Post Graduate Diploma in Digital Cartography

Syllabus – (w.e.f. 2010-11)
### Post Graduate Diploma in Digital Cartography

**(Semester – I)**

<table>
<thead>
<tr>
<th>Paper No.</th>
<th>Title of the Paper/Theory</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>Introduction to Cartography and Mapping Framework</td>
<td>4</td>
</tr>
<tr>
<td>II.</td>
<td>Cartographic Mapping</td>
<td>4</td>
</tr>
<tr>
<td>III.</td>
<td>Quantitative Methods in Cartography</td>
<td>4</td>
</tr>
<tr>
<td>IV.</td>
<td>Non-Conventional Sources of Geographic Data</td>
<td>4</td>
</tr>
</tbody>
</table>

**Practicals**

<table>
<thead>
<tr>
<th></th>
<th>Title of the Practical</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>Conventional Cartography</td>
<td>2</td>
</tr>
<tr>
<td>II.</td>
<td>Topographic and Thematic Mapping</td>
<td>2</td>
</tr>
</tbody>
</table>

**(Semester – II)**

<table>
<thead>
<tr>
<th>Paper No.</th>
<th>Title of the paper/Theory</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>V.</td>
<td>Digital Mapping-I</td>
<td>4</td>
</tr>
<tr>
<td>VI.</td>
<td>Digital Mapping-II</td>
<td>4</td>
</tr>
<tr>
<td>VII.</td>
<td>The Global Positioning System (GPS)</td>
<td>4</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th></th>
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<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>III.</td>
<td>Quantitative Methods in Cartography</td>
<td>2</td>
</tr>
<tr>
<td>IV.</td>
<td>Mapping from Aerial Photography and Satellite Images</td>
<td>2</td>
</tr>
<tr>
<td>V.</td>
<td>Digital Mapping</td>
<td>2</td>
</tr>
<tr>
<td>VI.</td>
<td>Global Positioning System</td>
<td>2</td>
</tr>
</tbody>
</table>

**Project:** 8
INTRODUCTION TO CARTOGRAPHY AND MAPPING FRAMEWORK

UNIT-I: Cartographic Visualization

Cartography and digital cartography and visualisation; Geo-visualisation; Analytical cartography; web cartography; Cartographic communication – virtual, cognitive, temporal and permanent maps. Digital cartography and World Wide Web: Web map design, Web maps and multimedia Mapping cyberspace.

UNIT-II: Developments in Cartography

Development of cartography and analytical cartography since World War II: Role of remote sensing, GPS & GIS in map production, reproduction and map analysis.

UNIT-III: Elements of Geodesy

Shape and size of the Earth: Geoid, spheroid ellipsoid for world and India. Vertical datum; Plumb line and deflection of vertical, geodetic coordinate system, UTM and Indian Grid Systems.

UNIT-IV: Fundamentals of Map Projections

Developable and Non developable surfaces; Properties of map projections; Map projection classification, choice systems; Polyconic, UTM, UPS, Lamberts Conformal projection.

Recommended books

UNIT-I: Introduction to Map

Definition of a map; Map as a data model; Map types: Scale, function and the subject matter; Topology and topological maps; cartograms.

UNIT - II: Compilation of Maps

Compilation of geographical maps: Scaling-enlargement and reduction; Aggregation and smoothing; Manual and digital compilation from cadastral map, SOI, Topographical maps 1:50,000 and 1:25,000 scale maps, New map policy.

UNIT-III: Selection

Difference between maps and aerial photographs/imageries; Information entropy; Minimisation of entropy; Cognitive considerations.

UNIT-IV: Generalisation and Symbolisation

Generalisation: Simplification, classification and smoothing of data; Controls of generalisation; Symbolisation: Symbols systems; Creation of symbols: Graphical and pictorial, Qualitative and quantitative; Controls of symbols, international sign system and meteorological symbols.

Recommended books

UNIT-I: Classification

Uni-variate operators-[Quartile, nested means, arithmetic, geometric and logarithmic methods]; Multivariate operators (use of principal component analysis, weighted/un-weighted z-score and ranking single indices of concepts and constructs). Time series smoothening: Moving average; Filtering and statistical fitting.

UNIT-II: Mapping Techniques

Methods of relief representation: Contours hachure, hill/plastic shading; Qualitative mapping: Shading, colours and other symbols; Quantitative mapping: dot, choropleth, isopleths methods; Located Diagrams.

