ಮಂಗಳೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ

MANGALORE UNIVERSITY

ಕ್ರಮಾಂಕ/ No. : MU/ACC/CR.1/2023-24/A8

ಕುಲಸಚಿವರ ಕಛೇರಿ
ಮಂಗಳಗಂಗೋತ್ರಿ – 574 199
Office of the Registrar
Mangalagangothri – 574 199

ದಿನಾಂಕ/Date: 08/06/2023

NOTIFICATION

Sub: Syllabus of Geo-informatics as a Core course for B.Sc Degree Programme under NEP 2020-reg

Ref: Decision of the Academic Council meeting dated 22.05.2023

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Pursuant to the above, the syllabus of Geo-informatics as a core course for I and II semester B.Sc Degree programme prepared as per model curriculum of NEP 2020 is hereby notified for implementation with effect from the academic year 2023-24.

Copy of the Syllabus should be downloaded from the Mangalore University website www.mangaloreuniversity.ac.in

REGISTRAR.

To:

1. The Registrar (Evaluation), Mangalore University, Mangalagangothri.
2. Prof. B.R Manjunatha, Chairman, PG BOS in Geo-informatics, Dept. of Marine Geology, Mangalore University.
3. Dr.D.P Angadi, Associate Professor, Dept. of Geography, Mangalore University
4. The Assistant Registrar/Superintendent, Academic Section, O/o The Registrar, Mangalore University.
5. The Director, DUIMS, Mangalore University – with a request to publish in the website.
6. Guard File.
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B.Sc. Honours in Geography and Geoinformatics,
Syllabus - NEP-2020 & CBCS

First Year

Semester	Course Code	Course Title	Teaching Hours	Hours / Week	Examination Pattern Max. & Min. Marks / Paper			Duration of the Exam (hours)	Total Marks / Paper	Credits
					Theory / Practical					
				Theory / Practical	Max.	Min.	IA	Theory / Practical		Theory / Practical
	DSC.B1 T	Basics of Cartography	60	4	60	21	40	2	100	4
	DSC.B2 P	Thematic Cartography & Map Projections	60	4	25	9	25	2	50	2
	OE – 1.3	Basics of Geographic Information System	45	3	60	21	40	2	100	3
	OE – 1.4	Basics of Remote Sensing								

Semester	Course Code	Course Title	Teaching Hours	Hours / Week	Examination Pattern Max. & Min. Marks / Paper			Duration of the Exam (hours)	Total Marks / Paper	Credits
					Theory / Practical					
				Theory / Practical	Max.	Min.	IA	Theory / Practical		Theory / Practical
	DSC.B3 T	Fundamentals of Geographic Information Systems	60	4	60	21	40	2	100	4
	DSC.B4 P	GIS for Map-making	60	4	25	9	25	2	50	2
	OE-2.3	Global Navigation and Satellite System	45	3	60	21	40	2	100	3
	OE–2.4	Digital Cartography								

B.Sc. Semester – I
Title of the Course: DSC.B1 T. Basics of Cartography

Number of Theory Credits	Number of theory hours
4	60

Course Learning Outcomes:

After the completion of this course, student should be able to:

1. Understating a map and map-making process
2. Formulate the techniques involved in representing the 3D feature on 2D surface
3. Manage the methods involved in preparing visually appealing maps
4. Organizations involved in mapmaking

Course Objectives:

This course aims to:

1. Develop foundational knowledge and demonstrate applied skills in cartographic principles and geo-spatial data visualization, design, and communication.
2. Analyze, interpret, and make measurements from topographic and thematic maps, aerial photographs, and satellite imagery.

