure; sustainable society, livestock, small animal farming, pisiculture, sericulture, Healthand hygiene education, transport, cues. b) Monitoring and Evaluation - purpose of monitoring and evaluation, nature ofmonitoring and evaluation - an interativedynamicProcess,designofmonitoringprograms-determininginformationneeds,settinginformation-needpriorities,Determiningmeansofcollectinginformation,Information management in monitoring programs; monitoring biophysical data, monitoring socio-economic data, monitoringproject activities and outputs, design ofevaluation procedures, types of evaluation, focus of evaluation, reporting evaluation results, insuring use of monitoring and evaluation information, a final word ofcaution.

Learning outcomes:

After completion of this unit the student will be able to

- Realize the importance of people's participation in water resources management
- Collect information and prepare evaluation reports

TextBooksandReferences

1. WatershedManagement,J.V.S.Murthy -Publishers;NewAgeInternational(P)Ltd.,NewDelhi.
2. SpaceTechnologyApplicationsforSustainableDevelopmentsatWatersheds,TechnicalReport,ISRO-HQ-TR-104-95,ISRO,Bangalore.
3. WatershedManagementProjectPlanning,MonitoringandEvaluation;AManualfortheAsianRegion-Asian-USWatershedProject-ForestryforsustainableDevelopment Program.UniversityofMirnesota,Collegeof Natural Resources,St. PaulMirnesota, U.S.A.

RS.1.6. Elective2

B. Geoinformatics for Earth Science Applications

COURSE OBJECTIVES

The objective of the course is to

- Impart knowledge on Remote sensing applications in Lithological studies.
- Gain knowledge in remote sensing applications in Geological structures.
- Familiarize with geospatial applications in Geomorphology.
- Impart knowledge on RS & GIS techniques in Geological investigations.

COURSE OUTCOMES

After completion of the course the student will be able to

- Explain remote sensing applications in Lithological studies.
- Understand the importance of Remote sensing in Geomorphological studies.
- Explain Remote sensing applications in Geological investigations.
- Gain knowledge on remote sensing application in disaster management.

Unit–I: Remotesensingapplicationsinlithologicalstudies

Introduction; Scope for Geological applications in multispectral data, Thermal Data, Microwave data Mapping of Broad scale Lithological Units in General,Igneous, sedimentary and metamorphic rock, Identification of Mineral Assemblage, their physical properties mode of origin and mode of occurrence; Lithologicalmappingusingaerial photos and satelliteimagery,Digital analysisforlithologicaldiscrimination

Learning outcomes:

After completion of this unit the student will be able to

- Identify the scope of remote sensing data in geological studies
- Prepare lithological maps using aerial an satellite imagery

Unit – II: Remote Sensing applications in structural analysis Bedding and simple dipping strata, Folds, Faults, rift zones, Lineaments, Unconformity, Structuralmapping–structuralanalysis throughaerial-andsatellite-data, digitaltechniquesforstructural analysis.

Learning outcomes:

After completion of this unit the student will be able to

- Explain remote sensing application in study of folds and faults
- Prepare structural analysis through aerial and satellite imagery.

Unit-III: Remotesensingapplicationingeomorphology Natureandtypeoflandformslikedenudational,structural,fluvial,marine,Aeolian,glacialandvolcanic

Learning outcomes:

After completion of this unit the student will be able to

- Explain remote sensing applications in Geomorphological studies
- Interpret satellite and aerial imagery to identify aeolian, volcanic and marine landforms.

Unit – IV: Remote sensing application in geological investigations Remote sensing in Mineral Exploration, Main types of Mineral Deposits and their surfaceindications, Stratigraphic & lithological Guides, Geomorphological guides, Structural guides, Guide formed by Rock alteration, Geobotanical gudes. Groundwater,Petroleum, Hydrogeological mapping, Engineering Geological studies, Land slide studies and disaster management studies using Remote Sensing and GIStechniques–casestudies

Learning outcomes:

After completion of this unit the student will be able to

- Explain remote sensing applications in Geological investigations and mineral exploration
- Describe the importance of RS & GIS in Disaster management

Unit-V: EngineeringandSub-surfaceexploration&DisasterAssessment

Engineering geological Investigations: river valley projects, dams and reservoirs, route location (high ways and Rail ways) canal and pipeline alignments;neotectonism, seismic hazard and damage assessment, local ground condition, disaster assessment, volcanic and geothermal Energy applications, volcanicmappingandmonitoring,identificationofcoalfires;environmentalgeologyResistivity,aeromagneticand electromagneticsurveyforsubsurfaceexplorations

Learning outcomes:

After completion of this unit the student will be able to

- Explain the importance of geospatial technologies in sub surface exploration

  Explain application of RS & GIS in various civil engineering projects

Textbooks

RaviP.Gupta,RemotesensingGeology-SpringerPublisher,A1BooksCo.in.

Joseph Lintz (Jr) and David Simonett Remote Sensing of environment,

Addison Wesley Publishing Company London,

1976.ParbinsinghGeologyKatson PublishingHouseLudhiana 4thedition1985.

Manual of Remote Sensing Vol. II, American Society of

Photogrammetry falls church virginia –

1985.ThreeDimensionalApplications in

GeographicalInformationSystems– byJonathan

Raper,Dept.ofGeology,BirkbeckCollege,UniversityofLondon–1989.

RS1.7Lab.1:Photogrammentry and PhotoInterpretation Practical

COURSE OBJECTIVES

The objective of the course is to

- Familiarize student in calculation of height,scale etc from aerial phot**o**graphs**.**
- Impart knowledge on identification of features from aerial photographs**.**
- Train student in preparing aerial mosaics**.**
- Train student in extracting contours, drainage etc from DTMs**.**

COURSE OUTCOMES

After completion of the course the student will be able to

- Determine vertical exaggeration from aerial photograph**.**
- Calculate height,scale from aerial photos**.**
- Interpret aerial photographs to identify different landforms**.**
- Construct digital terrain models**.**
- Extract contours, watershed and drainages from DTMs**.**

PG.1.Testingstereovision

PG.2. Use of Lens stereoscope and Mirror stereoscope

PG.3Determinationofverticalexaggeration

PG.4.UseofParallaxBarforheightcalculationfromaerialphotographs

PG.5.Calculationofscaleofthephotographs,MarkingPrincipalpointandconjugateprincipalpointonthestereopairs

PG.6.Preparationofaerialmosaics

PG.7.Interpretationofaerialphotographsforidentificationoflandformsoffluvial,Aeolian,glacial,coastal,volcanicandaridprocesses

PG.8.Identificationoftectonicelementsfromaerialphotographs

Digitalphotogrammetry–digitalimagematchingandcollectionofmasspointsConstructiondigitalterrainmodels

ApplicationofDTMs–contourgeneration;fill;flythough;slopeandaspect;viewshedanalysis;watershedanddrainageextraction;volumetricanalysis;preparationoforthoimages.

