SHIVAJI UNIVERSITY
KOLHAPUR

B

Accredited By NAAC

New Syllabus For

POST GRADUATE DIPLOMA COURSE

IN

DIGITAL CARTOGRAPHY

(Geospatial Technology)

Under

Innovative Programme

Syllabus to be implemented from June 2013 onwards

POST GRADUATE DIPLOMA COURSE

IN

DIGITAL CARTOGRAPHY

(Geospatial Technology)

Under

Innovative Programme

UGC: XIIth Plan

INTRODUCTION

Modern science and technology have made tremendous progress in all possible fields. Geospatial technology has been emerged a new spatial information technology. Digital Cartography is a newly emerged field in Geospatial Technology. In the current changing global scenario there is more demand and scope for professionally trained man power. To meet this challenge starting of need based skill enhancing and career building courses facilitate jobs, self-employments and empowerment of the students.

Keeping in view the need for developing trained human resources, technological application and creating job opportunities, the course in Digital Cartography has been proposed for the postgraduate students.

OBJECTIVES

The main objective of the course is to impart adequate professional knowledge and computer skills so as to enable the students to take up career in the field of Geospatial Technology.

The course aims to achieve the following objectives:

- To introduce to the students a new Geospatial Technology of Digital Cartography.
- To provide conceptual knowledge and training in Remote Sensing GIS and GPS.
- To develop the skill of spatial data acquisition, management, analysis, mapping and decision making etc. leading to an elevated career profile and job opportunities in the corporate sector.
- To gain an understanding of cartographic software to produce accurate appropriate convincing and creative cartographic and graphic images.
- To create digital maps reflecting the purpose, content and function of geospatial data.
- To promote scientific and technological applications in teaching and research work.

SCOPE OF THE COURSE

Better information leads to better decisions. In order to get that information, we need the right set of tools and techniques. Geospatial technology encompasses remote sensing, geographical information system and GPS. It has been meticulously gathered, manipulated, monitored, analyzed and mapped spatial data. It combines tools and techniques of spatial and computational sciences. Digital spatial data acquired from remotely sensed images analysed by GIS and visualized on computer screen or paper form the core of geospatial technology.

Cartography is the knowledge associated with the art, science and technology of maps. Maps represent and communicate about our worlds. Maps portray spatial relationship among selected phenomena of interest. In today digital age billions of pieces of data are collected every day and much of this information includes a component that feels the geographic location of the data. Almost all maps of places on the earth are created today using computerized systems. It is a tool used capture, edit, store, manipulates, analyses and display spatial data.

The digital revolution has created an unprecedented demand for people who understands and how to make and use maps.

PROSPECTS

Geospatial technology is one of three emerging industries with the highest demand for workers and potential for growth in the coming decade. Professional map makers create maps of different places for various purposes cartographers and GIS professional are working behind the scenes to collect up to date information and display them on maps and computers to help a diverse range of users do an infinite number of things.

People in the map sciences are everywhere in engineering, recreation, health care, city planning, environmental and earth sciences, internet planetary astronomy, real estate, local and federal government universities etc. and so collected with GIS technology. Careers in mapping sciences are among the fastest growing and most in demand professions in India and abroad. This course opens wide

variety of professions in the fields of cartography and GIS. These are two major career fields in the mapping sciences using geospatial technology.

This course provides an introduction to the principal concepts, software and hardware necessary to produce good maps, especially in the context of geographic information system. This will be the first of its own kind course in the southern part of Maharashtra.

COURSE STRUCTURE

Course Focus

Postgraduate Diploma Course in Digital Cartography focuses on the potential users of Geospatial technology. This course caters to the needs of students, teachers, professionals, researchers, businessmen, government employees and all those who want to make intelligent use of geospatial technology.

The Course

Title of the Course : Digital Cartography

Level of the Course : PG Diploma

Duration of the Course : One Year Regular Course

Examination Pattern	: Annual Pattern (80 External/20 Internal Evaluation)
Intake capacity	: 25 Students
Eligibility	: Postgraduate of any discipline of any recognized University.
Admission	: Common Entrance Test (CET).
Evaluation:	
	A. University: Theory and Practical Examination Viva-Voice on Project work
	B. Internal : Assignment/ Tests/ Seminar/ Discussion/Presentation.
Standard of passing	: Minimum 40 percent in each head
Teacher qualification	: MA /M.Sc in Geography with NET/SET/Ph.D and PG Diploma /Master in Geoinformatics /equivalent in concern subject.

