School of Electronics
Devi Ahilya University, Indore
M. Tech. Spatial Information Technology, Batch 2021-23 (Scheme)

Semester I — 32Credits

Sr. No	Course Code	Course Name	Lecture (L) Hr	Tutorial (T) Hr	Practical (P) Hr	Credit
Core:						
1	EL71104	Digital Signal Processing	3	1	0	4
2	EL71107	Geographic Information System-I	3	1	0	4
3	EL71108	Introduction to Remote Sensing	3	1	0	4
Electives: Discipline Centric						
4	EL71101	Database Management Systems	3	1	0	4
5	EL71201	DBMS Lab	0	0	4	2
6	EL71203	System Programming Lab	0	0	4	2
7	EL71204	Digital Signal Processing Lab	0	0	4	2
8	EL71207	Geographic Information System-I Lab	0	0	4	2
Electives-Generic:						
9	EL71103	System Programming	3	1	0	4
10	EL71301	Comprehensive Viva Voce (Virtual)	-	-	-	4

SemesterII — 32Credits

Sr. No	Course Code	Course Name	Lecture (L) Hr	Tutorial (T) Hr	Practical (P) Hr	Credit
Core:						
1	EL72107	Geographic Information System-II	3	1	0	4
2	EL72109	Introduction to Photogrammetry	3	1	0	4
Electives: Discipline Centric						
3	EL72106	Digital Image Processing	3	1	0	4
4	EL72110	Global Positioning Network	3	1	0	4
5	EL72201	Mobile System Programming Lab	0	0	4	2
6	EL72206	Digital Image Processing Lab	0	0	4	2
7	EL72207	Geographic Information System-II Lab	0	0	4	2
8	EL72401	Student Seminars	0	0	4	2
Electives-Generic:						
9	EL72101	Mobile System Programming	3	1	0	4
10	EL72301	Comprehensive Viva Voce (Virtual)	-	-	-	4

SemesterIII — 12Credits

Sr. No	Course Code	Course Name	Lecture (L) Hr	Tutorial (T) Hr	Practical (P) Hr	Credit
1	EL73501	Major Project Phase I Viva Voce	-	-	-	12

Semester IV — 12Credits

Sr. No	Course Code	Course Name	Lecture (L) Hr	Tutorial (T) Hr	Practical (P) Hr	Credit
1	EL74501	Major Project Phase II Viva Voce	-	-	-	12

TotalCredits 88Credits

School of Electronics, DAVV
M.Tech Spatial Information Technology Batch 2019-21 (Syllabus)

SEMESTER – I

COURSE TITLE	COURSE CODE	CREDIT-4		THEORY PAPER
Database Management Systems	EL71101	L	P	Max.Marks-100
		4	--	

Unit 1:
Introduction: Advantages of DBMS approach, Various views of data, data independence, schema & sub-schema, primary concept of data models, database languages, transaction management, database administrator & users, data dictionary, databasearchitectures.
E-R model: Basic concepts, design issues, mapping constraint, keys, E-R diagram, weak & strong entity-sets, specialization & generalization, aggregation, inheritance, design of E-R schema, Reduction of ER Schema to tables. Domains, relation, kind of relation, Relational databases, Various types of keys.

Unit 2:
Relational Algebra and SQL: Relational algebra with extended operations, modification of database, Idea of relational calculus, basic structure of SQL, Set operation, Aggregate functions, Null values, Nested Sub queries, derived relations, views, Modification of database, join relation, Domain, relation & keys, DDL inSQL.
Programming concepts of PL/SQL

Unit 3:
Relational Database Design & Normalization: Basic definitions, Trivial & non-trivial dependencies, Introduction to Normalization, Normal forms, Decomposition, Functional dependencies, non loss decomposition, FD diagram, First, second & third normal forms, Dependency preservation, BCNF, multivalue dependencies and fourth normal form, join dependencies and fifth normal form, Database Integrity. Transaction, Concurrency & Recovery: Basic concept, ACID properties, transaction state, Implementation of atomicity & durability, Concurrent execution, Basic idea of serializability, Basic idea of concurrency control, basic idea of deadlock, Failure Classification, storage structure-types, stable storage implementation, data access, recovery & Atomicity: log based recovery, deferred database modification, immediate database modification,checkpoints.