	Content of Theory Course	60
Unit – 1	**Concept, scope & significance of Cartography**: 1.1 Growth & Development of cartography: Impact of Technology on Cartography. Map as tool in Geographical Studies, 1.2 Cartography as a science of human communication. Web cartography. 1.3 Elements of generalization. Measurement of Geographical variables: Nominal, Ordinal, Interval and Ratio. 1.4 Map-making process: Map symbolization. Perception and Designing, Color theory, Color and Pattern Creation, Typography and Lettering the map, 1.5 Qualitative and Quantitative symbols Map compilation and map layout, Future Cartography. 1.6 Mapping organization and services in India: SOI, NATMO and NRSC.	04 04 03 04 02 03
Unit – 2	**Shape of the Earth:** 2.1 Spheroid, Ellipsoid and Geoid. 2.2 Geographic Coordinates: Latitude and Longitude. Datum. 2.3 Map projections: Properties, Distance, Direction and Angle, Selection of appropriate map projection and types. 2.4 **Assignment**: Students should select nearby Taluk / District and draw coordinate systems and submit a report.	03 03 06 02
Unit – 3	**Scope and Objectives of Map Designing:** 3.1 Controls of map design and constrains in map design. 3.2 Map Scale: Statement, Representative Fraction and Geographical Scales, Determining and scale. 3.3 Ground Survey and Positioning: Measuring distance, and direction, 3.4 Traditional Survey methods, 3.5 Global Positioning Systems.	02 04 04 02 02
	Types of Maps:	

Unit –4	4.1 Types of maps: Thematic and composite mapping. 4.2 Techniques of map making: Choropleth, Isarthmic, Dasymetric, Chorochromatic, Choroschematic and Flow maps. 4.3 Data representation on maps: Pie diagrams, bar diagrams and line graphs. 4.4 **Field Study:** Students will have to draw few layers of maps of a village nearby and prepare layout and fringe information and submit.	02 06 04 02

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1. Dent B.D., 1999. Cartography: Thematic Map Design, (Vol. 1), McGraw Hill
2. Gupta K.K and Tyagi V.C., 1992. Working with Maps, Survey of India, DST, New Delhi.
3. Mishra R.P. and Ramesh A., 1989. Fundamentals of Cartography, Concept Publishing.
4. Monkhouse, F.J. and Wilkinson, H.R., 1971. Maps and Diagrams. Methuen and Co. Ltd., London. K.
5. Singh, R.L., 2005. Elements of Practical Geography. Kalyani Publishers, New Delhi. India.
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9. Singh R.L. and Singh R.P.B., 1999. Elements of Practical Geography, Kalyani Publishers.
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12. Singh, L.R. and Singh, R., 1973. Map work and practical geography, Central Book Allahabad
13. Siddhartha, K., 2006. Geography through maps, Kisalaya Publications Pvt. Ltd, Delhi
14. Singh, R.L., and Dutt, P.K., 1968. Elements of practical geography, Students' Friends, Allahabad
15. Steers, J.A., 1970. An Introduction to Study of Map Projections. University of London Press Ltd., London.

B.Sc. Semester – I **Title of the Course: DSC.B2 P. Thematic Cartography & Map Projections**	
Number of Theory Credits	**Number of theory hours**
2	**60**

Course Learning Outcomes:

After the completion of this course, student should be able to:

1. Understating a map and map-making process
2. Formulate the techniques involved in representing the 3D feature on 2D surface
3. Manage the methods involved in preparing visually appealing maps
4. Organizations involved in mapmaking

Course Objectives:

This course aims to:

1. Develop foundational knowledge and demonstrate applied skills in cartographic principles and geo-spatial data visualization, design, and communication.
2. Analyze, interpret, and make measurements from topographic and thematic maps, aerial photographs, and satellite imagery.

	Content of Practical Course	**60**
Exercise 1	Constriction of Dot Density, Graduated Symbol, Graduated Color, Gray Scale,	8
Exercise 2	Constriction of Choropleth Method, Isopleth Method and interpretation.	8
Exercise 3	Preparation of Block Pile Diagrams, Pie Diagrams	8
Exercise 4	Preparation of Stacked Bar Charts, Flow-diagrams	8
Exercise 5	Large Scale vs Small Scale, Construction of the Map Scales, Map Scale Conversion, RF Scale	7
Exercise 6	Construction of Projections	7
Exercise 7	Introduction to UTM Projection	7
Exercise 8	**Field Study:** Students have to collect data and submit report regarding cartographic methods.	7

References

1. Dent B.D., 1999. Cartography: Thematic Map Design, (Vol. 1), McGraw Hill
2. Gupta K.K and Tyagi V.C., 1992. Working with Maps, Survey of India, DST, New Delhi.
3. Mishra R.P. and Ramesh A., 1989. Fundamentals of Cartography, Concept Publishing.
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15. Steers, J.A., 1970. An Introduction to Study of Map Projections. University of London Press Ltd., London.