STRUCTURE OF THE COURSE

Course Code: PGDDC

Paper Code: DC

Paper No	Title	Credit	Marks		
			University	Internal	Total
DCT: 101	Fundamentals of Cartography.	04	80	20	100
DCT : 102	Quantitative Techniques in Cartography.	04	80	20	100
DCT : 103	Thematic Mapping and Remote Sensing.	04	80	20	100
DCT : 104	Digital Mapping.	04	80	20	100
DCP : 105	Laboratory Work.	05	80	20	100
DCP : 106	Field Work and Project Work.	05	80	20	100
		26	480	120	600

COURSE CURRICULUM

Paper-I (DCT: 101)

FUNDAMENTALS OF CARTOGRAPHY

Marks: 100

Unit: I Introduction to Cartography:

Definition, Nature and Scope of Cartography; Manual Cartography Vs Computer Cartography; Role of Remote Sensing, Geographical Information System and Global Positioning System in map production, reproduction and map analysis.

Unit: II Elements of Cartography:

Maps: Categories of maps and scale factor; Geodesy and coordinate systems; Map projection: Classification, Properties, and Distortion on map projections, Map projections transformation, Polyconic, LCC, Mercator, UTM UPS and choice of map projections; Representation and compilation of spatial data; Graphic elements of map making; Generalization: elements and controls; Symbolization: qualitative and quantitative; Visualization: visual variables; Colour and pattern; Production and reproduction

Unit: III Basics of Computer Cartography:

Cartographic Data: Point data, linear data areal data, volume data, surface data; Sources of cartographic data: Conventional and non- conventional; Cartographic databases; Cartographic processes: map base construction- projection and co-ordinate systems; Compilation- base data, thematic data; Generalization; Map design; Symbolization;

Typography and lettering; Visualization of spatial data; Production and reproduction; Cartographic methods and techniques: Graphic images (Graphs and Diagrams); Mapping techniques (Dot, Choropleth, Isoclines map); Modern techniques of map production: dynamic and interactive mapping, animation, simulation, web maps, electronic atlas.

Unit: IV Application of Computer Cartography:

Hardware and software for computer cartography; Representation of geospatial data: histogram, bar graphs, line graphs, scatter diagram, pie diagram and trend line; Preparation of located diagrams on maps; Advantages and disadvantages of computer assisted cartography.

Application of computer cartography in the various fields e.g. earth sciences, environmental sciences, natural resources, regional development and planning, management, agriculture, forestry, disaster management, water resources, urban planning etc.

Recommended Books:

- Monmonier, M.S. (1982): Computer Assisted Cartography: Principles and Prospects, Prentice Hall.
- Robinson, H. et al (1995): Elements of Cartography, 6th Edition, John Wiley & Sons, New York.
- Monkhouse, F.J.R. & Wilkinson H.R.(2000):Maps and Diagrams, Methuen &Co. London.
- Raise, Erwin (1962): Principles of Cartography, McGraw-Hill, New York.
- Cromley, R.G.(1992): Digital Cartography, Prentice-Hall, New York.
- Dent, B.D.(1999): Cartography- Thematic Map Design, 5th Edition, WCB Mc Grew Hill, Boston.

- Rampal, K.K.(1993): Mapping and Compilation, Concept Publishing Co. New Delhi.
- Slocum, T.A.et al.(2008): Thematic Cartography and Geovisualization , 3rd Edition, Prentice Hall.
- Mishra, R.P. (1973): Fundamentals of Cartography, Prasaranga, University of Mysore.
- Kraak M.J.and Ormeling.F (2004): Cartography: Visualization of Spatial Data, Pearson Edu.pvt Ltd. (Singapore) Inelian Branch, New Delhi.
- Sarkar, A (2009): Practical Geography: A Systematic Approach, Orient Longman, Kolkatta.

Paper-II (DCT: 102)

QUANTITATIVE TECHNIQUES IN CARTOGRAPHY

Marks: 100

Analysis and Representation of Geospatial Data in Cartography

Unit: I **Geostatistics:**

Frequency distribution and its graphical representation; Univariate analysis: Central tendency, Dispersion/Variation; Bivariate analysis: Correlation and Regression; Multivariate analysis: Principal Component Analysis, Factor analysis and Multiple regressions; Sampling: Sample distribution and sampling techniques; Hypothesis Testing: Chi-square, t-Test; Probability: Normal, Binomial and Poisson distribution; Introduction to Matrices and Linear Programming.