RS1.8Lab. 2: Remote Sensing & Image Interpretation

COURSE OBJECTIVES

The objective of the course is

- Train student in satellite image annotation
- Impart knowledge on different spectral response patterns.
- Train student in studying and interpretation of optical, thermal and RADAR imagery.
- Train student in interpreting high resolution imagery.
- Impart knowledge on ground data validation.

COURSE OUTCOMES

After completion of the course the student will be able to

- Study and understand annotation of satellite images.
- Understand spectral response pattern of different land cover features.
- Understand and Interpret Optical, Thermal and RADAR imagery.
- Interpret high resolution satellite imagery.

RS:P1StudyofSatelliteImageAnnotation(information)LANDSAT,SPOTandIRSandReferencingScheme(Analog)
RS:P2. Studyof Digital ReferencingScheme (NRSC/Digitalglobe/space imagingetc).
RS.P3 Understanding of Spectral Response Pattern of different Land cover objects 1 & 4
RS.P4StudyofGivenAreainB/WIR,ColourandIRcolourPhotographs (IKONOSAUarea)
RS. P5 Study of Satellite Imagery (B/W) in Different bands and Visual Interpretation(Landsat 6 band data for Visakhapatnam)
RS.P6-Studyof ThermalImage, Interpretationof VariousFeatures-
RS.P7-StudyofRadar(Microwave)ImageryandInterpretationofFeatures
RS.P8- Study of Radar And SAR (Microwave) Imagery And Interpretation of Features-
RS.P9.Interpretationof CulturalDetails From high resolutionimagery
RS.P10 . Digital Interpretation and preparation of Land use Map at 1:50,000 scale
RS.P11.FieldexerciseonvisualImageinterpretationandvalidationusinggrounddata

SEMESTER II

RS2.1-Digital ImageProcessing and Interpretation

COURSE OBJECTIVES

The objective of the course is to

- Study the image fundamentals and mathematical transforms necessary for image processing.
- Impart knowledge on image processing.
- Study the image enhancement techniques.
- Study image restoration procedures.
- Familiarize with image classification and change detection methods.

COURSE OUTCOMES

After successful completion of the course the student will be able to

- Review the fundamental concepts of a digital image processing system.
- Evaluate the techniques for image enhancement and image restoration.
- Categorize various compression techniques.
- Interpret image segmentation and classification techniques.

Unit-1a)Introduction-Imageprocessingdisplaysystems.

b) Initialstatisticalextraction-univariateandmultivariatestatistics,histogramanditssignificanceinremotesensingdata.

c) Preprocessing - Introduction, missing scan lies, desk tripping methods, geometriccorrection and registration, atmospheric corrections, illumination and viewangleeffects

Learning outcomes:

After completion of this unit the student will be able to

- Define digital image processing
- Explain various pre-processing techniques in image processing

Unit-2 a) Image reduction, image magnification, contrast enhancement; linear, non-linear, rationing, edge enhancement; linear, non linear. low pass filters,high pass filters, edge detection, point and neighborhood operation b) Image transform - Arithmetic operations' based image transforms, principle componentanalysis,discriminateanalysis.Fourier transforms,FastFourierfrequencydomainfiltersandvegetationindices.

Learning outcomes:

After completion of this unit the student will be able to

- Explain image enhancement techniques
- Describe image transformation and principal component analysis concepts

Unit-3a)Imagecompression fundamentals:Coding, interpixelandPsycovisualredudency,and fidelity criteria.b) Image compression models: Sourceencoder and decoder, channel encoder decor c) Elements of information theory: Measuring information, the information channel fundamental coding theorems andusinginformation theory.

Learning outcomes:

After completion of this unit the student will be able to

- Explain fundamentals of image compression

Unit-4 a) Image segmentation: Detection of points, lines and edge detection and combined detection b) Edge linking and boundary detection: Localprocessing, Global processing via Hough transform c) Thresholding: foundation, role of illumination, simple global thresholding, optimal thresholding. Split andmergeandTexture based Segmentation.

Learning outcomes:

After completion of this unit the student will be able to

- Identify edges in digital images through various methods
- Understand the concepts of image segmentation

Unit-5 a) Classification - Geometrical basis of classification, unsupervised classification, supervised classification techniques - training sample selection,parallelepiped classifier,centroid classifier,maximumlikelihood method,Hybrid methodsanddecision- tree classifiers.Useof externaldata, contextualinformation, feature - sub-feature study, classification accuracy. b) Change detection - the nature of change detection, change detection algorithms, imagedifferencing, and image rationing and classification comparisons. c) Hyper spectral remote sensing, Imaging Spectroscopy, Data Processing techniques-N-DimensionalScatter plots, Spectral anglemapping,Spectralmixture analysis

Learning outcomes:

After completion of this unit the student will be able to

- Explain different image classification methods
- Describe change detection techniques

ListofTextBooks

1. Introductorydigitalimageprocessing-ARemoteSensingperspective,John R.Jenson,PrenticeHall,1986.
2. RajaRamanV.,ElementsofParallelcomputing,PrenticeHall,1990.
3. CharlesR.GiardinaandEdwardR.,Doloughenly,MorphologicalMethodsinImageandSignalprocessing,PrenticeHall.
4. ComputerProcessingofRemoteSensedImages,PaulM.Mather,JohnWiley&Sons,1987.
5. RosenfeldA.andA.C.Kak,DigitalPictureProcessing,NewYork–AcademicPress,1976.
6. Pratt.W.K.DigitalImageProcessingWileyIntersciences,1976.
7. KalhwangandDouglasDegroot,parallelprocessingforsupercomputersandartificialintelligence,McGraw-Hill,1980.
8. RafaelC.Gonzalez,RichardE.WoodsDigitalImageProcessing,1993.