B.Sc. Semester – I Title of the Course: OE. - 1.3 Basics of Geographic Information System	
Number of Theory Credits	**Number of Theory hours**
3	**45**

Course Learning Outcomes:

At the end of the course the students will:

1. Students are trained to adapt the theoretical concepts in a practical way through the mathematical models of geography.
2. Students will have the hands-on training on various modes of spatial and non-spatial data collection, data storage, data analytics, data interpretation and data display through the thematic maps.
3. Students are exposed on spatial thinking to solve the geographical problems with range of proven mathematical and statistical models.
4. Students can employ in various corporate and government organization where they deal to solve geographical problems.

Course Objectives:

This course aims to

1. Understand the concept and techniques of the Geographic Information Systems.
2. Define the GIS data types and structures.
3. Study geo processing and visualization concepts and techniques in GIS.

	Content of Theory Course	**45 h**
Unit – 1	**Introduction to GIS** 1.1 Concept of GIS, Definition and Functions of GIS. 1.2 Key Components of GIS – Hardware, Software, Procedure, Data, User. 1.3 Origin of GIS. 1.4 GIS – Three views of information system. 1.5 GIS – A set of interrelated Subsystems.	**02** **02** **02** **02** **02**
Unit – 2	**Data and Coordinates in GIS** 2.1 Types of data – Spatial and Non-Spatial. 2.2 Cartesian coordinates, latitude, longitudes, Geographical coordinates and Projected coordinates. 2.3 Data models in GIS – Raster, Vector, advantages and disadvantages, difference. 2.4 Data source. 2.5 Data encoding methods and editing in GIS. 2.6 **Assignment**: Students should study different coordinate system and submit a report.	**02** **03** **03** **02** **03** **02**
Unit – 3	**Data analysis and Manipulation:** 3.1 Measurement of lengths, perimeter and areas. 3.2 Spatial and attribute query. 3.3 Proximity analysis, surface analysis, Hydrology. 3.4 Interpolation Techniques.	**02** **02** **03** **03**
Unit – 4	**Applications of GIS:** 4.1 Disaster Management. 4.2 Urban Studies. 4.3 Agriculture. 4.4 Water resource management. **4.5 Field Study: The students have to submit a report on local environment.**	**02** **02** **02** **02** **02**

References:

1. An Introduction to Geographical Information Systems - Ian Heywood (2011)
2. Geographic Information Systems: A Management Perspective - Aronoff, S. (1989)
3. GIS - Fundamentals, Applications, and Implementations - Elangovan, K. (2006)
4. Introduction to Geographical Information Systems - Chang, Kang-Tsung (2015)
5. Remote Sensing and GIS - Bhatta, B. (2011)
6. Mathematical Modelling in Geographical Information System, Global Positioning System and Digital Cartography - Sharma, H.S. (2006)
7. Spatial analysis and Location-Allocation Models - Ghosh, A. and G. Rushton (1987)
8. Geographic Information Systems and Cartographic Modelling - Tomlin, C.D. (1990)
9. Geographic Information Systems and Science - Paul A. Longley, et. al. (2015)
10. Geographic Information Systems and Environmental Modelling - Clarke, C., K. (2002)

Websites:

1. IIRS MOOC programme: https://isat.iirs.gov.in/mooc.php
2. ITC Netherlands, Principles of GIS https://webapps.itc.utwente.nl/librarywww/papers_2009/general/principlesgis.pdf
3. Geographical Information Systems: Principles, Techniques, Management and Applications https://www.geos.ed.ac.uk/~gisteac/gis_book_abridged/

B.Sc. Semester – I **Title of the Course: OE. - 1.4 Basics of Remote Sensing**	
Number of Theory Credits	**Number of Theory hours**
3	**45**
Course Learning Outcomes:	

After the completion of the course, the students will be able to:

1. Understand the history and evolution of Remote Sensing.
2. Identify and uses of various sources of satellite imageries from web platforms.
3. Illustrate the features of remote sensing data.
4. Analyze spatial data from imageries.
5. Analyze the temporal changes from imageries and prepare various thematic maps.

