Five-Year Integrated B.Sc and M.Sc Programs in Geography with specialization of Geoinformatics or Natural Disaster Management
Syllabus - NEP-2020 & CBCS

First Year

Semester	Course Code	Course Title	Teaching Hours	Hours / Week – Theory / Practical	Examination Pattern Max. & Min. Marks / Paper – Theory / Practical Max.	Min.	IA	Duration of the Exam (hours) – Theory / Practical	Total Marks / Paper	Credits – Theory / Practical
First	DSC.T-1	Principles of Geomorphology	56	4	60	21	40	2	100	4
	DSC.P-1	Geomorphological Mapping Techniques	56	4	25	9	25	2	50	2
	DSC.T-2	Basics of Cartography								
	DSC.P-2	Thematic Cartography & Map Projections								
	OE-1.1	Mathematics for Geography	42	3	60	21	40	2	100	3
	OE-1.2	Fundamentals of Remote Sensing								
	L1-1.1	English	42	3	60	21	40	2	100	3
	L2-1.2	Kannada / Hindi / …..	42	3	60	21	40	2	100	3
	SEC.S-1	Cartographic Techniques / Digital Fluency	28	2	30	9	20	2	50	2
	SEC.V-1		14	1			25	1	25	1
	SEC.V-2		14	1			25	1	25	1

Semester	Course Code	Course Title	Teaching Hours	Hours / Week – Theory / Practical	Examination Pattern Max. & Min. Marks / Paper – Theory / Practical Max.	Min.	IA	Duration of the Exam (hours) – Theory / Practical	Total Marks / Paper	Credits – Theory / Practical
Second	DSC.T-3	Introduction to Climatology	56	4	60	21	40	2	100	4
	DSC.P-3	Interpretation of Weather Maps	56	4	25	9	25	2	50	2
	DSC.T-4	Physical Geography								
	DSC.P-4	Interpretation of Topographic Maps								
	OE-2.1	Spatial Statistics	42	3	60	21	40	2	100	3
	OE-2.2	Introduction to Geographic Information System								
	L1-2.1	English	42	3	60	21	40	2	100	3
	L2-2.2	Kannada / Hindi / …..	42	3	60	21	40	2	100	3
	AECC-1	Environmental Studies	28	2	30	9	20	2	50	2
	SEC.V-3		14	1			25	1	25	1
	SEC.V-4		14	1			25	1	25	1

B.A. / B.Sc Semester – I	
Title of the Course: DSC.T- 1 Principles of Geomorphology	
Number of Theory Credits	**Number of theory hours**
4	56

Course Learning Outcomes:

After the completion of this course, student should be able to:
1. Define the field of Geomorphology and to explain the essential principles of Geomorphology.
2. To outline the mechanism of dynamic nature of the Earth's surface and it's interior.
3. To illustrate and explain the forces affecting the crust of the earth and its effect.
4. To understand the conceptual and dynamic aspects of landform development.

Course Objectives:

This course aims to:
1. To define the concepts in Geomorphology and Physical Geography.
2. To introduce various concept to understand cycles of the solid Earth surface.
3. To understand the dynamic nature of the Earth's surface, various processes and landforms.
4. To study the impact human on geomorphic system.

	Content of Theory Course	**56**
Unit – 1	**Introduction**: 1.1 Introduction to Physical Geography – Branches of Physical Geography, Inter Relationship between Physical and Human Geography. 1.2 Geological Time Scale, Importance of Quaternary Period. 1.3 Origin and evolution of the earth's crust. Physical conditions of the earth's interior. 1.4 Factors Controlling landforms development. Isostasy – Pratt and Airy Views	04 04 02 04
Unit – 2	**Order of Landforms – First Order of Landforms – Continents and Oceans -Origin and Theories** 2.1 Introduction to first order landforms. Endogenetic and exogenetic forces. 2.2 Tetrahedron Theory by Lowthian Green, 2.3 Continental Drift Theory by Alfred Wegener: Geological, Biological and Climatological Evidence. Merits and Criticisms. Geosynclines. 2.4 Convectional Current Theory by Arthur Holmes -Types of Convection currents. Fundamentals of geomagnetism. 2.5 **Assignment:** Students should visit nearby locality and observe landforms types and characteristics and submit a report.	 02 03 04 03 02
Unit – 3	**Second Order Landforms: Origin and Theories. (How mountains Plateau and Plains are formed?)** 3.1 Plate Tectonic Theory – Major and Minor Plates., Causes of Plate Movements, 3.2 Plate Boundaries and Plate Margins 3.3 Associated Landforms – Volcanic Causes and Types, (Endogenetic) 3.4 Earthquakes & Tsunamis - Causes, Waves and its Impact. (Endogenetic) 3.5 Recent Views on Mountains Building- Folded and Faulted Mountains. Sea Floor spreading.	 06 02 02 02 02
	Third Order Landforms (Geomorphological Landforms)	

