Department of Geography

Faculty of Natural Sciences

JAMIA MILLIA ISLAMIA

NEW DELHI – 110 025

(A Central University by an Act of Parliament)

Post Graduate Diploma in
Digital Cartography

Syllabus – (w.e.f. 2010-11)

Post Graduate Diploma in
Digital Cartography

(Semester – I)

Paper No.	Title of the Paper/Theory	Credit
I.	Introduction to Cartography and Mapping Framework	4
II.	Cartographic Mapping	4
III.	Quantitative Methods in Cartography	4
IV.	Non-Conventional Sources of Geographic Data	4
Practicals		
I	Conventional Cartography	2
II.	Topographic and Thematic Mapping	2

(Semester – II)

Paper No.	Title of the paper/Theory	
V.	Digital Mapping-I	4
VI.	Digital Mapping-II	4
VII.	The Global Positioning System (GPS)	4
Practicals		
III.	Quantitative Methods in Cartography	2
IV.	Mapping from Aerial Photography and Satellite Images	2
V.	Digital Mapping	2
VI.	Global Positioning System	2
Project:		8

Paper – I (PGDDC-401)

INTRODUCTION TO CARTOGRAPHY AND MAPPING FRAMEWORK

Credits: 4

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

1. Robinson, H. et al. 1995, Elements of Cartography, 6th Edition, John Wiley & Sons.

2. Kraak, J. and Allan Brown, 2001, Web Cartography, Taylor& Taylor.

3. Dodge M. & Rob Kitchin 2000, Mapping Cyberspace, Routledge.

4. Richardus, P. and R.K.Adler, 1972, Map Projections for Geodiests, Cartographers and Geographers, North Holland publishing Company.

5. Mailing,D.H. 1973, Coordinate Systems and Map Projections, George Phillip &Sons, London.

Paper - II (PGDDC-402)

CARTOGRAPHIC MAPPING

Credits: 4

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

1. Robinson, H. et al. 1995, Elements of Cartography, 6th Edition, John Wiley & Sons.

2. Dent, Borden D. 1999: Cartography: Thematic Map Design, Fifth Edition, W C B McGraw-Hill.

3. Kraak, M. and F. Ormeling, 2003, Cartography, 2nd edition, Pearson Education Ltd.

4. Monkhouse F.J. and Wilkinson, H.R, 1963 Maps and Diagrams, Methuen, London.

5. Cromley G.R. 1991, Digital Cartography, Prentice Hall- Gale, Englewood, New Jersey.

Paper III (PGDDC-403)

QUANTITATIVE METHODS IN CARTOGRAPHY

Credits: 4

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

1. Meyer, P.L Introductory Probability and statistical Applications.
2. Wesley A. Introduction to Data Structure.
3. Robinson, H. et al. 1995, Elements of Cartography, 6th Edition, John Wiley & Sons.
4. Monkhouse F.J. and Wilkinson, H.R,1963 Maps and Diagrams, Methuen, London.

Paper – IV (PGDDC-404)

NON CONVENTIONAL SOURCES OF GEOGRAPHIC DATA

Credits: 4

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

1.Wilfred L., 2006, Digital Photogrammetry- A Practical course, 2nd Edition, Springer.

2.Egels,Y.et al. 2002, Digital Photogrammetry, Taylor & Francis.

3.David P. et al. 2003, Aerial Photography and Image Interpretation John Wiley & Sons.

4.Lillesand, T. M. 2004 Remote Sensing and Image Interpretation, 5th Edition, John Wiley & Sons.

5..Zhilin Li, et al. 2005, Digital Terrain Modelling, Principles and Methodology, CRC Press.

6. Dickinson, G.C. 1979, maps and Aerial Photographs, Arnold Heinemann. New Delhi.

7. Wolf, P.R. 1974, Elements of Photogrammetry, Mc Graw Hill. New York.

Paper – V (PGDDC-405)

DIGITAL MAPPING-I

Credits: 4

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-spatial/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

1. Anji Reddy, M. 2004: Geoinformatics for Environmental Management.B.S. Publications.

2. Chang.T.K. 2002: Geographic Information Systems. Tata McGraw-Hill

3. Heywood.I, et al. 2003: An Introduction to Geographical Information Systems. Pearson Education.

4. Bernhardsen T. 2002, Geographical Information Systems. John Wiley.

5. Wise S.2002: GIS Basics. Taylor Publications.

6. Cromley, R.G. 1992, Digital Cartography, Prentice Hall, Englewood Cliffs, New Jersey .

Paper - VI (PGDDC-406)