RS2.2-Remote Sensing Applications

COURSE OBJECTIVES

The objective of course is to

- Introduce the potential s and limitations of remote sensing applications in various domains.
- Impart knowledge on Remote sensing applications in Resource mapping.
- Impart knowledge on Remote sensing applications in Urban planning.
- Familiarize with water resources relates application of remote sensing.
- Impart knowledge on RS applications in Disaster management.

COURSE OUTCOMES

After completion of the course the student will be able to

- Understand the importance of remote sensing applications.
- Gain knowledge in remote sensing applications in resource mapping.
- Explain applications of remote sensing in Urban planning.
- Apply geospatial technology for water resource mapping and monitoring.
- Gain knowledge in applying remote sensing technology in disaster management.

Unit-11.ScopeofRemoteSensingapplications-potentialsandlimitations2.Resourcemappingandintegratedinformationforsustainabledevelopment3. Resourceevaluation:Soils,mineralsforestandagriculture.

Learning outcomes:

After completion of this unit the student will be able to

- Explain the potentials and limitations of remote sensing
- Elaborate the applications of remote sensing in Natural resource evaluation

Unit-2 Applicationsinlanduseandlandcoveranalyses1. Landuseclassificationprinciplesandsystems2.Mappingandmonitoringoflanduse/landcoverandregionalplanning 3. Urban land use,Urbansprawl andurbanplanning.

Learning outcomes:

After completion of this unit the student will be able to

- Identify different land use classification systems
- Summarize the remote sensing applications in Urban planning

Unit-3 WaterResourceApplications1.Mapping,monitoringofsurfacewaterbodies,tanks,lakes/reservoirs2.Hydrogeomorphicmapping,groundwaterzoningfromunconsolidated, semi consolidated and hard rocks.

Learning outcomes:

After completion of this unit the student will be able to

- Explain mapping and monitoring methods of water resources using remote sensing

Unit-4 Coastalandnearshoreapplications1.SatellitesensorsforCoastalzoneenvironment2.Coastallandformsandevolution3.Coastaldynamicsandshoreline changesandCoastal wetlands

Learning outcomes:

After completion of this unit the student will be able to

- Identify different satellite sensors for coastal zone management
- Explain RS applications in various coastal zone activities

Unit-5 Environmentalanddisastermanagementapplications1.MappingandmonitoringofNaturalhazardsa)Cyclones/floodsb)Droughtsc)Landslidesd)Volcanoes e) Earthquakes2.Analysis ofhuman-inducedhazardsa)Deforestationb) Erosion c) Siltation

Learning outcomes:

After completion of this unit the student will be able to

- Explain the applications of remote sensing in Disaster management
- Summarize remote sensing applications in Human induced hazards.

TextBooks

1. AppliedRemoteSensing,C.P.Lo,Longman,ScientificandTechnicalPublishers
2. RemoteSensinginhydrology,Engman,E.T.Gurney,R.J.
3. RemoteSensinginwatermanagementincommandareas,Govardhan,V.
4. Satelliteoceanography,AnintroductionforoceanographersandRemoteSensingScientists,I.R.Robinson,EllisHorwoodseriesmarinesciences.
5. RemoteSensing -PrinciplesandInterpretation,SabinsF.F.Freeman&Co.,1987.

ReferenceMaterial

4. SatellitemeteorologyTechniquesandapplications,Vol.IandVol.2,EditedbyB.M.Rao,et.al.

RS2.3-Geographic Information Systems

COURSE OBJECTIVES

The Objective of the course is to

- Familiarize about the concept of GIS, its components, along with its advantages.
- Focus about different available data formats in GIS.
- Impart knowledge on spatial data structures details and input, management and output processes.
- Explain different data analysis techniques.
- Impart knowledge on latest technological trends in the field.

COURSE OUTCOMES

After completion of the course the student will be able to

- Gain knowledge in the basics of GIS and its components.
- Learn about types of GIS data, data imputing and errors.
- Gain knowledge in raster and vector based spatial data analysis in GIS.
- Learn about latest technological developments in GIS.

Unit-1: Fundamentals of GIS a) Introduction to GIS, Understand the difference between GIS and information system in general, GIS components and functionof GIS: hardware software requirement of GIS, data types and spatial data models, idea of conceptual, logical and physical models, RDBMS, data basenormalizationRepresentationofrealworldviavectorandrasterrepresentationmodel.b)DefinitionofamapGeographicdatainthecomputer.Fileanddata processing, data base structures, perceived structures and computer representation and geographical data. Raster data structure, Vector data structures forgeographicalentities.

Learning outcomes:

After completion of this unit the student will be able to

- define terms and concepts related to GIS
- Classify and explain different components of GIS

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. Errorsarising through processing, problem; and errors arising from overlay and boundary intersections. Errors resulting room rasterizing a vector map. Errors associatedwithoverlayingtwoormorepolygonnetworks.Thenatureofboundaries.Thestatisticalnatureofboundaries.Combiningattributesfromoverlaidmaps.

Learning outcomes:

After completion of this unit the student will be able to

- Explain about data imputing in GIS
- Identify different errors in GIS data to improve data quality.

Unit-3DEM&MapProjections a) Digital Elevation Models: The need of DEMs, methods of representing DEMs. Image methods, data sources and sampling

methodsfor DEMs. Productsthatcanbe derivedfroma DEM. Automatedlandform delineationfromDEMs.b) Map projectionsinGIS.

Learning outcomes:

After completion of this unit the student will be able to

- Explain about map projections in GIS
- Extract data products from DEMs

Unit-4 DataAnalysisa)Vector&Rasterbasedanalysis:Attributedataanalysis,Integratedspatialandattributedataanalysis :Singleandmultilayerrasterand 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 ofSpatialinterpolation.Theavailablemethodsforinterpolation,globalmethodsofinterpolation,locationinterpolators,optimalinterpolationmethodsusingspatialauto covariance. Extensions of krigging to large areas. Comparing krigging with other interpolation techniques. Choosing a Geographic Information System.Designingtheneedsfor GIS.