UNIT-III: Map Design

Graphic design concepts: Elements and controls of map design; Lay-out of maps; Placements of map elements and legends; Elements of typography; Methods of lettering and positioning; Lettering as ordinal symbols; Digital lettering and positioning; Advantages and limitations.

UNIT-IV: Map Analysis

Measurements from maps; Spatial analysis; Nearest-neighbour analysis, spatial analysis; Aggregation and disaggregation of data; Modification of mapping units; Interpolation: Discrete points; Point to polygon and polygon to point interpolation; Terrain analysis.

Recommended Books

2. Wesley A. Introduction to Data Structure.
NON CONVENTIONAL SOURCES OF GEOGRAPHIC DATA

UNIT-1: Aerial Photograph

Aerial photography and Photogrammetry: types of photographs, Photographic scale, Vertical aerial photographs – Principal point; Over lap and side lap; Ground coverage Stereoscopy – 3D perception, Vertical exaggeration – factors involved and determination. Orthophotography, AP Mosaicing, Relief displacement on vertical aerial photographs, Image parallax and parallax measurements – monoscopic and stereoscopic methods. Elements of image interpretation.

UNIT-II: Basics of Analytical and Digital Photogrammetry

Digital Photogrammetry – aerial and satellite Photogrammetry, Aerial triangulation – automatization, Orthophotography, Coordinate transformation between image and terrain; Image coordinates and local Cartesian coordinates; Transformation between geocentric and local Cartesian coordinates; Space intersection and space resection. Stereo data products, Digital terrain modelling – concepts, approaches and applications.

UNIT-III: Remote Sensing

Definition and principles; EMR; Stages in remote sensing; Remote Sensing Platforms Sensors; Optimum conditions for remote sensing.

UNIT-IV: Satellite Images

Satellite data formats; image resolution; Spectral signatures, Introduction to Micro wave remote sensing and Thermal remote sensing; Updating of maps through visual analysis (interpretation) of satellite images; Ground truth for data Confirmation & validation.

Recommended Books

UNIT-I: Introduction of Computers

Types of computers; Hardware and peripheral with reference to cartography; Computer literacy: Networking; Management of files; Directory structure, installation of software, backup files, saving and retrieving files, naming and registry of files Operating systems; Algorithms, programmes and software; Internet interactive digital cartography.

UNIT-II: Types and Structure of Data

Cartographic data: Spatial and non-spacial/attribute data; Sources of geographic data; Types and structure of spatial and non-spatial data; Conversion of raster to vector and vice-versa. Linkage between spatial and non spatial data.

UNIT-III: Topology Building

Concept and significance of topology; Differences between GIS and CAD topology systems; Topology building: Geo referencing; Manual and electronic digitisations; Up-head and on-board digitisation; Editing of digitized maps; Transformation of scale, projection and datum.

UNIT IV: Spatial Analysis

Spatial data: significance and type; Vector based spatial analysis; Raster based spatial analysis; Buffer analysis.

Recommended Books

UNIT-I: Digital Database Management

Principles and concepts of electronic database management; Introduction to latest DBMS: MS Access, Oracle, SQL-querries etc.

UNIT-II: Digital Map Analysis

Spatial auto correlation; Quadrat analysis; nearest neighbour analysis; Trend surface analysis and interpolation; Spatial interaction analysis; Network analysis.

UNIT-III: Digital Cartographic Packages

Overview to GIS and cartographic Packages – ARC GIS, ILWIS, GEOMEDIA, IDRISI; Digital Cartography-virtual 3D web cartography.

UNIT-IV: Digital Cartographic Modelling

Cartographic modelling and its type; Habitat modelling; Modelling transport route for hazardous waste; Modelling location of malls, hospitals, schools, airports etc; 3D modelling; TIN, DEM and GRID.

Recommended Books

THE GLOBAL POSITIONING SYSTEM (GPS)

UNIT-I: Coordinate and Time Systems

Principles; GPS satellite constellation and principles of their functioning; GPS Master Control Network: Need and functions; Conventional and orbital geodetic coordinates; Time systems: Propagation of light and reckoning of time; Correction of clock at reference station; Satellite orbits and motions: Forces perturbing them.

UNIT-II: GPS Signal and Data

Structure and Uniqueness of GPS signals; Pseudo-range measurements; Carrier phase measurements; Sources of noise: Neutral atmospheric delay, hydrostatic and water vapour, ionospheric delay (dispersive) and multipath.