Unit 4:
Storage Structure & File Organization: Overview of physical storage media, magnetic disk: performance & optimization, RAID, File organization, Organization of records in files, basic concept of Indexing, ordered indices: B+ tree & B tree index files, Query processing, Queryoptimization.

Unit 5:
Introduction of Oracle 10g, Spatial Database

Suggested Books:

1. Database System concepts – Henry F. Korth , Tata McGrawHill
2. SQL, PL/SQL The programming language of Oracle- IvanBayross
3. An introduction to Database System - C.JDate
4. Complete Reference – Oracle10g

COURSE TITLE	COURSE CODE	CREDIT-4		THEORY PAPER
System Programming	EL71103	L	P	Max.Marks-100
		4	--	

Object Oriented Analysis: Review of object oriented concepts, potential benefits and drawbacks of object oriented. Compare object oriented paradigm with structural/procedural paradigm. What is class, how to Identify them, relationship among objects, relationship amongclasses.

Introduction to JAVA: Features of Java, How to write simple Java programs, Understanding CLASSPATH, Java keywords, Lexical issues, Comments, Reserved Keywords, Identifiers, Literals, Operators, Separators, Variables, Naming Conventions, Data Type- Numeric types, Integers, Floating point numbers, Casting characters, Boolean, Simple type, Arrays, Multiple dimensional arrays, Type conversion & casting, Operators, Control Statements, Selection Statements, Iteration Statements.

Introducing Class: Class fundamentals, Declaring objects, new and dot operator, this keyword, Introducing methods, Constructors, Garbage collection, Overloading methods and constructor, Nested and Inner class.

Inheritance: Extending classes, Access modifiers, Keywords- super, final, static, finalize method, Method overriding, Dynamic Method Dispatch, Abstract classes, The Object class and Class class.

Packages and Interfaces: Defining a package, Access Protection in packages, importing packages, Access protection, Defining an Interface, Implementing Interfaces, Applying interfaces, Variables in interfaces, Achieving multiple inheritances through interfaces.

String Handling: String Class, String constructors, Special string operations, Character extracting, String comparison, Searching strings, Modifying a string, Strings buffer, Different string methods.

Exception Handling: Fundamentals, Exception types, try and catch, Multiple catch clauses, nested try statements, Throw, throws and finally, Exception subclasses, Creating own exception classes.

Multithreading: Thread basics, Creating and running a thread, The thread life cycle, Thread priorities, Advanced threading, Asynchronization, Messaging, Inter thread communications, Priorities and Scheduling, Daemon threads.
Introduction to Swing, Applets, AWT and IO Package.

REFERENCES

1. Object Oriented Analysis and Design by Gready Booch (Chapter 1, 2,3)
2. Complete Reference Java by HerbertSchildt
3. JAVA in Nutshell byO'Reilly
4. Java Threads byO'Reilly

COURSE TITLE	COURSE CODE	CREDIT-4		THEORY PAPER
DIGITAL SIGNAL PROCESSING	EL71104	L	P	MAX.MARKS-100
		4	--	

Unit I : Signal Processing Review: Signals, Systems and Applications, Amplification, distortion, and noise, Linear, time-invariant systems, impulse response and convolution sum, linear constant-coefficient difference equation, Fourier transform and frequency response

Unit II : The Generic DSP System Introduction: ADCs and DACs / Signal Conditioning, Anti-alias and Reconstructions Filters Distortion, Quantization Error and Noise, The Nyquist Sampling Rate, z-domain representation and transforms Frequency Domain Analysis :Periodic, a periodic and random signals, The DFT, DTFT and FFT, Signal analysis and synthesis based on DFT, Modern spectral analysis, Time/FrequencyRepresentation

Unit III : Digital Filtering :FIR and IIR Digital Filters, Digital Filter Design Parameters and methods, All-pass, low-pass, band-pass, comb filters etc.., Poles and zeroes and the Z-domain DSP Software/Hardware: The Generic DSP Processor Architecture, Application Specific Integrated Circuits, DSP Design and Analysis Software, Application specific – MATLAB programming. Filter Design: Fundamental structures of digital filters, Internal representation of LTI systems, Digital filter design – I, Digital filter design – II

Unit IV : DSP Audio/Baseband Processing: Over-/under-sampling; Sigma delta ADC/ DACs, Sample rate; decimation & interpolation, Quantization noise shaping Adaptive DSP Algorithms: Least squares (LS) and Least mean squares (LMS), Channel equalization / Inverse system identification, Echo Control for feedback suppression, Acoustic echo control /noise control DSP Baseband Communications : Information theory, AM/FM/PM modulation; ASK/PSK/FSK Signaling, Pulse shaping / Matched Filtering /Root Raised Cosine , Data equalization , Error control andcoding.