Unit: II **Quantitative techniques:**

Measures of inequalities: Lorenz curve Ginni's co-efficient; Trends and estimation: Semi average, Moving averages and Least square; Growth rate: Simple, compound and exponential; Pattern of distribution: Nearest Neighbour Analysis; Network analysis: Accessibility and Connectivity; Disparities and combinational analysis: Concentration and diversification indices, Crop combination method; Drainage analysis: Stream ordering, Drainage density, Bifurcation ratio; Morphometric analysis: Size and Shape index.

Unit: III **Spatial analysis and Mapping:**

Raster analysis and Vector analysis; Overlay analysis; Multi criteria analysis; Site suitability analysis; Terrain mapping and analysis: DEM and DTM; Spatial and Non-Spatial query; Surface mapping.

Unit: IV Mapping Techniques:

Qualitative mapping: Shading colours symbols; Quantitative mapping: Dot, Choropleth, Isopleths methods and located diagrams; Mapping of physical and socio-economic data

Recommended Books:

- Gregory, S. (1978): Statistical Methods and the Geographers, 4th Ed. Wiley
- Hammond, R. and McCullagh P.S. (1978): Quantitative Techniques in Geography: An Introduction, Oxford University Press, USA.
- Mahmood, A. (1977): Statistical Methods in Geographical Studies, Rajesh Pub., New Delhi.
- David, Ulwin (1981): Introductory Spatial Analysis, Methuen, London.
- Mathew, J.A. (1981): Quantitative and Statistical Approaches to Geography, Rawat Jaipur.
- Pal, S.K. (1999): Statistics for Geoscientists: Techniques and Applications, Concept, New Delhi.
- Taylor, P.J. (1977): Quantitative Methods in Geography, Houghton Miffin, Boston.
- Robinson, H. et al, (1995): Elements of Cartography, John Wiley & Sons, New York
- Monkhouse, F.J. and Wilkinson, H.R. (1963): Maps and Diagrams, Methuen, London.
- Elhance, D. N. (1972): Fundamentals of Statistics, Kitab Mahal, Allahabad.

Paper No: III (DCT: 103)

THEMATIC MAPPING AND REMOTE SENSING

Marks: 100

Unit: I **Fundamentals of Remote Sensing:**

Electromagnetic Radiation and EMR spectrum; Sensors and remote sensing data acquisition; Platforms: Aircrafts and Satellites; Remote Sensing types and products; Aerial Photography: Types of air photographs and aerial photogrammetry; Satellite Remote Sensing: Satellite images and Digital photogrammetry.

Unit: II **Digital Image Processing and Image Interpretation:**

Introduction to image processing: Acquisition of digital images and image formats; Digital image processing operations: Image rectification and restoration, image enhancement, spatial feature manipulation, spectral ratioing, image data fusion, image classification; Image interpretation: elements and techniques; Air- photo interpretation, Satellite imagery interpretation.

Unit: III **Thematic Mapping:**

General and Thematic maps; Concept of Thematic Cartography; Types of thematic maps (qualitative and quantitative); Chorochromatic and Choroschematic maps; Choropleth maps; Isolines maps; Diagrametic maps/Cartograms; Dot maps; Flow line maps; Statistical surfaces.

Unit: IV **Application of Remote Sensing in Thematic mapping:**

Land use/Land cover mapping; Forest cover mapping; Crop type mapping; Soil mapping; Flood mapping; Disaster mapping; Urban land use mapping; Terrain mapping;

Landforms mapping; Ground water potential zones and quality mapping; Mapping of mining areas; Pollution mapping; Overview to ERDAS.

Recommended Books:

- Sabin,S,F. (1987): Remote Sensing: Principles and Interpretation, Freeman & Co. New York.
- Lillesand, T.M. and Kiefer, R.W (2000): Remote Sensing and Image Interpretation, John Wiley & Sons, New York.
- Campbell, J.B.(1996): Introduction to Remote Sensing, Taylor and Francis, London.
- Rampal, K.K.(1999): Handbook of Aerial Photography and Interpretation, Concept Publishing Co., New Delhi.
- Curran, P.J.(1985): Principles of Remote Sensing, Longman, London.
- Hort, R.M.(1989): Digital Image Processing of Remote Sensed Data, Academic, New York.
- Walford, N.(1995): Geographical Data Analysis, John Wiley & Sons, New York.
- Nag, P. et al (1992): Thematic Cartography and Remote Sensing, Concept Publishing Co., New Delhi.
- Nag, P. and Kudrat, M. (1998): Digital Remote Sensing , Concept, New Delhi.
- Cromley, R.G.(1992): Digital Cartography, Prentice Hall of India, New Delhi.
- Dent, B.D.(1999): Cartography: Thematic Map Design, W.C.B, McGraw Hill, Boston.
- Slocum, T.A. et.al (2008): Thematic Cartography and Geo-visualization, Prentice Hall.
- Reddy, M. A. (2008): Text book of Remote Sensing and Geographical Information System, BS Publication, Hyderabad.
- Wolf, P. R. (1974): Elements of Photogrammetry, McGraw Hill, Bostan.
- Rashid, S.M. (1993): Remote Sensing in Geography, Manak Publication Pvt. Ltd., Delhi.