Course Objectives:

This course aims to

1. To introduce the students about the principles of Remote Sensing and image acquisition systems
2. To aware the basic and modern photogrammetric methods
3. To familiarize the concepts and resolutions of different remote sensing imaging systems and its applications.
4. To aware the applications of Remote sensing.

	Content of Theory Course	**45 h**
Unit – 1	**Introduction to Remote sensing:** 1.1 Concept and Definition of Remote Sensing. 1.2 Remote Sensing: Art or Science or Technology 1.3 History of Remote Sensing, Origin of Indian Remote Sensing. 1.4 Remote Sensing Process. 1.5 Types of Remote Sensing.	**02** **01** **03** **02** **03**
Unit – 2	**Energy Source:** 2.1 EMR – Wavelength, Frequency. 2.2 Electromagnetic Spectrum. 2.3 Interaction of EMR with the earth's atmosphere and surface features. 2.4 Atmospheric Window. 2.5 Active and Passive Remote Sensing. 2.6 **Assignment:** Students will have to study about spectral signature of different surface features and prepare report.	**02** **02** **03** **01** **01** **02**
Unit – 3	**Remote sensing Platforms and Launch Vehicles:** 3.1 Ground based, Air based, Space based platforms. 3.2 Aerial photographs and its classification. 3.3 Elements of aerial photo interpretation. 3.4 Indian satellite launch vehicles and their payload. 3.5 Indian Remote sensing organizations.	**03** **03** **02** **03** **02**
Unit – 4	**Applications of Remote sensing:** 4.1 Disaster management and mitigation. 4.2 Topographical mapping. 4.3 Ocean Studies. 4.4 EIA. **4.5 Field Study: The students have to compare the ground features with satellite images of local area and prepare maps and submit report at the end of course.**	**02** **02** **02** **02** **02**

References

1. Bossler J.D (2002): Manual of Geospatial Science and Technology, Taylor and Francis, London.
2. Girard M.C and Girard C.M (2003): Processing of Remote Sensing Data, Oxford &IBH, New- Delhi.
3. John R. Jensen (2000): Remote Sensing of the environment: An earth resource perspective, Pearson publication.
4. Lilles and T M., and Kiefer R W., (2000): Remote Sensing and Image interpretation, New York,
5. John.Wiley and Sons. Pradip Kumar Guha (2013): Remote Sensing for the beginner, Third Edition, East-West Press, New Delhi.
6. Suresh S and Mani K., (2017): Application of Remote Sensing in understanding the relationship Between NDVI and LST, IJRET, Vol. 6, Issue: 02. Curran P.J (1985).
7. Principles of Remote Sensing, Longman, London.
8. Lillisand T.M and R.W. Kiefer (1994). Remote Sensing and Image Interpretation (3rd edition). John Wiley & Sons, New York.
9. Sabins F.F Jr. (1987). Remote Sensing: Principles and Interpretation, W.H.Freeman & Co., New York.
10. James B. Campbell, Randolph H. Wynne, Valerie A. Thomas (2022). Introduction to Remote Sensing, Guilford Press, New York.
11. Alexey Bunkin and Konstantin Voliak (2001). Laser Remote Sensing of the Ocean, John Wiley and Sons., New York.
12. Gibso, P., and Clare H. Power, (2000). Introductory Remote Sensing: Principles and Concepts, Routledge, London.

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1. https://www.gsi.gov.in/webcenter/portal/OCBIS
2. https://www.usgs.gov/
3. https://www.moes.gov.in/
4. https://www.gislounge.com/gis-and-natural-resource-management
5. https://ksrsac.karnataka.gov.in/

B.Sc. Semester – II **Title of the Course: DSC.B3. T. Fundamentals of Geographic Information Systems**	
Number of Theory Credits	**Number of Theory hours**
3	**45**

Course Outcomes:

1. Students are trained to adapt the theoretical concepts in a practical way through the mathematical models of geography.
2. Students will have the hands-on training on various modes of spatial and non-spatial data collection, data storage, data analytics, data interpretation and data display through the thematic maps.
3. Students are exposed on spatial thinking to solve the geographical problems with range of proven mathematical and statistical models.
4. Students can employ in various corporate and government organization where they deal to solve geographical problems.