Suggested Books:

- Signal Processing &Linearsystem : B.P. Lathi,Oxford
- DigitalSignalProcessing : Proakis and Manolakis,Pearson
- DigitalSignalProcessing : S.K.Mitra, Tata McGrawDSPusing
- MATLAB : Ingle & Proakis, ThomsonLearning

COURSE TITLE	COURSE CODE	CREDIT-4		THEORY PAPER
Geographical Information Systems-I	EL71107	L	P	Max.Marks-100
		4	--	

Unit I : Introduction to GIS– Definition of a GIS, features and functions; why GIS is important; how GIS is applied; GIS as an Information System; GIS and cartography; contributing and allied disciplines; GIS data feeds; historical development of GIS. Maps and their characteristics (selection, abstraction, scale, etc.); automated cartography versus GIS; map projections; coordinate systems; precision and error.

Unit II : Concept of data model; raster data model; compression, indexing and hierarchical data structures; vector data model; topology; TIN data model. Major data feeds to GIS and their characteristics: maps, GPS, images, databases, commercial data; locating and evaluating data; data formats; data quality; metadata, databases and GIS.

Unit III : Questions a GIS can answer; GIS analytical functions; vector analysis including topological overlay; raster analysis; statistics; integrated spatial analysis. Parts of a map; map functions in GIS; map design and map elements; choosing a map type; producing a map formats.

Unit IV: Land information systems- Definitions and Basic Concepts of LIS, General characteristics of high quality information; Data& information, Land Cover and Land Use: Classifications of Information. Ownership units (e.g. assessment, land use, population, environmental quality, etc.); Collection of Information in LIS: Property survey and land registrationinformation.

Unit V : GIS applications; GIS application areas and user segments; creating custom GIS software applications; user interfaces; case studies; future issues – data ownership, privacy, education; GIS career options and how to pursue them.

Text Books:

1. Introduction to GIS by Chang, Kang-Tsung: (3rd Ed.), McGraw-Hill HigherEducation

Reference Book:

1. Fundamental of GIS by MICHAEL N DEMERS – M N DEMERS. Published by John Wiley & SonsInc

COURSE TITLE	COURSE CODE	CREDIT-4		THEORY PAPER
Introduction Remote Sensing	EL71108	L	P	Max.Marks-100
		4	--	

Unit I: Introduction: Definition and Objective of Remote sensing, Remote sensing versus photogrammetry, elements of remote sensing, Important concepts: Spatial resolution, Radiometric resolution, Spectral resolution, Temporal resolution; Remote sensing data acquisition platforms: History, terrestrial platform, Aerial platform, Space-borne platform: Geostationary satellite system, Sun-synchronous satellite system, Passive versus Active remote sensing systems, Applications

Unit II: Electromagnetic Radiations: Radio waves, Microwaves, Infrared radiations, Ultraviolet radiations, X-rays, Gamma rays, Properties. Special issues: blackbody radiations, solar emission, radiation interaction with atmosphere: Scattering, absorption. Radiation interaction with surface features: Surface roughness Vs wavelength of incident radiation, Specular Vs diffuses surfaces, Spectral reflection of vegetation, soil and water.

Unit III: Remote sensing Data Acquisition System: Utilized portion of electromagnetic radiations: Optical sensors, Multi and hyper spectral scanners, LIDAR systems, Microwave systems (RADAR), Optical sensors (Scanning operational Principles): Electro-mechanical scanners, Linear array (Pushbroom) scanner, Frame imaging system. LIDAR operational principles, RADAR operational principle.