Learning outcomes:

After completion of this unit the student will be able to

- Learn about spatial data analysis in GIS
- Explain raster and vector data analysis

Unit-5 Technological trends in GIS a) Tools for Map analysis: Single maps, Map reclassification, operations and attribute tables, spatial topological andgeometric 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, Fuzzylogic methods. b) GIS customization, Datawarehousing, cloud GIS, data mining, OLAP, SDSS, distributed, parallel and GPU, spatial data infrastructure,(i.e. integration and standards etc.,) Free and opensourcetoolsandwebresources,Introductiontospatialdecisionproblems,GISanddecisionsupportsystem,overviewofInternetGIS,Locationbasedservices.

Learning outcomes:

After completion of this unit the student will be able to

- Identify different GIS based tools for map analysis
- Explain about Internet GIS and latest technological developments in GIS.

ListofTextBooks

1. PrinciplesofGeographicalInformationSystemforLandResourceAssessment,P.A.Burrough,ClarendonPress,Oxford,1986.
2. GeographicInformationSystems,T.R.Smith&Piqent,LondonPress,1985.
3. Principlesofdatabasesystems,J.D.Ullman,ComputerSciencePress.
4. Longly,PaulA.,Goodchild,MichaelF.,Maguire,DavidJ.,andDavidW.

Rhind.(2005)GeographicInformationSystemandScience,@nded.,JohnWileyandsons,Toronto.

5. Marguerite,Maddm,(2009).ManualofGeogra
phicInformationsystem,ASPRS,2009WebSites
1. http://www.gespatialworld.net
2. www.earthmapping.com/
3. http://www.esri.com//
4. http://www.innovativegis.com/basis/

RS-2.4: ADVANCES IN REMOTESENSING

COURSE OBJECTIVES

The objective of the course is to

- Teach basics of hyperspectral remote sensing.
- Impart knowledge on hyperspectral sensors and data analysis.
- Explain the concept of LIDAR systems and LIDAR data analysis.
- Impart knowledge on GPS.
- Familiarize with application of hyperspectral, LIDAR and GPS data.

COURSE OUTCOMES

After completion of the course the student will be able to

- Comprehend the basics of hyperspectral, LIDAR and GPS.
- Process and interpret hyper spectral, LIDAR datasets.
- Utilize skills obtained for different applications of hyperspectral, LIDAR remote sensing.

Unit-1 1. Introduction to Hyperspectral Remote Sensing 2. Spectral consideration 3. High resolution spectral features 4. Hyperspectral sensors

Learning outcomes:

After completion of this unit the student will be able to

- Define hyperspectral remote sensing
- List out different hyperspectral sensors and their features.

Unit-21.Airbornehyperspectralsensors2.Spacebornehyperspectralsensors3.Processingofhyperspectraldata4.Proceduresofdataanalysis

Learning outcomes:

After completion of this unit the student will be able to

- Identify airborne and spaceborne sensors
- Analyze hyperspectral data

Unit-31. Principles ofLIDAR 2.Laser and scanningsystem3. ExtractionofDSM4.AnalysisofLIDARdata

Learning outcomes:

After completion of this unit the student will be able to

- Explain principles of LIDAR system
- Extract DSM from LIDAR data.

Unit-41.FundamentalconceptsofGPS2.Varioussegmentsandobservationprinciples3.Structure,basicconceptsofGP

Sreceiveranditscomponents4. ClassificationofGPSreceivers.

Learning outcomes:

After completion of this unit the student will be able to

- Define fundamental concepts of GIS
- Explain GPS components and classify GPS receivers

Unit-51.Applicationsofhyperspectralremotesensing2. LIDARderivedvegetation3. LIDARderivedurbanenvironment4.ApplicationsofGPSinsurveyingandresourceinventory

Learning outcomes:

After completion of this unit the student will be able to

- List out applications of hyperspectral remote sensing
- Summarize application of GPS in surveying

TextBooks

1. Elachi,C.:introductiontothePhysics andTechniquesofRemoteSensing,WileyInterscience,1987
2. JohnR.Jenson:Remotesensingoftheenvironment
3. ThomasM.Lillesand,KiefereandJonathanW.Chipman:RemoteSensingandImageinterpretation,Johnwiley, 2004
4. ManualonGPS-CanadaGSPublication
5. MarcusBorengasser,WilliamS.HungateandRussellWatkins:HyperspectralRemoteSensingPrinciplesandA pplications

R.S.2.5Elective-I
(Choose any one of the following)

A.GeoinformaticsforEnvironmentalstudies;

B.Watershed Management;

C–Urban Planning and Information Systems

A. GeoinformaticsforEnvironmentalStudies

COURSE OBJECTIVES:

The objective of the course is to

- Impart knowledge on RS applications in water and soil studies
- Explain about impacts of pollution on environment
- Impart knowledge on RS application in environmental monitoring
- Give more insight into environment protection with case studies.

COURSE OUTCOMES

After successful completion of the course the student will be able to

- Explain Remote sensing applications in water quality monitoring
- Realize the effect on pollution on environment
- Gain knowledge on marine environment monitoring using remote sensing
- Measure meteorological parameters like temperature, wind etc..

Unit –1 Water and the Environment Remote sensing of fluorescence – water quality – water pollution – potential pollution sources – water runoff, RemoteSensing and Water quality management – snow surface cover – flood prediction. Soils and land forms – insects and disease – soil erosion – salinity – flooddamage– soillimitation–soildegradationusing Remote Sensing and GIS.