UNIT-III: Differential GPS

DGPS: Corrections of errors due to noise; Real-time corrections; Post processing correction, Computation of differential correction at reference station; GPS software for processing and correcting received signals and data.

UNIT-IV: GPS Application

Geodetic and Geo science application: Earth rotation; determination of reference datum points; Application in navigation: Ship, aircraft and vehicle movements; Emergency application: tracking criminals, fire fighting, hospitalization, rescue operations; Geographic and geologic applications: Small scale surveying; locating objects and phenomena for spatial and geo statistical analysis and mapping; Environmental and socio-economic application: Locating points, lines, areas of interests and respondents in a field survey.

Recommended Books

UNIT I: Lettering and Symbolization
Lettering maps using different type style, form and size with correct positioning; Drawing of Pictorial and geometric symbols.

UNIT II: Map Projections
Construction of UTM, UPS, Polyconic, Lamberts Conformal (Two Standard Parallels).

UNIT III: Mapping Techniques
Preparation of dot, Choropleth and isopleths map of cultural landscape.

UNIT IV: Construction of diagrams and cartograms
Construction of simple, comparative, compound line and deviated bar graphs, age-sex pyramid; Preparation of maps using proportional squares, circles and spheres and construction of value area cartograms.

Recommended Books
UNIT I: Drawing of contours

Drawing of contours from discrete point values using different graphical and numerical methods.

UNIT II: Relief Mapping

Mapping relative relief and slopes using methods of G.H. Smith (isopleth), Raize and Henry (choropleth) and a combination of Wentworth’s (to determine average slope) and Robinson’s (to place dots) methods.

UNIT III: Profiles

Drawing of Simple, Superimposed, Projected, composite and longitudinal profiles.

UNIT IV: Construction of Relief Model

Hill Shading and construction of Perspective Block diagram.

Recommended Books

UNIT I: Classification of Data

Quantitative Classification of data for Choropleth mapping: quartile nested mean and Standard Deviation methods.

UNIT II: Condensation of data

Constructing multivariate indices using Z score, ranking method and Principle component analysis using SPSS.

UNIT III: Smoothening of data

Smoothening of Time series using moving average, filtering and curve fitting.

UNIT IV: Spatial Analysis

Nearest Neighbour analysis, Interpolation techniques and Terrain analysis.

Recommended Books

Practical IV-(PGDDC-411)
Mapping from Aerial photographs and satellite images
Credits: 2

UNIT I: Aerial Photography and Photogrammetry
Stereoscopic test; Use of stereo pair; Determination of photo scale; Determination of height using single and stereo pair of aerial photographs; Orientation and use of stereo pair of aerial photographs; Determination of slope; Preparation of photo index.

UNIT II: Thematic Mapping from Aerial Photographs
Preparation of image interpretation keys; Interpretation of stereopairs for mapping terrain forms, general landuse and urban landuse; Landuse/Landcover mapping from aerial photographs.

UNIT III: Thematic Mapping from Satellite Imageries
Referencing and Layout of IRS imageries; Identification of objects/features on multiband imageries; Interpretation, classification and delineation of land use/land cover from False Colour Composite (FCC); Urban Land use/Land cover mapping; Use of digital data: image enhancement and classification.

UNIT IV: Land use Mapping
Urban Land use mapping of Delhi, Bangalore, Bombay and Chandigarh.

Recommended Books
UNIT I: Data Entry and Manipulation

Georeferencing of maps and satellite images; Digitization of satellite imageries and map; Conversion of map projection and scale; Rasterization and vectorization of spatial data.

UNIT II: Spatial Analysis

Overlay proximity and buffer analysis; spatial autocorrelation; spatial interaction and network analysis; 3D modelling, Construction of DEM and TIN; Slope analysis.

UNIT III: Mapping and Designing

Dot, Choropleth and Isopleths mapping; Proportional circles, volumetric diagrams, and symbol maps; Map designing and Layout creation.

UNIT IV: Programming

Oracle and java.

Recommended Books


UNIT-I: Introduction

Familiarisation with GPS Receiver and to know the set up unit; System initialization; to develop familiarity with GPS functions.

UNIT-II: Use of GPS

Use of GPS with map and compass; finding distance, direction, altitude; area calculation.

UNIT III: Navigation

Navigation by way points; navigation by track points; Transfer of points; differential GPS.

UNIT-IV: Map Upgradation

Map preparation and upgradation.

Recommended Books


PROJECT

Credits: 8