Unit –4	4.1. Ten Concepts in Geomorphology. Geomorphic cycles and landscape development. Cycle of erosion- Davis and Penck.	02 05
	4.2. Agents of denudation with - Fluvial, Wind, Glacier, Tides & Waves, Karst and Underground Water – Erosion, Transportation and Depositional landform features. Rejuvenated and polycyclic landforms.	02
	4.4 Rocks - Types, Characteristics and Importance, Weathering, Meaning, Types and Controlling Factors.	02 01
	4.5 Denudation Chronology; channel morphology; erosion surfaces; slope development	02
	4.6. Soil Formation and Soil Profile	
	4.6 **Field Study:** Students must be taken to nearby region to observe local land formation and degradation and write a report on their effectiveness.	

References

1. Ahmed E. (1985) Geomorphology, Kalyani Publishers, New Delhi.
2. Strahler A.N. (1968) The Earth Sciences, Harper & Row Intl. Edn, New York
3. Thornberry W.D. (1969) Principles of Geomorphology 2nd Edition, Wiley International Edn. & Wiley Eastern Reprints 1984.
4. Verstappen H. (1983) Applied Geomorphology, Geomorphological Surveys for Environmental Development, Elsevier, Amsterdam
5. Woodridge S.W and R.S. Morgan (1991) An Outline of Geomorphology, The Physical Basis of Geography, Orient Longman, Kolkata.
6. Dayal P. (1995) A Text Book of Geomorphology 2nd Edition. Sukla Book/Dept. Patna.
7. Homes A. (1965) Principles of Physical Geology, 3rd Edition, ELBSS Edn.
8. Goudie Anrew et.al. (1981) Geomorphological Techniques, George Allen & Unwin,London.
9. Bloom A.L. (1978) Geomorphology: A Systematic Analysis of Late Cenozoic Landforms Prentice – Hall of India, New Delhi.
10. Brunsden D. (1985) Geomorphology in the Service of Man: The Future of Geography, Methnen, U.K.
11. Worcester P.G. (1965), A Text Book of Geomorphology, Can North and 2nd Edition, East West Edn. New Delhi.
12. Board Shaw M.J. Et. Al. (1979) The Earth's Changing Surface, Hodder & Stoughton London.
13. William D. Thornbury(2004). Principles of Gomorphology, 2nd Edition, CBS Publisher and Distributor Pvt. Ltd, New Delhi
14. Vishwas S. Kale, Avijit Gupta (2018), Introduction to Geomorphology, Universities Press.

   Websites:
   1. http://www.solarviews.com/eng/earth.htm
   2. http://www.moorlandschool.co.uk/earth/tectonic.htm
   3. https://www.gsi.gov.in/webcenter/portal/OCBIS
   4. https://www.usgs.gov/
   5. https://www.moes.gov.in/

B.A. / B.Sc. Semester – I	
Title of the Course: DSC.P- 2 Geomorphological Mapping Techniques	
Number of Theory Credits	**Number of theory hours**
2	56

Course Learning Outcomes:

After the completion of this course, student should be able to:
1. Define the field of Geomorphology and to explain the essential principles.
2. To outline the mechanism of dynamic nature of the Earth's surface and it's interior.
3. To illustrate and explain the forces affecting the crust of the earth and its effect.
4. To understand the conceptual and dynamic aspects of landform development.

Course Objectives:

This course aims to:
1. To define the concepts in Geomorphology and Physical Geography.
2. To introduce various concept to understand cycles of the solid Earth surface.
3. To understand the dynamic nature of the Earth's surface, various processes and landforms.
4. To study the impact human on geomorphic system.

