

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous),
Shivajinagar, Pune 05

T.Y.B.Sc. Geography NEP 2023 Pattern

Syllabus

To be implemented from Academic Year 2025-26

Semester	Paper	Subject code	Title of Paper	No. of credits
Semester V				
T.Y.B.Sc. Sem V	Minor (Paper IV) (Theory + Practical)	23ScGeoU5301	Watershed Management (T + P)	4
Semester VI				
T.Y.B.Sc. Sem VI	Minor (Paper V) Practical	23ScGeoU6301	Introduction to Geoinformatics (T + P)	4

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Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune 05
T. Y. B.Sc. Geography (Minor)
(2023 Course under NEP 2020)
Course Code: 23ScGeoU5301 (T+P)

Section-I (Theory)
Title of the Course: Watershed Management (T+P)

Credits: 02

Examination Scheme: CIA: 20 Marks

Total Lectures: 30

End-Sem: 30 Marks

Course Objectives:

1. To introduce the concept and significance of watershed management
2. To develop an understanding of watershed characteristics and hydrological processes
3. To provide knowledge about soil properties, and erosion process

	Semester – V	Lectures
Unit 1	Concept of Watershed Management	07
	A. Watershed: Meaning and Types B. Watershed management: Definition, Principles, Objectives C. Identification of problems in watershed regions	
Unit 2	Characteristics of Watershed	07
	A. Delineation of watershed B. Geomorphological Characteristics: linear, aerial & relief aspects	
Unit 3	Hydrological Process in Watershed	08
	A. Hydrological cycle B. Precipitation, interception, infiltration, evaporation and evapo-transpiration, runoff, ground water-flow C. water budget D. Ecological characteristics of the river	
Unit 4	Soils in Watershed	08
	A. Soil characteristics- Physical, Hydrological B. Soil erosion: Meaning and causes	

Course Outcomes:

Students will be able to:

1. Understand the Fundamentals of Watershed Management, its principles and objectives.
2. Identify the need for watershed management in sustainable resource planning.
3. Recognize common problems and challenges in watershed management.
4. Analyse geomorphological and Hydrological Characteristics of Watershed as well as the ecological characteristics of river systems within a watershed.
5. Evaluate Soil Properties in Watersheds

References:

- Dhruvanarayana, V. V., Sastry, G., & Patnaik, U. S..*Watershed Management*.

- Kakde, B. K. (2004). *Watershed Manual – A Guide for Watershed Development Practitioners and Trainers*. BAIF Development Research Foundation, Pune.
- Rajora, R..*Integrated Watershed Management: A Field Manual for Equitable, Productive, and Sustainable Development*. Rawat Publications, Jaipur.
- Schwab, G. O., Fangmeier, D. D., Elliot, W. J., & Frevert, R. K. (1993). *Soil and Water Conservation Engineering* (4th ed.). John Wiley & Sons.
- Singh, R. V. (2003). *Watershed Planning and Management* (2nd ed.). Yash Publishing House, Bikaner, India.
- Suresh, R. (2006). *Soil and Watershed Conservation Engineering* (2nd ed.). Standard Publication Distributors, Delhi.

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Course Code: 23ScGeoU5301 (T+P)

Section-II (Practical)

Title of the Course: Watershed Management (T+P)

Credits: 02

Total Lectures: 15

Examination Scheme: CIA: 20 Marks

End-Sem: 30 Marks

Course Objectives:

1. To Develop Skills in Drainage Basin Analysis
2. To Enhance Understanding of Drainage Network Analysis
3. To Train students in plotting and analysing related to watershed
4. To Strengthen Fieldwork and Watershed Analysis Skills

	Semester - V	Practical
Unit 1	Drainage basin analysis	05
	A. Delineation of watersheds using toposheets B. Demarcation of drainage basin and calculation of drainage area by graphical method. C. Water budget diagram /Water balance estimation D. Soil loss estimation	
Unit 2	Drainage network analysis	08
	A. Determination of stream orders by Strahler's and Horton's method. B. Measurement of stream lengths and calculation of basin areas of each order. C. Calculation of drainage density, stream frequency and bifurcation ratio. D. Stream order and number relationship (Calculation and plotting). E. Stream order and length relationship (Calculation and plotting). F. Stream order and area relationship (Calculation and plotting).	
Unit 3	Field Visit	02
	A. Minimum one day or two days field visit to study relief, climate, soil, natural vegetation etc. in any watershed in India.	