Course Objectives:

This course aims to:

1. Understand the concept and techniques of the Geographic Information Systems.
2. Define the GIS data types and structures.
3. Study geo-processing and visualization concepts and techniques in GIS.

	Content of Theory Course	**45 hrs**
Unit – 1	**Remote sensing:** Concept of Remote Sensing, EMR – Wavelength, Frequency. Electromagnetic Spectrum. Interaction of EMR with the earth's atmosphere and surface features. Atmospheric Window. Active and Passive Remote Sensing. **GIS:** Emergence of GI Science, Milestone and Developmental stages in GIS, Definition, scope, role of GIS in digital world; Components, functionalities, merits and demerits, global market, interdisciplinary domains, and its integration with GIS.	**11**
Unit – 2	**Geodesy and Spatial Mathematics**: Cartesian coordinates, latitude, longitudes, formats of angular units, geographical coordinates, Datum: WGS-84, vs NAD-32. UTM, Aerial Distance measurement using Geographic and projected coordinates, Area, Perimeter, length by coordinates and various international measures. **Assignments:** Students should study different coordinate system and submit a report.	**11**
Unit – 3	**GIS Data and Scale:** Spatial Data and its structures; sources and types of data collection; data errors, topology of data and relationship. Large Scale vs Small Scale, generalization; precision and accuracy of data-logical consistency and non-spatial data integration.	**11**
Unit – 4	**Geo-processing and Visualization**: Spatial and Non-Spatial Queries, proximity analysis, Preparation of Terrain and Surface models. Hotspot and density mapping. Types of maps, thematic maps and its types, relief maps, flow maps and cartograms. Tabulations: Graphs and Pivot tables. **Case Study: Field Study:** The students have to submit a report on mapping local environment.	**12**

References

1. Ian Heywood (2011), An Introduction to Geographical Information Systems, Pearson
2. Aronoff, S. (1989), Geographic Information Systems: A Management Perspective, Geocarto International: Vol. 4, No. 4, pp. 58-58.
3. Elangovan, K. (2006), GIS - Fundamentals, Applications, and Implementations, Nipa
4. Chang, Kang – Tsung (2015), Introduction to Geographical Information Systems, McGraw-Hill Education
5. Bhatta, B. (2011), Remote Sensing and GIS, Oxford
6. Sharma, H.S. (2006), Mathematical Modelling in Geographical Information System, Global Positioning System and Digital Cartography – New Delhi, India
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9. Geographic Information Systems and Science – Paul A. Longley, et.al. (2015)

10. Geographic Information Systems and Environmental Modelling - Clarke, C.,K. (2002)
11. An Introduction to Geographical Information Systems, 3rd Edition- Ian Heywood, Sarah Cornelius, Steve Carver (2009)
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4. https://ksrsac.karnataka.gov.in/
5. https://www.isro.gov.in/
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Semester – II

Title of the Course: DSC.B4 P. GIS for Map-making

Number of Theory Credits	Number of Theory hours
2	60

Course Outcomes:

1. Students are trained to adapt the theoretical concepts in a practical way through the mathematical models of geography.
2. Students will have the hands-on training on various modes of spatial and non-spatial data collection, data storage, data analytics, data interpretation and data display through the thematic maps.
3. Students are exposed on spatial thinking to solve the geographical problems with range of proven mathematical and statistical models.
4. Students can employ in various corporate and government organization where they deal to solve geographical problems.

Course Objectives:

This course aims to:

1. Understand the concept and techniques of the Geographic Information Systems.
2. Define the GIS data types and structures.
3. Study geo-processing and visualization concepts and techniques in GIS.