Unit IV: Radiometric processing of remote sensing data: Sensor calibration: DN/Grey values to at-sensor radiations, Atmospheric correction: at-sensor radiance to surface radiance, Solar and Topographic correction: surface radiance to surface reflectance. Image based atmospheric corrections, Model based atmospheric corrections.

Unit V: Geometric processing of remote sensing data: Geometric distortion of optical imaging system, Optical distortion of RADAR imagery, Image registration paradigm: Registration primitives, transformation functions, similarity measures, matching strategies, Tools: Coordinate transformation, Resampling, Spatial/frequency filtering; Application: Change detection:- Input data, output data.

Unit VI: Image Classification: Supervised classification techniques:- maximum likelihood classifier, minimum distance classifier, Nearest neighbor classifier; Unsupervised classification techniques, Accuracy assessment: Confusion matrix:- basic accuracy measures.

Text books:

1. Fundamentals of Remote Sensing: A Canada centre for remote sensing - Remote Sensing Tutorial.
2. Remote Sensing by James B. Campbell. Published by Taylor & FrancisLtd.
3. Remote Sensing Digital Image Analysis by John A. Richards ·Xiuping Jia published by Springer-Verlag Berlin Heidelberg, 2006

References:

1. Remote Sensing and Image Interpretation by Thomas Lillesand and Ralph W Keifer published by John Wiley &Sons
2. Remote sensing – Principles and Interpretation by Floyd F. Sabins, Jr. published by Freeman & Co., NewYork.

SEMESTER – II

COURSE TITLE	COURSE CODE	CREDIT-4		THEORY PAPER
Mobile System Programming	EL72101	L	P	Max.Marks-100
		4	--	

Basics of Operating System : Component of Computer System, Booting Process, kernel & Evolution of Operating Systems. Real Time Operating Systems, its types-soft real time operating systems,its features and examples, hard real time operating systems its features and examples. Operating Structure: System Call, OS Services, System Program, System Structure, Virtual Machine, and System Design & Implementation. Process Management: Process Concept, Process Scheduling, Process Co-operation, Inter-Process Communication. Memory Management: Paging andSegmentation

Introduction to Android: Background and positioning of the Android platform, including comparisons to other popular platforms such as BlackBerry, iPhone, and Windows Mobile, high-level architecture of Android applications and the operating system environment. Introducing Android, Stacking up Android, Booting Android development, An Android application, Summary

Development environment. The Android SDK, Fitting the pieces together, Building an Android application in Eclipse, Building an Android application in Eclipse, The Android Emulator, Debugging

User interfaces.: Activity Life Cycle, Creating the Activity, An Overview of User Interfaces
3.4 Using XML Layouts, Selection Widgets, Date and Time Tabs, Hardware & Software Keyboards, Using Menus, Using Fonts, The WebView and the WebKit Browser, Dialog Boxes: AlertDialog & Toast, Usingresources

Intents and Services: Working with Intent classes, Listening in with broadcast receivers, Building a Service, Performing Inter-Process Communication
Storing and retrieving data: Using preferences, Using the filesystem, Persisting data to a database, Working with ContentProvider classes

Networking and web services: An overview of networking, Checking the network status,
Communicating with a server socket, Working with HTTP POST, Working with HTTP GET
Notifications and alarms: Introducing Toast, Introducing notifications, Alarms
Multimedia: Introduction to multimedia and OpenCORE, Playing audio, Playing video, Capturing media
Location Services: Simulating your location within the emulator, Using LocationManager and LocationProvider, Working with maps, Converting places and addresses with Geocoder

REFERENCES

Required Text(s)

1. Operating System Concepts – Silberschtz GalvinGagne
2. Mobile Computing – Dr.Rajkamal
3. Essential Windows CE Application Programming by RobertBurdick
4. Hello, Android by EdBurnette

Essential References

5. Windows® Embedded CE 6.0 Fundamentals by Stanislav Pavlov and PavelBelevsky
6. Beginning Visual Basic®2005 Databases by ThearonWillis

COURSE TITLE	COURSE CODE	CREDIT-4		THEORY PAPER
Digital Image Processing	EL72106	L	P	Max.Marks-100
		4	--	

Unit I: Introduction to image processing, analysis and understanding with applications to GIS and pattern recognition. Image perception, sampling and quantization, Image representation, modeling anddisplay.