Learning outcomes:

After completion of this unit the student will be able to

- Explain the importance of remote sensing in monitoring water quality parameters
- Study soil erosion and degradation using RS & GIS

Unit –II Urban Environment General consideration rural structure – Urban areas – Impact of industrial pollution – chemical effluents, land reclamation –disposalofsolid waste–mining pollution

Learning outcomes:

After completion of this unit the student will be able to

- Identify the negative effects of industrial pollution
- Explain how solid waste effects the environment

Unit- III Marine Environment Sensors for environmental monitoring – sensors – visible and outside visible wave length – absorption spectrometers – selectionof ground truth sites – sea truth observations – Radar techniques for sensing ocean surface – thermal measurements – application of sensing, mapping oil slicks –Chlorophylldetection– Fisheriesresources–Coastalmarinestudies– determination oftemperatureandseastate.

Learning outcomes:

After completion of this unit the student will be able to

- List out sensors used for marine environment monitoring
- Explain RADAR techniques for ocean monitoring
- Determine sea surface temperature from satellite data

Unit –IV Air pollution and Global Climatology Remote sensing techniques for Air quality monitoring – case studies – weather forecasting and climatology –emissivity characteristics – measurement of atmospheric temperature – composition – constituent distribution and concentration – wind flows and air circulation –Hurricanetracking –meteorologicalsatellitesystems.

Learning outcomes:

After completion of this unit the student will be able to

- Recall remote sensing techniques for air quality monitoring
- Measure atmospheric temperature and composition from meteorological data.

Unit –V Case studies River pollution – the case of Ganga River Air Pollution in Delhi; Mathura Refinery and Taj Mahal; Marine pollution in Visakhapatnam;Urbanizationand itsimpactonVisakhapatnamcityenvironment

Learning outcomes:

After completion of this unit the student will be able to

- Gain more insight into river and marine pollution with some case studies
- Explain the effect of Urbanization on any study area

References

Baretl,E.C.andCulisI.F.IntroductiontoEnvironmentalRemoteSensing,secondedit ion,ChapmanandHall,NewYork,1993Lintz,J. andSimonent, D.S.Remote SensingofenvironmentAddisionWesley, Radingmars, 1976

B. Watershed Management

COURSE OBJECTIVES

The objective of the course is to

- Expose student to different issues in water shed management.
- Impart knowledge on soil related studies.
- Impart knowledge on rainfall and run-off.
- Impart knowledge on integrated water management in Agriculture.

COURSE OUTCOMES

After completion of the course the student will be able to

- Understand importance of watershed management and characteristics.
- Estimate rainfall and runoff in catchments.
- Gain knowledge on integrated water management in Agriculture.

Unit-1(WatershedConcept) c)Issues inwatershedmanagement-land degradation,agriculturalproductivity,reservoirssedimentation,depletionofbioresources, floods and droughts. Principles and approaches - principles of watershed management, different approaches in watershed management;
Problemorientedapproach,threedimensionalapproaches,integratedapproach,stepsinwatershedmanagement.d) Watershedcharacteristics-size,shapephysiography, slope, climate, drainage, land use, vegetation, geology, soils, hydrology, hydrogeology, socio-economics. Linear aspects of channel systems - Aerialaspects ofdrainagebasins.

Learning outcomes:

After completion of this unit the student will be able to

- Explain the principles of watershed management
- Describe watershed characteristics

Unit-2 (Land Management) c) 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. Brushwood dam, Rock fill dam, Gabion; Impervious check dams. d) Land capabilityclassification, land degradation and problem soils. Reclamation of saline soils, alkaline soils, saline soils, acidic soils, sulphide soils; sediment yield modeling andwatershedprioritization.Theuniversalsoillossequation,sedimentyieldindexmethod,statisticalregressionmodel,theEuropeansoilerosionmodel;Siteselectionfromconservationmeasures.

Learning outcomes:

After completion of this unit the student will be able to

- Explain basic soil surveying techniques
- Describe land degradation problem and its mitigation

Unit-3 (Water Management) c) Surface water - Study of rainfall, estimation of run-off at micro

catchments, stream gauging; Rainwater harvesting catchment,harvesting,harvestingstructures,Groundwater-explorationofcanalcommandareas,potentialareas;integratedwaterresourcesmanagement,conjunctiveuse.
d) Dry land Agriculture- Runoff agriculture, micro catchment forming, irrigation with saline water, reusing water, conserving water, sprinkler irrigation, dripirrigation,potirrigation,othersystems,reducingcroplandpercolationlosses,reducingtranspirationlosses,selectionofwateruse efficiencycrops.

Learning outcomes:

After completion of this unit the student will be able to

- Estimate rainfall and run-off in micro catchments
- Explain dry land agriculture methods

Unit-4 (Integrated Management) c) 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; treeculture; form forestry; bund utilization, boundary plantation; social forestry; Energy - Renewable resource water power, solar energy wind power; biomass, fire foodsynthetic fuels, burning of municipal / garbage, ocean tides and waves. d) Appropriate Technology - Farm Equipment; Contour Methods; Check Dams, Watercatchment and Harvesting, Kunds, Depression Harvesting, Harvesting below ground level, Harvesting below stream bed level, Ground water harvesting; low costtechnology, Water Conservation, Utilization of Wasted Natural Resources, Novelties; Rural Technological Delivery Systems, Cultivating Wasted Lands, TreeCulture,FarmForestry, Silvipastures,horticulture,Social forestry,afforestation, wonder ways.

Learning outcomes:

After completion of this unit the student will be able to

- List out different farming techniques
- Gain knowledge on groundwater harvesting techniques

Unit-5 (Monitoring and Evaluation) c) 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. d) Monitoring and Evaluation - Purpose of Monitoring and Evaluation, Nature of Monitoring andEvaluation - An interactive dynamic Process, Design of Monitoring programs - Determining information needs, Setting information-need priorities, Determiningmeans of collecting information, Information management in monitoring programs; Monitoring Biophysical Data, Monitoring Socio-economic Data, MonitoringProject Activities and outputs, Design of Evaluation Procedures, Types of Evaluation, Focus of Evaluation, Reporting Evaluation Results, Insuring Use ofMonitoringand Evaluation Information, AFinalWordofCaution.