	Content of Practical Course	**56**
Exercise 1	Collection of Rock types and Rock Samples: Igneous, Sedimentary and Metamorphic rock Samples, (Granite, Basalt, Limestone. Sandstone, Quartzite, Marble and Shale).	7
Exercise 2	Soil Profile: Preparation of Soil profile layers Such as oo, Ao, A, B, C and D soil layers.	7
Exercise 3	Construction of Land forms through Contour features from Toposheets –Hill, Plateau, Gorge, Escarpment.	7
Exercise 4	**Field Study:** Students have to visit nearby stream and submit report regarding stream order.	7
Exercise 5	Extraction of geomorphic landforms from topographical maps: Such as Contour Lines, Form Lines, Spot Heights, Bench-Mark and Marginal Information of Topographical Maps.	7
Exercise 6	Preparation of contour maps from toposheet, construction of relief profiles –serial , superimposed, projected and composite.	7
Exercise 7	Delineation of watershed using Topographical sheets or Google map by marking water divide line and Identification of stream orders.	7
Exercise 8	Slope analysis Slope maps- Wentworth's Method, Hypsometric curve.	7

References

1. Ahmed E. (1985) Geomorphology, Kalyani Publishers, New Delhi.
2. Strahler A.N. (1968) The Earth Sciences, Harper & Row Intl. Edn, New York
3. Thornberry W.D. (1969) Principles of Geomorphology 2nd Edition, Wiley International Edn. & Wiley

Eastern Reprints 1984.

4. Verstappen H. (1983) Applied Geomorphology, Geomorphological Surveys for Environmental Development, Elsevier, Amsterdam

5. Woodridge S.W and R.S. Morgan (1991) An Outline of Geomorphology, The Physical Basis of Geography, Orient Longman, Kolkata.

6. Dayal P. (1995) A Text Book of Geomorphology 2nd Edition. Sukla Book/Dept. Patna.

7. Homes A. (1965) Principles of Physical Geology, 3rd Edition, ELBSS Edn.

8. Goudie Anrew et.al. (1981) Geomorphological Techniques, George Allen & Unwin,London.

9. Bloom A.L. (1978) Geomorphology: A Systematic Analysis of Late Cenozoic Landforms Prentice – Hall of India, New Delhi.

10. Brunsden D. (1985) Geomorphology in the Service of Man: The Future of Geography, Methnen, U.K.

11. Worcester P.G. (1965), A Text Book of Geomorphology, Can North and 2nd Edition, East West Edn. New Delhi.

12. Board Shaw M.J. Et. Al. (1979) The Earth's Changing Surface, Hodder & Stoughton London.

13. William D. Thornbury(2004). Principles of Gomorphology, 2nd Edition, CBS Publisher and Distributor Pvt. Ltd, New Delhi

14. Vishwas S. Kale, Avijit Gupta (2018), Introduction to Geomorphology, Universities Press.

Websites:

1. http://www.solarviews.com/eng/earth.htm
2. http://www.moorlandschool.co.uk/earth/tectonic.htm
3. https://www.mines.gov.in/
4. https://www.surveyofindia.gov.in/
5. https://ksrsac.karnataka.gov.in/

Integrated B.Sc and M.Sc Programs

Semester – I
Title of the Course: DSC.T- 2 Basics of Cartography

Number of Theory Credits	Number of theory hours
4	56

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	56
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.	02 02 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:	
	4.1 Types of maps: Thematic and composite mapping.	02
Unit –4	4.2 Techniques of map making: Choropleth, Isarthmic, Dasymetric, Chorochromatic, Choroschematic and Flow maps.	06
	4.3 Data representation on maps: Pie diagrams, bar diagrams and line graphs.	04
	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

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.
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.
6. Ramamurthy, K., 1982. Map Interpretation, Rex Printers, Madras.
7. Robinson A. ,1953. Elements of Cartography, John Wiley.
8. Sharma J. P., 2010.Prayogic Bhugol, Rastogi Publishers.
9. Singh R.L. and Singh R.P.B., 1999. Elements of Practical Geography, Kalyani Publishers.
10. Singh R.L., 1998. Proyogic Bhugol Rooprekha, Kalyani Publication.
11. Singh, G., 2005. Map work and practical geography. Vikas Publishing House Pvt. Ltd., New Delhi
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.