	Content of Theory Course	60 hrs
Exercise 1	Introduction to Arc GIS.	**4**
Exercise 2	Georeferencing toposheets and maps.	**8**
Exercise 3	Projecting and Transformation to UTM Zones.	**4**
Exercise 4	Digitization and Map making.	**10**
Exercise 5	Area, Length and Perimeter Calculation.	**8**
Exercise 6	Query and Proximity analysis.	**10**
Exercise 7	Thematic Mapping.	**10**
Exercise 8	**Field Activity:** GPS waypoint collection, Elevation measurement with GPS.	**6**

References

1. An Introduction to Geographical Information Systems – Ian Heywood (2011)
2. Geographic Information Systems: A Management Perspective - Aronoff, S. (1989)
3. GIS - Fundamentals, Applications, and Implementations - Elangovan, K. (2006)
4. Introduction to Geographical Information Systems - Chang, Kang – Tsung (2015)
5. Remote Sensing and GIS - Bhatta, B. (2011)
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7. Spatial Analysis and Location-Allocation Models - Ghosh, A. and G. Rushton (1987)
8. Geographic Information Systems and Cartographic Modelling - Tomlin, C.D. (1990)
9. Geographic Information Systems and Science – Paul A. Longley, et.al. (2015)
10. Geographic Information Systems and Environmental Modelling - Clarke, C.,K. (2002)

Reference Websites

1. IIRS MOOC programme: https://isat.iirs.gov.in/mooc.php
2. ITC Netherlands, Principles of GIS https://webapps.itc.utwente.nl/librarywww/papers_2009/general/principlesgis.pdf
3. Geographical Information Systems: Principles, Techniques, Management and Applications https://www.geos.ed.ac.uk/~gisteac/gis_book_abridged/
4. https://www.esri.com/en-us/home

B.Sc. Semester – II

Title of the Course: OE.- 2.3 Global Navigation Satellite System

Number of Theory Credits	Number of Theory hours
3	45

Course Learning Outcomes:

After the completion of this course, students should be able to

1 Describe the principles of GNSS based positioning methods, the main components in a satellite
2 navigation system and their functions.
3 Implement basic algorithms for estimation of GNSS based positions
4 Plan, perform and process precise GNSS measurements
5 Formulate the role of GNSS, or GNSS based products and services, in sustainable development.
6 Gain ideas about GPS'S Satellite geometry and GPS coordinate system.
7 Gain practical ideas about Geodetic Surveying and It's Measuring techniques and Pre survey preparations.
8 Understand the hardware and software control systems.
9 Acquire ideas on GNSS Applications in Navigation, Tracking, Mapping.

Course Objectives:

This course aims to

1 Demonstrate a clear understanding of the GPS signal, codes and biases
2 Discuss the practical applications of GPS and the implications of its modernization
3 Explain the difficulties in determining heights with satellite positioning and how they can be
4 overcome
5 Describe the differences between relative and autonomous GPS positioning, code phase carrier phase,
6 DGPS and RTK

	Content of Theory Course	45 h
Unit – 1	**Introduction:** 1.1 Historical development - Conventional navigation, background, concepts. 1.2 Evolutions of global navigation satellite systems (GPS, GLONASS, Galileo, BeiDou/ COMPASS) and regional navigations satellite systems (IRNSS, QZSS) 1.3 Components of GPS – Space segment, Control Segment, User segment. 1.4 GPS signal propagation and quality.	**03** **03** **02** **02**
Unit – 2	**Working Principles of GPS:** 2.1 Simple navigation – satellite ranging, calculating the distance to the satellite. 2.2 Error sources: atmospheric - Ionospheric errors – multipath - Selective availability anti spoofing, error rectification - atmospheric and Ionospheric models –choke ring. 2.3 Military GPS receivers. 2.4 Differentially corrected positions (DGPS). 2.5 **Assignment:** Students will have to study different GNSS systems and submit the report.	**04** **04** **02** **03** **02**
Unit – 3	**Surveying with GPS:** 3.1 GPS reference system. 3.2 Pre-survey Preparation. 3.3 Tips during operation. 3.4 GPS Surveying Techniques – Static, Rapid static, Kinematic, RTK surveying.	**02** **02** **02** **04**
Unit – 4	**Applications of GNSS:** 4.1 Location - Navigation - Tracking – Mapping. 4.2 Disaster Management – Rescue operations. 4.3 Agriculture.	**02** **02** **02** **02** **02**

	4.4 Transportation – Road, Air, Marine. **4.5 Field Study:** Students will have to collect GPS locations using GPS device and submit the report.	