Learning outcomes:

After completion of this unit the student will be able to

- Realize the importance of peoples participation in water resources management
- Collect information and prepare evaluation reports

TextBooksandReferences

1. WatershedManagement,J.V.S.Murthy -Publishers;NewAgeInternational(P)Ltd.,NewDelhi.

2. SpaceTechnologyApplicationsforSustainableDevelopmentsatWatersheds,TechnicalReport,ISRO-HQ-TR-104-95,ISRO,Bangalore.
3. WatershedManagementProjectPlanning,MonitoringandEvaluation;AManualfortheAsianRegion-Asian-USWatershedProject-ForestryforsustainableDevelopment Program. Universityof Minnesota,Collegeof Natural Resources,St. Paul Minnesota,U.S.A.

C–Urban Planning and Information Systems

COURSE OBJECTIVES

The objective of the course is to

- Introduce the concept of urban planning and its history in Indian context.
- Impart knowledge in urban planning components.
- Familiarize with geospatial application in urban planning.
- Impart knowledge on aspect of transportation planning.

COURSE OUTCOMES

After completion of the course the student will be able to

- Gain knowledge in Urban planning and its history.
- Understand the concepts of zoning, masterplans etc.
- Use different GIS techniques and data types to assess urban planning problems.
- Gain knowledge in transportation studies in urban context.

Unit–
IIntroductionPlanning:backgroundandprinciples;Needforplanning;Urbanisationanditsimpact,Distributionofla nduse/landcover;TownplanninginancientIndiaandnewtownsofIndia;Requirements andpossibletypesofdevelopmentoftowns;Geoinformatics applicationinUrbanPlanning

Learning Outcomes

After completion of this unit student will be able to

- Understand the principles of urban planning
- Summarize distribution of landuse/landcover in urban plqnning

Unit II Formulation of Plans Objectives and contents; Regional plan; Perspective plan; Master plan; Development plan; Project (scheme) plan; Delineation ofplanning area; Trend analysis; Land suitability analysis; Land use planning; Zoning and principles of zoning; Building Byelaws and its principles; Requirement ofurban& regional planners; Remotesensingfor different levelsofdevelopmentplanning

Learning Outcomes

After completion of this unit student will be able to

- Formulate different plans in urban context
- classify different zones and building bylaws

Unit–
IIIHousingImportanceofhousing;urbanhousingdemandandproduction;Slumsandsquatters;HousingprobleminI ndia;NationalHousingpolicy;Siteanalysis-Layoutdesign;Housingprojects/Slumhousing; Urbanrenewal

projects;Urban infrastructureplanning

Learning Outcomes

After completion of this unit student will be able to

- Recongnize the importance of housing and its related problems
- Conduct site analysis and design layouts.

Unit – IV Transportation planning Classification of urban roads; Traffic surveys: speed, time, delay surveys; Use of speed, journey time and delay studies;Traffic volume; OriginDestinationsurveys;Parking surveys;Utilityof remotesensing intrafficandtransportation studies

Learning Outcomes

After completion of this unit student will be able to

- Conduct traffic surveys for solving transportaioon problems
- Apply remote sensing technology to traffic and transportation studies.

Unit – V Urban Information System Information system: Land; Housing; Transportation; Infrastructure; Trends in mapping using remote sensing, GIS andGPS;Database creationfor Infrastructure developmentDecisionsupportsystem forurbanand regionalmanagement.

Learning Outcomes

After completion of this unit student will be able to

- Create database for urban information system
- Developdecision support system for urban management

R.S.2.6 Elective-2
(Choose any one of the following)

A.Digital Photogrammetry and Mapping

B.Geoinformatics for Resources Studies and Disaster Management

C.Spatial database and GIS Modelling

A. DigitalPhotogrammetryandMapping

COURSE OBJECTIVES

The objective of the course is to

- Impart knowledge on basics of Geodesy.
- Teach fundamentals of GPS, GNSS.
- Impart knowledge on Aerial and satellite photogrammetry.
- Introduce fundamental of cartography and geo data base organization.

COURSE OUTCOMES

At the end of the course the student will be able to

- Understand Fundamentals of Geodesy, Techniques involved in establishment of geodetic control.
- Concepts of geoid, ellipsoid and their interrelationship.
- Gain knowledge in Aerial and satellite photogrammetric techniques.
- Understand different cartography techniques and Geo D.

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

Learning outcomes:

After completion of this unit the student will be able to

- Explain fundamentals of Geodesy and map projection
- Integrate data from different sources for mapping projects

Unit-IIGNNS: Carrier phase measurements, Signal structure, GNNS Errors and biases, Differential Positioning –concepts and principles, IGS station-finalephemeris, differential corrections,accuracy in differential satellite positioning system PS, local area DGPS, wide area DGPS, LAAS, WAAS,GAGAN, Mappingmethods with GPS – rapid static method, semi-kinematic method, kinematic method. Real time DGPS. GNSS, GLONASS, IRNSS, GALILEO, Beidou, and futureprospects ofnavigationalsatellites

Learning outcomes:

After completion of this unit the student will be able to

- Explain concept of differential positioning
- Discuss various GPS methods and their advantages
- Identify various GPS satellite systems

Unit-III: Aerial and SatellitePhotogrammetry Photogrammetric camera(digital),Imaging systems-Asynchronous imaging, multiline scanners, multiplecamera/multisensors,areascanners,panoramiclinear

arrayscanners,widefieldcamera,Imagingproperties,Theoryoforient ation:(IO,ROandAO).**Photogrammetric Triangulation:** Single image, Stereo-pair (two overlapping images), Strip triangulation, Block Adjustment of Independent Models (BAIM),Bundle Block Adjustment, Special cases (resection, intersection, and stereo-pair generation). **Satellite Photogrammetry:** Orbital Parameters, Orbital Modeling,Data Processing for stereo generation (block triangulation, optimum control requirement), Space Resection and Intersection, Solutions and differences in differentsensormodelsfor photogrammetric processing.Processingof IRSIC/ID,CARTOSAT, ASTER,ALOS PRISM,SPOT,IKONOS, Quick Birdetc.

Learning outcomes:

After completion of this unit the student will be able to

- Compare Aerial and satellite photogrammetry techniques
- Generate stereopairs from photographs

Unit IV: Close Range Photogrammetry Principles of CRP, Cameras for Close Range Applications, Data Acquisition, Camera Calibration, Data Processing,Surface Generation, Validation, Terrestrial LaserScannersand future prospects.