Course Outcome:

Students will be able to:

1. Analyse and use topographic sheets to delineate watersheds accurately.
2. Graphically demarcate drainage basins and calculate their areas.
3. Estimate water balance and soil loss using appropriate methods.
4. Determine stream orders using Strahler's and Horton's methods.
5. Measure stream lengths and calculate basin areas for each order.
6. Compute drainage density, stream frequency, and bifurcation ratio.

7. Analyse and plot stream order relationships with number, length, and area.
8. Visit and analyse successful watershed development projects and Prepare detailed field visit reports with observations and data interpretation.

References:

1. **Briggs, D.** (1979). *Soils*.
2. **Heathcote, I. W.** (2009). *Integrated Watershed Management: Principles and Practice*. John Wiley & Sons.
3. **Hein, C.** (2020). *Adaptive Strategies for Water Heritage: Past, Present, and Future*. Springer Nature.
4. **Jain, S. K., & Singh, V. P.** (2023). *Water Resources Systems Planning and Management*. Elsevier.
5. **Kakde, B. K.** (2004). *Watershed Manual – A Guide for Watershed Development Practitioners and Trainers*. BAIF Development Research Foundation, Pune.
6. **Katyal, J.C., Singh, R.P., Sharma, S., Das, S.K., Padmanabhan, M.V., & Mishra, P.K.** (1995). *Field Manual on Watershed Management*. CRIDA, Hyderabad.
7. **King, C. A. M.** (1994). *Techniques in Geomorphology*.
8. **Lyon, J. G.** (2002). *GIS for Water Resources and Watershed Management*. CRC Press.
9. **Mahnot, S.C.** (2014). *Soil and Water Conservation and Watershed Management*. International Books and Periodicals Supply Service, New Delhi.
10. **Miller, Austin.** (1979). *Skin of the Earth*.
11. **Naiman, R. J.** (Ed.). (2012). *Watershed Management: Balancing Sustainability and Environmental Change*. Springer Science & Business Media.
12. **Piper, C. S.** (1975). *Soil Chemical Analysis*.
13. **Rajvir Singh.** (2008). *Watershed Planning and Management* (2nd Ed.). Yash Publishing.
14. **R. Suresh.** (2006). *Soil and Watershed Conservation Engineering* (2nd Ed.). Standard Publication Distributors, Delhi.
15. **Sabatier, P. A., Focht, W., Lubell, M., Trachtenberg, Z., Vedlitz, A., & Matlock, M.** (2005). *Collaborative Approaches to Watershed Management*.
16. **Savindra Singh.** (2002). *Geomorphology*. Prayag Pustak Bhawan, Allahabad.
17. **Sharda, V.N., Sikka, A.K., & Juyal, G.P.** (2006). *Participatory Integrated Watershed Management: A Field Manual*. Central Soil and Water Conservation Research and Training Institute, Dehradun.
18. **Singh, G.D., & Poonia, T.C.** (2003). *Fundamentals of Watershed Management Technology*. Yash Publishing House, Bikaner.
19. **Westervelt, J.** (2001). *Simulation Modeling for Watershed Management*. Springer Science & Business Media.
19. **Wilkinson, H. R., & Monkhouse, F. J.** (1975). *Maps & Diagrams*.
20. **Wilson, J., & Gallant, J.** (2000). *Terrain Analysis: Principles and Applications*. John Wiley & Sons.

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(2023 Course under NEP 2020)

Course Code: 23ScGeoU6301

Section-I (Theory)

Title of the Course: Introduction to Geoinformatics (T+P)

Credits: 02

Examination Scheme: CIA: 20 Marks

Total lectures:30

End-Sem: 30 Marks

Course Objectives:

1. To introduce fundamental concepts of Geographic Information System (GIS).
2. To familiarize the students with the GIS data types and models.
3. To acquaint the students with operations of spatial data, DEM and DTM.

Semester VI		Lectures
Unit 1	Introduction to GIS	08
	A. Historical Development, Tasks and Components of GIS B. Applications, Advantages and limitation of GIS C. Modern trends in GIS	
Unit 2	GIS Data Types and Models	12
	A. Concept of Space and Time, Data and Database B. Spatial Data Models: vector and raster data C. Non-Spatial Data Models: Concept and Types of Database Management System (DBMS)	
Unit 3	Structuring and Operations of spatial data	10
	A. Digitization, Editing and topology building B. DEM and DTM	

Course Outcomes:

Student will able to:

1. Understand the definition, components, task, application, historical development and merits-demerits GIS.
2. Explain the concept and nature of spatial and non- spatial data types with their models, Compare the raster and vector GIS spatial data.
3. Acquaint with the concepts of digitization, editing, DTM, DEM and also able to assess the topology building and overlay analysis.