Paper No: IV (DCT: 104)

DIGITAL MAPPING

Marks: 100

Unit: I **Introduction to Computer:**

Types of Computers; Structure of digital Computer; Input-Output devices with reference to cartography; Files and directory; Operating systems; Software required for digital cartography; Computer Coding, Number systems and Computer arithmatics

Unit: II **Principles of Digital Mapping:**

Representation of geospatial data in digital environment.

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 data vice-versa; Linkage between spatial and non-spatial data. Cartographic databases: images, line, point, area, elevation and spatial database. Cartographic data processing: hardware and software for dataprocessing; typology, georeferencing, manual and electronic digitization, editing of digitized maps; Transformation of scale, projection and datum. Graphic design in map making- elements of map design, colour and pattern, typography lettering. Mapping methods; Techniques of map production; Digital map analysis.

Unit: III **GIS and GPS application in Digital Mapping.**

GIS application in environment and regional development planning: Cadastral and Utility maps (large scale maps), Socio-economic maps and environmental maps (small scale maps), Thematic and temporal maps.

GPS application in surveying, mapping and map upgradation, vehicle tracking, location based services, navigation Over view to GIS and Cartographic packages: ARC GIS, ILWIS, GEOMEDIA, IDRISI, AUTO CAD, MAP INFO.

Unit: IV Computer Programming Languages:

Evolution of Programming Languages; Introduction to Computer Programming Languages: C, DOT NET and SQL.

Recommended Books:

- Maguire, D.J. (1989): Computers in Geography, Longman, London.
- Mather, P.M. (1991): Computer Applications in Geography, Wiley, New York, USA.
- Monmonier, M.S.(1982): Computer Assisted Cartography: Principles and Prospects, Pentice Hall, New York
- Unwin, D.J. and Dawson, J.A. (1985): Computer Programming in Geography, Longman, London.
- Kraak, M.J. and Ormeling, F.(2004): Cartography: Visualization of Geospatial Data, 2nd Edition, Pearson Education
- Kraak, M.J. and Brown, A. (2001): Web Cartography Developments and Prospects, Taylor and Francis, London.
- Cromley, R.J. (1992): Digital Cartography, Prentice Hall of India, New Delhi.
- Chang, K.T. (2006): Introduction to Geographic Information System, Tata McGraw Hill, New Delhi.
- Nag, P. and Sengupta, (2007): Geographical Information System-Concepts and Business Opportunities, Concept Publishing Co., New Delhi.
- Maguire, D.J., Goodchild, M.F. and Rhind, B.M. (1991): Geographical Information Systems: Principles and Applications, Longman Group, UK.
- Burrough, P.A. and McDonnell, R. (1998): Principles of Geographical Information Systems, Oxford University Press New York.

Practical-I (DCP: 105)

LABORATORY WORK

Marks: 100

Lab Session-I: (Fundamentals of Cartography)

Construction of scales and map projections; Representation of socio-economic data using graphs and diagrams; Representation of physical data: mapping landforms, drainage patterns, slope from SOI toposheets; drawing of profiles and block diagrams; mapping relative relief and slope; Representation of climatic data by different graphs, diagrams and maps

Lab Session-II (Quantitative Techniques in Cartography)

Graphical representation of frequency distribution; computation of central tendency values, dispersion measures; Exercises on bivariate and multivariate analysis and its representation; Examples on sampling and probability; Construction of Lorenz curve and Ginni's co-efficient; Trend analysis and estimation; Determination of distribution; Measures of disparities and combination; Shortest path network analysis; Drainage analysis and morphometric analysis. Lab. work on spatial analysis and mapping using GIS Softwares; Preparation of qualitative and quantitative maps for physical and socio-economic data

Lab Session-III (Thematic Mapping and Remote Sensing)

Stereoscopic test; Air photo scale and resolution; determination of height using single and stereo pairs of air photographs; Determination of ground coverage and slope; Calculation of image distortion and number of photographs to cover the area.