Learning outcomes:

After completion of this unit the student will be able to

- Acquire and process Photogrammetric data
- Validate the accuracy of data

Unit V: Digital Cartography and Visualization Geo Spatial Data Base organization, Digital Cartography, Web Cartography, 3D Simulation and Visualization,Digitalearthmodelsanddatadisseminationservices: contemporaryapproaches(Bhuvanand GoogleEarth)andfutureprospects.

Learning outcomes:

After completion of this unit the student will be able to

- Discuss various modern cartographic techniques
- Access and operate various web applications like google earth

SuggestedReadings:

BooksandReports

1.ToniSchenk:DigitalPhotogrammetry,VolumeI.,TerraScience.

2. SanjibK.Ghosh,(1979):AnalyticalPhotogrammetry,NewYork:PergamonPress

3. SanjibK.Ghosh.(2005).FundamentalsofcomputationPhotogrammetry.ConceptPublishing,NewDelhi.

4. Luhmann,Thomas,Robson,StuartandKyle,Stephen,(2007).CloseRangePhotogrammetry:

Principles,TechniquesandApplications.Wiley,2007.528.ISBN:978047010633.

5. KasserMichelandEglesYves,(2002).DigitalPhotogrammetry.London:TaylorandFrancis,2002.XV,351p..

6. WolfgangTorge,W.,Geodesy,3rdedition

7. RobinsonH.Arthur,MorrisonJoelL.andMuehrckePhillipC.(1995).“ElementsofCartography,6thed.,JohnWileyandSons,Inc,671p.

8. SlocumTerryA,(1999).ThematicCartographyandVisualization.NewJersey:Prentice-HallInc.,1999.293p.

9. KraakMenno-JanandOrmelling,Ferjan(2003):Cartography:Visualizationofgeospatialdata.2nd(ed.)Harlow:PrenticeHall,IX,205p.

10. KraakMenno-Jan(Ed.)andBrownAllan(Ed)(2001).WebCartography:DevelopmentsandProspects.NewYork:Taylor&Francis,IX,213p.

Textbooks

- Rangwala,TownPlanning,CharotarPublishingHouse,Anand,India

- Gallian B. Arthu and Simon Eisner, The Urban Pattern, City Planning and Design. Affiliated Press Pvt. Ltd., New Delhi 1985. - Margaret Roberts, AnaIntroductionto Town PlanningTechniques,Hutchinson,London,1980.

B. *Geoinformatics for Disaster Management*

COURSE OBJECTIVES

The Objectives of the course is to

- Introduce basic concepts and importance of Natural resources management.
- Impart knowledge on geospatial applications in managing resources like water, soils and minerals.
- Teach the concept of disaster management.
- Introduce role of geoinformatics in managing different disasters.

COURSE OUTCOMES

After completion of the course the student will be able to

- Understand the importance of natural resource management.
- Explain the role of geoinformatics in managing resources like water, soils and minerals.
- Gain knowledge in concept of disaster management.
- Summarize the application of geoinformatics in different disasters.

Unit I Natural Resources Development: Introduction and Scope: role of geoinformatics technologies – aerial photographs; satellite remote sensing; GPS; andGISinresourceevaluation Waterresources–surface waterandgroundwaterresources:mappingand monitoringofwatersheds,tanksandreservoirs;hydrogeomorphic mapping and identification of groundwater potential zones Ocean resources: estimation of sea-surface temperature; primary productivity andpotentialfishing zones

Learning outcomes:

After completion of this unit the student will be able to

- Understand the scope of geoinformatics in natural resource management
- Identify groundwater potential zones
- Analyze satellite data and measure sea surface temperature.

Unit II Soil and agricultural resources: Spectral behavior of soils; Mapping of soils using multispectral images; Evaluation of soil erosion prone zones throughGIS; Remote sensing in Land use / land cover mapping; Crop area estimations; monitoring of crop vigour; Yield estimations. Forest resources: mapping of foresttypes;estimations oftimbervolume;monitoring offoresthealth– forestpests, forestfires,Trendsindeforestationand afforestation.

Learning outcomes:

After completion of this unit the student will be able to

- Prepare soil maps from multispectral images
- Estimate crop area and yield from satellite data
- Identify trends in deforestation and afforestation

Unit III Remote sensing techniques for identification of rocks and minerals; mapping of geological structures; surface manifestation of minerals and theiridentification;spectralpropertiesofminerals; roleofthermalandhyperspectral remotesensinginmineralexploration. Casestudies

Learning outcomes:

After completion of this unit the student will be able to

- Identify rocks and minerals from remote sensing data
- Summarize the role of hyperspectral and thermal remote sensing in mineral exploration

Unit IV Geoinformatics in Disaster Management: introduction and scope Coastal Hazards: Storm surges and Tsunamis: Origin, propagation and run-up; Roleof coastal topography, bathymetry and vegetation; Coastal hazard preparedness–Role of geoinformatics in coastal hazard mapping, risk and vulnerabilityassessmentand evacuationanalysis;coastalprotection,educationandawarenessofcoastalcommunities

Learning outcomes:

After completion of this unit the student will be able to

- Discuss the scope of geoinformatics in disaster management
- Prepare coastal hazard and vulnerability maps

Unit V Geoinformatics applications in disaster mapping and mitigation; Risk zone mapping: earthquakes – identification of geological structures like faults;volcanic activity – thermal imaging for monitoring temperature changes; Geoinformatics analysis of potential zones for landslides; avalanches; and floods. Mappingofdisasteraffectedareas forrescue andmitigation;damageassessment;GIS-based decisionsupport systems fordisaster management

Learning outcomes:

After completion of this unit the student will be able to

- Identify geological folds and faults from satellite data
- Prepare maps of disaster effected areas for rescue and mitigation

BooksandReferences:

Remotesensingforearthresources2ndEdition,(ed)D.