DIGITAL MAPPING-II

Credits: 4

UNIT-I: Digital Database Management

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

Over view 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

1. Monkhouse. F.J and Wilkinson.H.R. 1999 *Maps and Diagrams*. Methuen, London.

Paper - VII (PGDDC-407)

THE GLOBAL POSITIONING SYSTEM (GPS)

Credits: 4

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

1. Lo, C.P.and Yeung AKW. 2004 Concepts *and Techniques of GIS*, Prentice – Hall of India, New Delhi.

2. N.K.Agarwal 2004, *Essentials of GPS*, Spatial Network Pvt. Ltd.

3. NRSA, 1995, IRS - IC, Data User Handbook, Hyderabad.

Practical- I (PGDDC-408)
Conventional Cartography

Credits: 2

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

1. Monkhouse. F.J and Wilkinson.H.R.1999 *Maps and Diagrams*. Methuen , London.

2. Robinson 2003 *Elements of Cartography*, 6ed, Wiley India Pvt. Ltd., New Delhi.

Practical II (PGDDC-409)

Topographic and Thematic Mapping

Credits: 2

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

1. Monkhouse. F.J and Wilkinson.H.R. 1999 *Maps and Diagrams*. Methuen, London.

2. Robinson 2003*Elements of Cartography*, Wiley India Pvt. Ltd., New Delhi.

Practical III- (PGDDC-410)

Quantitative Methods in Cartography

Credits: 2

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

1. DAY & UNDERWOOD (2009) Quantitative Analysis, 6th ed., PHI Learning Pvt. Ltd, New Delhi.

2. Gomez, B and J Jones III J.P. eds. (2010) *Research Methods in Geography: A critical Introduction;* West Sussex: Wiley-Blackwell.

3. HARI SHANKAR ASTHANA (2007) Statistics for Social Sciences (with SPSS Applications). PHI Learning Pvt. Ltd, New Delhi.

4. Mahmood, A, 2000. Statistical Methods in Geographic Studies. Rajesh Publishers, New Delhi.

5. Montello, D.R., and Suttor, P.C. (2006) An Introduction to Scientific Research Methods in Geography; New Delhi : Sage Publications India Pvt. Ltd.

6. Mahmood, A, 2000. *Statistical Methods in Geographic Studies*. Rajesh Publishers, New Delhi.

7. Monkhouse. F.J and Wilkinson.H.R.(1999) *Maps and Diagrams*. Methuen , London.

8. Robinson (2003) *Elements of Cartography*, 6ed, Wiley India Pvt. Ltd., New Delhi.

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

1. Dickinson, G.C., 1979, Maps and Air Photographs, New Delhi, Arnold-Heinemann.
2. Lillesand T.M and Keifer R.W. (2000) *Remote Sensing and Image Interpretation*, IV th Eds. John Wiley and Sons, New York.
3. Lo, C.P.and Yeung AKW.(2004) *Concepts and Techniques of GIS*, Prentice – Hall of India, New Delhi.
4. Sabins,F.F.(2002), *Remote Sensing: Principles and Interpretation*, Freeman, New York.
5. Wolf, Paul R., 1993, Elements of Photogrammetry, McGraw - Hill, New York.

PRACTICAL V-(PGDDC-412)

DIGITAL MAPPING

Credits: 2

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

1. Lo, C.P.and Yeung AKW.(2004) *Concepts and Techniques of GIS*, Prentice – Hall of India, New Delhi.

2. Mahmood, A, 2000. *Statistical Methods in Geographic Studies*. Rajesh Publishers, New Delhi.

3. Monkhouse. F.J and Wilkinson.H.R.(1999) Maps and Diagrams. Methuen , London

4. Robinson (2003) Elements of Cartography, 6ed, Wiley India Pvt. Ltd., New Delhi.

Practical VI-(PGDDC-413)

Global Positioning System

Credits: 2

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 up gradation.

Recommended Books

1. Lillesand T.M and Keifer R.W. (2000) *Remote Sensing and Image Interpretation*, IV Th Eds. John Wiley and Sons, New York.

2. Lo, C.P.and Yeung AKW.(2004) *Concepts and Techniques of GIS*, Prentice – Hall of India, New Delhi.

3. N.K.Agarwal (2004), *Essentials of GPS*, Spatial Network Pvt. Ltd.

PROJECT

Credits: 8