Unit II: Image enhancement: spatial domain vs frequency domain; Enhancement via point operations - contrast stretching, colormap look-up tables, clipping, thresholding, negation, gray-level slicing, bit-plane slicing, range compression, algebraic operators; Enhancement via histogram modeling - histogram modification, histogram equalization, histogram specification.

Unit III: Processing via algebraic operations - input and output histograms, sums and differences of images, averaging noisy images, background removal, change or motion detection; Processing via spatial operations - weighted local area smoothing or averaging, derivative filters (Roberts, Prewitt, Sobel, Kirsch, Laplacian), sharpening filters, unsharp masking, median filtering, gray level interpolation, spatial transformations, applications of geometric operations (cameral calibration, image registration, map projection, morphing).

Unit IV: Linear systems theory and 2-D convolution for image processing; Frequency domain approach and the 2-D Fourier transform; Discrete Fourier Transform and the FFT; Discrete image transforms- Discrete Cosine Transform, Eigenvector-basedTransforms.

Unit V: Image restoration, inverse filtering and deconvolution; Hough Transform.Image segmentation via optimal histogram thresholding methods, connected components; Image and region statistics; Color models and multispectralimages.

Text Books:

1. R.C.Gonzalez and R.E.Woods. Digital Image Processing (2nd Ed.), Prentice Hall,2002.
2. Anil K. Jain. Fundamentals of Digital Image Processing, Prentice-Hall,1989.
3. K. R. Castleman. Digital Image Processing (2nd Ed.), Prentice Hall,1996.
4. W.K Pratt. Digital Image Processing (2nd Ed.), John Wiley, New York,1991.

COURSE TITLE	COURSE CODE	CREDIT-4		THEORY PAPER
Geographical Information System-II	EL72107	L	P	Max.Marks-100
		4	--	

Elementary Spatial Analysis- Introduction to GIS Spatial Analysis – A Simple Analysis Framework- GIS Data Query =- Navigation the GIS, Locating and identifying spatial objects defining spatial characteristics – point attributes, line attributes, area attributes – working with higher –level objects – higher- level point objects, higher-level line objects, higher-level area objects.

The Map as a **Model of Geographic Data** – Concept of data model; raster data model; vector data model; topology; TIN data model. Creating Digital Elevation model, Major data feeds to GIS and their characteristics: maps, GPS, images, databases, commercial data; locating and evaluating data; data formats; data quality; metadata, databases and GIS. Watershed and View shed Analysis

Statistical Surfaces – What are Surfaces? – Surface Mapping – Sampling the Statistical Surface – The DEM –Raster Surfaces – Interpolation – Linear Interpolation, Methods of Linear Interpolation – Uses of Interpolation – Problems in Interpolation- Terrain Reclassification- Steepness of Slope, Azimuth of Orientation (Aspect), Shape of Form, Visibility and Inter visibility – Slicing the Statistical Surface – Cut and Fill – Other Surface Analyses – Discrete Surfaces – Dot Distribution Maps, Choropleth Maps, Dasymetric Mapping. Spatial Arrangement – Point, Area, and Line Arrangements – Point Patterns – Quadrant Analysis, Nearest Neighbor Analysis – Thiessen Polygons – Area Patterns –Extending Contiguity Measures: the join Cont Statistic, other polygonal arrangement measures – linear patterns- line densities nearest neighbors and line intercepts- Directionality of linear and aerial objects – Connectivity of linear objects – Gravity model – Routing and allocation – The missing variable: Using other Coverages.

Comparing Variables Among Coverages – The Cartographic Overlay – point –in-Polygon and Line-in-Polygon operations – Polygon overlay – Automating the overlay pricess –Automating Point-in-Polygon and Line-in-Polygon Procedures in Raster, Automating Polygon Overlay in Raster, Automating Vector Overlay – Types of Overlay – CAD-Type of Overlay, Topological Vector Overlay, A Note about error in overlay – Dasymetric mapping – some Final Notes onoverlay.

Cartography: Introduction, Cartography today, Nature of Cartography, History of Cartography, Graticules, Cartometry - Earth, Earth-Map relations, Map Projections- Outlines and types, Scale Reference and coordinate system, Transformation - Basic Transformation, Affine Transformation.