P.Rao,AEGPubl.,Hyderabad,1999Geomaticssolutio

nsforDisasterManagement,Li,ZlatanovaandFabbri(e

d),Springer,2007

Role of remote sensing in disaster Management, Nirupama and S.P Simonovic,

ICLR Research Paper Series 21, 2002 (available

athttp://www.iclr.org/pdf/Niru_report%20Simonovic.pdf)

Remote Sensing imagery for natural resources monitoring: a guide for first time users,

D.S. Wlike and J.T. Finn, Columbia University PressSuccessfulresponsestartswith amap:

Improving GeospatialSupportforDisaster

ManagementbyCommitteeonPlanningforCatastrophe:ABlueprintforImproving

GeospatialData,Tools,andInfrastructure,NationalResearchCouncil,NationalAca

demiesPress,2006,ISBN:0309103401Applications ofRemote

SensinginAgriculture, M.D.Stevenand J.A.Clark,Butterworths,1990

Tsunamis-tosurvivefromtsunami,SusumuMurataetal.,2009WorldScientificBooks

Reference

Sea-LevelRiseandCoastalvulnerability–anassessmentofAndhraPradeshcoast,IndiathroughremotesensingandGIS,NageswaraRao,K.etal.,(2008) *JournalofCoastalConservation*,Vol.12:pp.195-207;ImperativesforTsunamiEducation,NageswaraRao,K.(2007)*CurrentScience*,Vol.93(1)pp.8-9.

C:Spatial database and GIS Modelling

Unit-I Spatial Database Management System: Database overview, attribute data model, Spatial Database, spatial Data Type and structures. **SpatialDatabaseDesign:**Conceptualdata modelling,ConceptsofUML, UMLuse case,Spatial datatopological relationship.

Learning outcomes:

After completion of this unit the student will be able to

- Explain the fundamentals of data base management in geopspatial context
- Describe the concepts of database modelling.

Unit-II Spatial Database: Storage and Retrieval Concepts of spatial data storage, spatial Indexing, Basics of relational algebra, Data normalization, SpatialQuerylanguagesusing extended SQL,spatialqueryprocessing andoptimization.

Learning outcomes:

After completion of this unit the student will be able to

- Explain database storage and retrieval concepts
- Understand the fundamentals of spatial query process

Unit-IIIGISImplementingArchitectures:GISImplementationarchitectures(desktop,clientserver,enterprise,mobile,web/cloud,webservicesfrommobileplatforms,spatialdataacquisition /supplyindistributedenvironment and securityissues.

Learning outcomes:

After completion of this unit the student will be able to

- Explain GIS architecture
- Identify various GIS related platforms

Unit-IV SpatialDataModelling05Spatialdatamodellinganditsclassification,spatialdecisionsupportsystem,spatialdecisionmodellingconcepts,AHPbasedmodelling with casestudy, Agentbasedmodellingwith casestudy.

Learning outcomes:

After completion of this unit the student will be able to

- Discuss spatial data modelling
- Interpret various case studies to understand data modelling

Unit-V SpatialDataMining:Overviewofdatamining,ConceptsofDecisiontreebasedapproachwithcasestudy,Contentbasedimageretrievalconceptwithcasestudy.

Learning outcomes:

After completion of this unit the student will be able to

- Explain concept of data mining

SuggestedReadings:

BooksandReports1.AlistairCockburn(2001).WritingEffectiveUseCases(Boston,MAAddisonWesley,12001

).

2. Date,C.J.:DatabaseSystem,TataMcGrawHillPublications.
3. ShashiShekhar&SanjayChawla(2003).Spatialdatabase:ATour,PrenticeHall,2003.
4. GarnadyBooch,James RumbaughandIvar,Jacobson(1999).TheUnifiedModelinglanguageUserGuide(Boston,MAAddisonWesley,1999).
5. MarvinV.Zelkowitz,AlanC.ShawandJohnD.Gannon(1979).PrinciplesofSoftwareEngineeringandDesign, EnglewoodCliffs,NJ:PrenticeHall,179,P5.

RS 2.7 Lab.1. Digital Image Processing Practical

Programme writing in C. language for Data handling and processing of Remote Sensing data including histogram construction, scene enlargement, rationing and enhancement. Application of spatial filters; transformations, colour display techniques, Radiometric correction techniques, for existing satellites. Segmentation and classification methods: supervised and unsupervised techniques for different applications.

RS2.8Lab. 2.Geographic Information Systems (GIS) Practical

COURSE OBJECTIVES

The objective of the course is to

- Familiarize with different GIS software.
- Train student in creating spatial layers in GIS.
- Train student in performing basic GIS tasks.
- Teach Map analysis.

COURSE OUTCOMES

After completion of the course the student will be able to

- Understand basic GIS data concepts.
- Perform basic GIS analysis of concepts.
- Demonstrated a practical application of GIS.
- Gain practical experience in spatial analysis in GIS.

1. FamiliaritywithDBaseCommandsincluding recordupdatingandprocessing.
2. Themerepresentationbyusageofgraphicscommandresourcesdatamaintenance-Themefillingandretrievalandusage.

Exercise:Development/ updatingofdatabasemanagementsoftwarepackagesfor aselectedpracticalproblemusingavailableGIS package.;Arc-info,Arc-Viewpractice and ILWISsoftwarepackages; Creationofdifferent spatiallayers.; Map analysis.

SEMESTERSIII&IV

Dissertation and VivaVoce

A) Dissertation

ThestudentforthefulfillmentofM.TechDegreeinRemoteSensingmustcarryoutindividualdissertationwork.Candidatescandotheirworkinthedepartmentorin anyindustry/researchorganization fortwo semesters(ie3rdand4thsemesters)

B) Evaluation procedure

ProgressofthedissertationthesisworkattheendofSemesterwillbeevaluatedbyacommitteeconsistingofChairman,BoardofStudies,HeadoftheDepartmentand Thesisguide.

The Final thesis at the end of 4th Semester is evaluated through defense and Viva Voce examination will be conducted to the student by the externalexaminer 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 thestudentthecandidate mayberecommendedforawardof agradesuchas**A**(=Excellent);**B**(=VeryGood); **C** (=Good);or**F**(=Not Accepted/Failed).

TheprerequisiteforsubmissionoftheM.Tech.thesisisthatoneshouldcommunicatehis/herwork toanyreferredjournalor Publicationin aconference.

ForfinalresultthedissertationcreditsarenotaddedforCGPA.