References:

1. Joseph, G. (2003). *Fundamentals of remote sensing*. University Press.
2. Mather, P. M. (1999). *Computer processing of remotely sensed images: An introduction*. Wiley.
3. Lillesand, T. M., & Kiefer, R. W. (2008). *Remote sensing and image interpretation*. John Wiley & Sons.
4. Wolf, P. R. (2001). *Elements of photogrammetry*. McGraw-Hill Science.
5. Tempfli, K., Kerle, N., Huurneman, G., & Janssen, L. F. (Eds.). (2009). *Principles of remote sensing: An introductory textbook*. The International Institute for Geoinformation Science.
6. Burrough, P. A., & McDonnell, R. A. (2002). *Principles of geographical information systems*. Oxford University Press.
7. Clarke, K. C. (1999). *Getting started with geographic information systems*. Prentice Hall.
8. DeMers, M. N. (2000). *Geographic information systems*. John Wiley & Sons.
9. George, J. (2004). *Fundamentals of remote sensing*. Universities Press Pvt. Ltd.
10. Jensen, J. R. (2003). *Remote sensing of environment: An earth resource perspective*. Pearson Education Pvt. Ltd.
11. Chang, K. (2003). *Geographic information systems*. Tata McGraw-Hill.
12. Lillesand, T. M., & Kiefer, R. W. (2002). *Remote sensing and image interpretation*. John Wiley & Sons.
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14. Goodchild, M. F., & Kemp, K. K. (1990). *Introduction to GIS*. National Center for Geographic Information and Analysis, University of California, Santa Barbara.
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Section-II (Practical)

Title of the Course: Introduction to Geoinformatics (T+P)

Credits: 02

Examination Scheme: CIA: 20 Marks

Total Practical:15

End-Sem: 30 Marks

Course Objectives:

1. To introduce major components of Geospatial technologies, Digital Image Processing methods applying satellite data
2. To familiarize students with the tools and techniques of interpretation of Aerial photographs, satellite image
3. To provide exposure to students with spatial analysis, GIS operations and mapping.
4. To acquaint students with the use and applications of GIS software's and techniques.
5. To create skill amongst students about the mapping and accuracy assessment of satellite data

Semester VI		Practicals
Unit 1	GIS Input	03
	A. Introduction of basic open sources GIS software (QGIS) B. Coordinate systems -Degree Minutes Second (DMS), Degree Decimal (DD), Conversion of DMS to DD and DD to DMS C. Geo-referencing and mosaic using GIS software	
Unit 2	Spatial Database Analysis	07
	A. Software based exercise i. Digitization of layers (point, line and polygon features) from geo-referenced SOI toposheet /quadrant ii. Creation and export of shpfiles, Editing and topology of vector layers iii. Attribute data attachment B. Manual exercise: i. Raster layer file structure: Run Length Encoding, Block Code, Chain Coding, Quadtree	
Unit 3	GIS Output	05
	GIS software based A. Map layout -Title, Grid, Scale, Direction, Index, sign and symbols B. Design of maps (Point, Line and Polygon features maps) using shape files of digitized toposheet/ quadrant	

Course Outcomes:

Student will be able to:

1. Prioritize GIS input, storage, manipulation, retrieval, analysis and maps geographical data
2. Design map layout and prepare GIS based various spatial and thematic maps, compose land use/land cover maps using the software.
3. Classify the land use/land cover layers using Digital Image Processing and examine accuracy assessment of Land use/land cover map.

References:

1. Burroughs, P. A. and McDonnell, R. A. (2002): *Principles of Geographical Information System*, Oxford University Press.
2. Clarke, Keith C.(1999) *Getting Started with Geographic Information Systems*, Prentice Hall, New Jersey
3. DeMers Michel N.(2000): *Geographic Information Systems*, John Wiley and Sons.
4. George J. (2004): *Fundamentals of Remote Sensing*, Universities Press Pvt. Ltd., Hyderabad.
5. Jensen, J. R. (2003): *Remote Sensing of Environment, An Earth Resource Perspective*, Pearson Education Pvt. Ltd., New Delhi.
6. Kang-tsung Chang (2003): *Geographic Information Systems*, Tata McGraw Hill, New Delhi
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8. LoAlbert, C. P., and Young, K. W (2003): *Concepts and Techniques of Geographical Information Systems*, Prentice Hall of India Pvt. Ltd., New Delhi.
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10. Paul A. Lonfley, Michel F. Goodchild, D J. Maguire and D W. Rhind, (2002): *Introduction to Geographic Information Systems and Science*, John Wiley and Sons Ltd.
11. Shrikat Karlekar (2014): *Geographic Information Systems*, Dimand Publication, Pune
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