Interpretation of air photographs and satellite imageries (LANDSAT, SPOT, IRS, CARTOSAT, NOAA) and preparation of maps of fluvial landforms and land use land cover

Thematic mapping from aerial photographs: Terrain, land use/ land cover, urban land use; Thematic mapping from satellite imageries: identification of objects/ features on multiband imageries, delineation of land use/land cover from FCC; Use of digital data: Case study of urban land use mapping; Upgradation of maps from satellite imageries; Georeference of toposheets and imageries; Digital image processing techniques.

Hands on image processing software: ERDAS

Lab Session-IV (Digital Mapping)

Conversion of number systems and computer arithmetics; Georeferencing of maps and satellite imageries; Digitization and scanning of maps and satellite images; Transformation of map projection and scale; Rasterization and vectorization of spatial data; Overlay, proximity and buffer analysis, spatial interaction, network analysis, 3D modeling; Construction of DEM and TIN; Slope analysis; Dot, choropleth, isopleths

mapping; Proportional circles, volumetric diagrams and symbol maps.

Analog to digital conversion; Introduction to GIS softwares; Digital database creation; contouring and DEM; Preparation of thematic maps on physical and socio-economic and environmental data using various cartographic techniques; Spatial analysis techniques and preparation of thematic layers using GIS; Digital Mapping using GIS data.

Introduction to C, DOT NET and SQL Programming Languages.

Recommended Books:

- Monmonier, M.S. (1982): Computer Assisted Cartography: Principles and Prospects, Prentice Hall, New Jersey.
- Cromley, R.G.(1992): Digital Cartography, Prentice-Hall, New Jersey.
- Hammond, R. and McCullagh P.S. (1978): Quantitative Techniques in Geography: An Introduction, Oxford University Press, USA.
- Elhance, D. N. (1972): Fundamentals of Statistics, Kitab Mahal, Allahabad.
- Nag, P. et al (1992): Thematic Cartography and Remote Sensing, Concept Publishing Co., New Delhi.
- Reddy, M. A. (2008): Text book of Remote Sensing and Geographical Information System, BS Publication, Hyderabad.
- Mather, P.M. (1991): Computer Applications in Geography, Wiley, New York, USA.
- . Kraak, M.J. and Ormeling, F.(2004): Cartography: Visualization of Geospatial Data, 2nd Edition, Pearson Education
- Unwin, D.J. and Dawson, J.A. (1985): Computer Programming in Geography, Longman, London
- Chang, K.T. (2006): Introduction to Geographic Information System, Tata McGraw Hill, New Delhi.

NATURE OF QUESTION PAPER

P.G. Diploma

In

Digital Cartography

(Geospatial Technology)

Paper: DCT-101 – DCT-104 (Theory)

Total Marks: 80

Q.1.	**Objective type question (MCQ)**	**10 Marks**
Q.2.	**Exercises**	**20 Marks**
Q.3	**Essay type Question with Internal Option**	**15 Marks**
Q.4	**Essay type Question with Internal Option**	**15 Marks**
Q.5	**Short Note (Any Four)**	**20 Marks**

NATURE OF QUESTION PAPER

P.G. Diploma

In

Digital Cartography

(Geospatial Technology)

Paper: DCP-105 (Practical)

Total Marks: 80

Q.1	**Lab Work**	**20 Marks**
Q.2	**Lab Work**	**20 Marks**
Q.3	**Lab Work**	**20 Marks**
Q.4	**Assessment**	**10 Marks**
Q.5	**Viva-voce**	**10 Marks**

Practical-II (DCP: 106)
FIELD WORK AND PROJECT WORK

Marks: 100

Project work shall deal with Digital Cartography application with reference to specific domain areas of earth sciences, environmental sciences, socio-economic development, industrial and corporate sector, administration, public utilities, planning and development of natural resources. Students are requested to carry out field work and generate primary data or collect secondary data and analyze it using computer technology to produce cartographic outputs,

To carry out project work problem in the available infrastructure in their own institution/ department or one of the recognized institute/laboratories, companies etc. to get acquainted with various image processing and GIS softwares.

The basic objectives of the project work include application of RS, GIS. GPS technologies in cartography, team work, design and execution of project, project report preparation and presentation

Scheme of Evaluation

Written examination	50 Marks
Evaluation of Project Report	30 Marks
Viva-Voce	20 Marks