References

1 Hofmann – Wellenhof, Lichtenegger, and Wasle, (2008). Global Navigational Satellite Systems (GNSS) Springer Wien New York.
2 F. van Diggelen. A-GPS, Assisted GPS, GNSS, and SBAS, Artech House, Boston, London, 2009 Earthprints. Internet repository of scientific papers.
3 Basudeb Bhatta (2021). Global Navigation Satellite Systems: New Technologies and Applications, CRC Press, India
4 Lu, Zhiping, Qu, Yunying, Qiao, Shubo (2014) “Geodesy: Introduction to Geodetic Datum and Geodetic Systems”
5 Torge, Wolfgang / Müller, Jürgen (2012) “Geodesy”.
6 Mohinder S. Grewal, Angus P. Andrews, Chris G. Bartone, (2020).Global Navigation Satellite Systems, Inertial Navigation, and Integration, 4th Edition
7 Agraval, N. K., (2006). Essentials of GPS, Geodesy and GPS publications, Hyderabad.
8 Jan Van Sickle, (2008). GPS for Land Surveyors, CRC Press, Taylor & Francis Group, New York.
9 NelSamama, (2008). Global Positioning Techniques and Performance, John Wiley and Sons, Inc., New Jersey.

Website:

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2. https://www.ion.org/publications/online-tutorial-intertial.cfm
3. https://www.novatel.com/an-introduction-to-gnss/
4. https://serc.carleton.edu/getsi/teaching_materials/high-precision/unit1.html
5. https://www.e-education.psu.edu/geog862/node/1407

B.Sc. Semester – II

Title of the Course: OE. – 2.4 Digital Cartography

Number of Theory Credits	Number of Theory hours
3	45

Course Learning Outcomes:

After the completion of this course, students should be able to

1. Familiar with the map types and scale.
2. Understand principles and application of projection systems.
3. Acquire knowledge visualize, the spatial data.
4. Describe the methods and application of information delivery and cartographic presentation on mobile devices.
5. Gain knowledge to explore the spatial and non- temporal datasets with data mining.
6. Handle modern techniques in map making and production.
7. Explore the multi-scale web mapping.
8. Asses the spatial arrangement various entities for effective mapping.
9. Visualize multivariate spatial data.
10. Understand web mapping and hosting principles

Course Objectives:

The course aims to

1. The course would discuss the basic concepts of Digital Cartography
2. The concepts of map construction and production are taught
3. Students would acquire the knowledge about the usage of conventional signs and symbols to interpret the various topographic maps.
4. Acquire knowledge on Spatial data analysis and visualization on digital platforms

	Content of Theory Course	45 h
Unit – 1	**Introduction to Cartography, Maps and Scale:** 1.1 Meaning, definition, and nature of cartography. 1.2 Map - types of maps. 1.3 Interpreting maps – Marginal Information. 1.4 Map scale - Nominal, Ordinal and Ratio.	 **04** **04** **03** **03**
Unit – 2	**Map Projections:** 2.1 General principles of map projections 2.2 Classification of map projection – cylindrical, conical, and zenithal projections 2.3 Geographical Coordinate system – WGS84 2.4 Projected Coordinate systems – UTM zones 2.6 **Assignment:** Students will have to practice different projection systems and submit report.	 **03** **04** **02** **02** **02** **02**
Unit – 3	**Scope and Objectives of Map Designing:** 3.1 Controls of map design and constrains in map design. 3.2 Map Scale: Statement, Representative Fraction and Geographical Scales, Determining and scale. 3.3 Ground Survey and Positioning: Measuring distance, and direction, 3.4 Traditional Survey methods, 3.5 Global Positioning Systems.	 **03** **03** **04** **04** **02**
Unit – 4	**Applied Cartography** 4.1 Terrain Visualization 4.2 Multivariate and Uncertainty 4.3 Visualization - Multiscale web mapping 4.4 Research and development 4.5 **Field Study:** Students will have to draw few layers of maps of a village nearby and prepare layout and fringe information and submit.	 **02** **02** **02** **02** **02**

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