Solapur University
Solapur

School of Earth Science

(Department of Geoinformatics)

Ph.D. Course Work Syllabus

(w.e.f.June-2014)

Solapur University, Solapur
Ph.D Course Work
Geoinformatics

There shall be Three papers of 100 marks each subject as below:-
I) Research Methodology & Information Communication Technology

II) Recent trends in Geoinformatics

III) Advanced development in (concerned subject) (elective)

Any one of the following Elective Papers:

I) Applications of Geoinformatics in Planning and Resource Management

II) Advanced Development in Geospatial Data Analysis

III) Advanced Development in Remote Sensing Techniques

Ph.D. Course Work Syllabus
Common Paper for Faculty of Science
(w.e.f. June 2014)
Paper No. I: Research Methodology and ICT

1. **Scientific Method:**

   Block schematic of scientific approach, inductive and deductive logic schemes, imperial basis of laws, theory, hypothesis, deductive system, requirements of theory, dynamics of theory construction, rational explanation, scientific explanation, limits of scientific explanation.

2. **Formulation of Research Problem:**

   Criteria of good research, types of research, significance, literature review, purpose, process of literature review, analysis of an article, search engine, formulation of research problems, accuracy of definition, objectives of research, research design, preparation of research article and thesis.

3. **Process of Research:**

   Definations of problem, planning of experiments, data collection and record keeping, results and discussions, presentation of research outcome as a research paper or filing patent.

4. **Research Publications and Quality:**

   Indices, publications, types, Impact factor, calculation of Impact Factor, uses, calculation of immediacy Index, calculation, SCOPUS, h – index, advantages, criticism ISSN, ISBN.

5. **ICT:**

   Various search engines available on internet, normal vs advanced search, key – words, formulation of search statement, Listing various journals in relevant topic, Science abstracts, e – database.
   Application of Computers in research, internet browsing, tool bar options, provisions of MS – word, MS – Excel, MS – PowerPoint, Origin.

6. **Fundamentals of Data Analysis and Statistical Methods:**

   Types of data and various methods of data collection, Framing of questionnaires, various sampling methods.
   Statistical techniques for analyzing data: Measures of central tendency, measures of dispersion, measures of asymmetry (Skewness), measure of relationship, simple regression analysis, testing of hypotheses, chi- square test, analysis of variance (ANOVA) and Covariance (ANCOVA).

Reference Books:

1. Research Methods - Ram Ahuja, Rawat Publications
2. Philosophy of Science – Mario Bunge, Transaction Publishers
3. Research Methodology - Methods and Techniques, C. R. Kothari New Age
4. Fundamentals of Statistics - Goon, Gupta and Das Gupta (Vol. I & Vol. II)

Paper No. II :- RECENT TRENDS IN GEOINFORMATICS

A) Background and Evolution of GIS, components and objectives of GIS, Geospatial data, GIS operations, commonly used map projections.

B) Object Based Data model Vector and Raster:

Object based data model, Geodatabase data model, interface, Topology rules, elements of raster data model, Type of raster data, raster data structure, and data conversion

C) Spatial data:

Type of data maps and their influence on the character of spatial data thematic character of spatial data, sources of spatial data, 3D model, modeling surface and network, vector vs. raster model of data structure

D) Aspatial/Attribute data management:

Data base management system, creating data base, data type, Structure, model and application

E) Data Analysis and modeling:-

Reclassification, integrating data map overlay, spatial interpolation, process of model Analysis of surface and network

F) Decision support System:-

Multicriteria Decision Analysis, Spatial Multicriteria Decision Analysis, Evaluation criteria, Decision alternatives, Criteria weighing, Decision rules.

References

1. Demers M.N (2000), Fundamentals of Geographic Information Systems, Second Edition, John Wiley & Sons.
2. Burrough P. A. MacDonneli R. A. (2000), Principles of Geographical Information Systems, Oxford University Press.
3. Makrewski Jacek (1999), GIS and Multi-criteria Analysis, USA.

Paper No. III :- Elective Papers: (Any one among the following three papers)

I) APPLICATIONS OF GEOINFORMATICS IN PLANNING AND RESOURCE MANAGEMENT

A)Forest resource management: Scope, nature, methods, themes, issues and case studies

B)Agriculture and soil management: Scope, nature, methods, themes, issues and case studies

c)Water resource management: Scope, nature, methods, themes, issues and case studies

D)Human settlement planning: Scope, nature, methods, themes, issues and case studies

E)Geosciences: Scope, nature, methods, themes, issues and case studies

F)Disaster Management: Scope, nature, methods, themes, issues and case studies

Suggested Readings:

1. Application of RS and GIS in Geosciences, Lectures notes by CSSTEAP, IIRS.
2. Application of RS and GIS in Water Resources, Lectures notes by CSSTEAP, IIRS.
3. Application of RS and GIS in Agriculture and Soil, Lectures notes by CSSTEAP, IIRS.
4. Remote Sensing for sustainable Development, Proceedings of National Symposium organized by ISRS and RSAC, Nov 1992, Published by ISRS.
5. Proceeding of National Symposium on RS for Agricultural Application held at New Delhi, Dec 1990, ISRS/IARI.
6. Proceedings of ISPRS Commission VII Symposium Resource and Environmental Monitoring, Hyderabad, Dec2002.
7. National Agricultural Drought Assessment and Monitoring System, India, Summary Report, Sept 2001
8. Remote Sensing and GIS Application in Urban and Regional studies by Subudhi A P, Sokhi B S, Roy P S, IIRS, 2001
9. Natural Disaster and their Mitigation by PS Roy, Published by IIRS, 2000
10. Biodiversity Characteristics at Landscape Level in North East using satellite Remote And Geographical Information System by Roy P S., IIRs, 2002
11. Forest Cover Assessment in Asia by P.S. Roy, IIRS, 2002
12. Biodiversity and Environment by P.S. Roy, IIRS, 2000
13. Subtle Issues in Coastal Management by Sudershana R, Mitra D, Mishra , Roy P.S., Rao D.P., IIRS, 2000
14. Spatial Technologies for Natural Hazards Management (Proceedings of ISRS National Symposium Nov 21-22,2000, IIT Kanpur)
15. Application of RS and GIS in Disaster Management, Lectures notes by CSSTEAP, IIRS.
16. Forest Resource Management, Lectures notes by CSSTEAP, IIRS.

II) ADVANCED DEVELOPMENT IN GEOSPATIAL DATA ANALYSIS

A) Spatial analysis Vector based: Overlay operations, point in polygon, line in polygon, polygon in polygon.

B) Single layer operations: feature identification, extraction, classification and manipulation. Multilayer operations - Union, Intersection, Difference.

C) Spatial analysis Raster based: Map algebra, grid based operations, Local, Focal , Zonal & Global functions, Cost surface analysis, Optimal path and proximity search.

D) Network analysis: Concepts, evaluation of network complexity using alpha, gamma indices. C - Matrices for evaluating connectivity of the network. Network data model.

E) Point pattern analysis: Methods for evaluating point patterns: clustered and random distribution

F) Surface analysis: Interpolation methods, DEM, TIN, variance filter, slope and aspect, relief and hill shading.

Suggested Readings:

1. Roy P. S (2000), Geographical Information Science, Vol. I, IIRS.
2. Demers M. N (2000), Fundamentals of Geographic Information Systems, Second Edition, John Wiley & Sons.
3. Burrough P. A. MacDonneli R. A. (2000), Principles of Geographical Information Systems, Oxford University Press.
4. Makrewski Jacek (1999), GIS and Multi-criteria Analysis, USA.

III) ADVANCED DEVELOPMENT IN REMOTE SENSING TECHNIQUES

A) Data products, Data formats, Ground Segment Organisation, Data Product generation, Referencing scheme, Value-added Products, Photo products and Digital products.

B) Microwave Remote sensing:- **I**ntroduction, Radar development, Slide Looking Radars, Geometric characteristics of SLAR imagery – Earth surface feature Characteristics influencing radar returns, image signatures and polarization

C) Contemporary Photogrammetry:- Background, classification, and organization of Aerial photographs, Stereo Photogrammetry, stereo Photogrammetry stereoscopic parallax, Stereoscopic plotting instruments – analogue and analytical, Aerial Triangulation.

D) Digital photogrammetry:- digital and soft copy of photogrammetry, Stereoscopic measurement of object height or terrain elevation.

E) Thermal Infrared Remote Sensing:- Background, Properties, Thermal radiation laws, Thermal Infrared Data collection and Thermal Infrared Remote sensing examples.

F) Multispectral Remote Sensing:- Concept and sytems, Digital Multispectral data collection, Multispectral image using discrete and scanning mirrors, Multispectral image using Linear Arrays.

Suggested Readings:

1. George Joseph (2004), Fundamentals of Remote Sensing, Universities Press (India) Private Limited.
2. Lillesand T. M., Kiefer R. W (2000), Remote Sensing and Image interpretation, John Wiley & Sons Inc.
3. Campbell James, Introduction to Remote Sensing, Taylor & Francis London.
4. Agarwal C.S (2000), Remote Sensing, Wheeler A. H and Co. Ltd.
5. Photogrammetry and Remote Sensing (2000), Lecture notes, Module **I**, IIRS; Agarwal C.S. and Garg, P. K. (2000): Remote Sensing, A. H. Wheeler and Co. Ltd., New Delhi.

Ph.D. (Course Work) Nature of Question Paper Pattern

- Ph.D. कोर्सवर्कसाठी फक्त Long Answer व Short Answer असेच प्रश्न असतील.
- Ph.D. (Course work) प्रश्नपत्रिकेत कोणताही External Option व Objective प्रश्न असणार नाहीत.
- एकूण प्रश्न - ५ x गुण २० = १०० गुण
- प्रश्न क्रमांक १ ते ५
- (A) दिर्घोत्तरी प्रश्न (१० गुण)

  (B) Answer Any two out of three (प्रत्येकी ५ गुण)

  या प्रश्नपत्रिकेच्या स्वरुपामुळे Internal Option हा २५% राहतो.