Text Books:

1 Introduction to GIS by Chang, Kang-Tsung: (3rd Ed.), McGraw-Hill HigherEducation

ReferenceBook:

1. Fundamental of GIS by MICHAEL N DEMERS – M N DEMERS. Published by John Wiley & SonsInc

COURSE TITLE	COURSE CODE	CREDIT-4		THEORY PAPER
Introduction to Photogrammetry	EL72109	L	P	Max.Marks-100
		4	--	

UNIT I
Introduction to Geodesy: Geodesy is study of the shape of the earth , geodesy gravity field, Crustal deformation study, focus on changes in shape of the earth surface and geoid, Basic principles of earth sciences

UNITII
Surveying: Importance of surveying, principles and classifications, mapping concepts, coordinate system, map projections, measurements of distance and directions, leveling, theodolite traversing, plane table surveying, errors and adjustments, curves.

UNIT III
Aerial Photography, types of aerial photographs, geometry of aerial photographs, significance of scale and types of mosaic - Stereoscopy, viewing instruments, normal vision, vertical exaggeration and factors affecting vertical exaggeration

UNIT IV
Process of aerial photography, basic requirements of aerial photographs, planning for photography, aerial cameras, planning and execution of photographic flights and procurement of aerial photographs.

UNIT V
Air photo interpretation - photo characteristics, truth, interpretation keys, elementary methods of map making, direct tracing, reflection and projection instruments, radial line triangulation, planimetnc mapping by radial line plotting, Ground control for aerial Photogrammetry

UNIT VI
Source of data - Ground Survey and Positioning, Remote Sensing data collection, census and sampling, data models for digital cartographic information, map digitising perception and design, Cartographic design, colour theory and models, colour and pattern creation and specification and map compilation.

Textbook

1. Elements of Photogrammetry with Applications in GIS (3rd Ed.) by Wolf P. and DeWittB., McGraw-Hill,2000.
2. Digital Photogrammetry, Theory and Application, Eilifried Linder, Springer,2003.
3. Digital Photogrammetry, Michel Kasse and Yves Egles, Taylor & Francis,2001.
4. Photogrammetry: Geometry from Images and Laser Scans by Kraus, Karl, de GruyterPublishers.
5. IntroductiontoModernPhotogrammetrybyEdwardM.Mikhail,JananS.Bethel&ChrisMcGlone, Wiley & SonsInc,2000

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COURSE TITLE	COURSE CODE	CREDIT-4		THEORY PAPER
Global Positioning Network	EL72110	L	P	Max.Marks-100
		4	--	

Unit I: Coordinate and Time Systems: Definition of global and local coordinate systems, Relationship between satellite and conventional geodetic systems. Satellite Orbital Motions: Description of motions, Forces acting on the satellites, Satellite NAV messages.

Unit II: GPS Observables: Pseudo ranges, Carrier phases, SA/AS, Format of data (RINEX). Estimation Procedures: Stochastic and mathematical models, Propagation of covariance matrices, Sequential estimation, Kalman filtering, Statistics in least-squares estimation.

Unit III: Propagation Medium: Troposphere, Ionosphere, Multi path. Mathematical Model of GPS Observables: Basic theory of contributions that need to be included for millimeter level global positioning, Use of differencing, differential position, Wide-lanes and use in kinematic positioning.

Unit IV: Methods of Processing GPS Data: Available software, Available data set, International GPS Service (IGS), Cycle slip fixing/Bias resolution, Kinematic (moving receiver) GPS processing, Relationship between satellite and conventional geodetic systems.

Unit V: Applications and Examples of GPS Data Analysis along with Other Space Geodetic Data

Text Books:

1. Hofmann-Wellenhof, B., H. Lichtenegger, and J. Collins. GPS Theory and Practice. New York: Springer-Verlag, Wein,1992.
2. Parkinson, B. W., J. Spilker, P. Axelrad, and P. Enge. *Global Positioning System: Theory and Applications.* Washington D.C.: Am. Inst. Aeronaut. Astronaut.,1996.
3. Gunter Seeber. Satellite Geodes, Walter de Gruyter1993.