Integrated B.Sc and M.Sc Programs		
Semester – I **Title of the Course: DSC.P- 2 Thematic Cartography & Map Projections**		
Number of Theory Credits		**Number of theory hours**
2		56

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	**56**
Exercise 1	Constriction of Dot Density, Graduated Symbol, Graduated Color, Gray Scale,	7
Exercise 2	Constriction of Choropleth Method, Isopleth Method and interpretation.	7
Exercise 3	Preparation of Block Pile Diagrams, Pie Diagrams	7
Exercise 4	Preparation of Stacked Bar Charts, Flow-diagrams	7
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.
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.
6. Ramamurthy, K., 1982. Map Interpretation, Rex Printers, Madras.
7. Robinson A. ,1953. Elements of Cartography, John Wiley.
8. Sharma J. P., 2010.Prayogic Bhugol, Rastogi Publishers.
9. Singh R.L. and Singh R.P.B., 1999. Elements of Practical Geography, Kalyani Publishers.
10. Singh R.L., 1998. Proyogic Bhugol Rooprekha, Kalyani Publication.
11. Singh, G., 2005. Map work and practical geography. Vikas Publishing House Pvt. Ltd., New Delhi
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.

Integgrated B.Sc and M.Sc Programs

Semester – I

Title of the Course: OE.- 1.1 Mathematics for Geography

Number of Theory Credits	Number of Theory hours
3	42

Course Learning Outcomes:

At the end of the course the students will:
1. Understand the foundations of mathematics.
2. Develop and maintain problem-solving skills.
3. Be able to write and understand basic proofs.

Course Objectives:

This course aims to
1. Develop mathematical curiosity and use inductive and deductive reasoning when solving problems.
2. Become confident in using mathematics to analyse and solve problems spatial in nature.
3. Students will feel a sense of accomplishment in their increasing ability to use mathematics to solve problems of interest to them or useful in their chosen fields. Students will attain more positive attitudes based on increasing confidence in their abilities to learn mathematics.
4. Students will learn to understand material using standard mathematical terminology and notation when presented either verbally or in writing.

	Content of Theory Course	42 h
Unit – 1	**Elementary Mathematics**: Matrices, Types of Matrices, Algebra of Matrices, Determinants, Linear Equations, Roots of variables, Permutation vs. Combination, Partial Fractions, Proper and Improper Fractions, Ratio and Proportions, Variables and Constants, Algebra of Limits, Concepts of Differentiation, Indefinite Integrals. Units and Units Conversion-Volume, Length, Area.	10
Unit – 2	**Geometry and Spatial Mathematics:** Geometrical shapes, Line, line segment, traverse, closed and open traverse, interior and exterior angles, sides of geometry, Centre, radius, diameter, arc, sector, chord, segment, semicircle, circumference, Types of angles, Measure of angles, Intersecting and perpendicular lines. Rhumb lines, greatest circle distance, earth radius, latitudes, longitudes, angular units, spatial measurements, Heron's method of area, land parcel division, direction and bearing measurements.	10
Unit – 3	**Spatial Complexity, Connectivity and Applications:** Geography of Networks, Diffusion and Coalescence of Space, Connectivity, Nodes, Links, Shortest Route, Dijkstra's algorithm, Urban Structure Matrix, Concepts of Monte Carlo Simulation, Shannon Entropy, Euclidean Distance, Spatial Interpolation **Assignment**:	10
Unit – 4	**Geographical Uncertainties and Mathematical Modeling:** In-Situ, transfer, epistemic and transmissivity uncertainty, semivariograms, bias detection, uncertainty modelling, Total operating characteristics (TOC), Relative Operating Characteristics(ROC), Confusion Matrix, Bias Correction, Cumulative Distributive	12

Function, Kappa Coefficient and Kling-Gupta Efficiency modelling, PBIAS, RMS, RMSE, R-Square modelleling.

Field Study: Students have to study the distribution of Natural Resources and their optimal utilization and prepare a report.

References:

1. Higher Engineering Mathematics by Grewal, B.S., Khanna Publishers, 1993.
2. Engineering Mathematics by Sastry, S.S., Vol.I and II, Prentice Hall of India, 2nd edition, 1994.
3. Elementary differential equations by Rainville, E.D. and Bedient, P.E., 6thedition.
4. Higher Engineering Mathematics by Grewel, B.S., 33rd edition.
5. Differential Calculus by Shanthi Narayan, 13th edition.

Integrated B.Sc and M.Sc Programs

Semester – I
Title of the Course: OE- 1.2 Fundamentals of Remote Sensing

Number of Theory Credits	Number of Theory hours
3	42

Course Outcomes:

At the end of the course the student will be able to
1. This course is to make understand the basic concepts of Remote Sensing and to impart necessary skills of remote sensing analysis, and image interpretation to the students. So that, students acquire employable skills in remote sensing.
2. Students will learn how to handle and process the satellite images for understanding of biophysical phenomena of the earth system.

Course Objectives:

The course aims to
1. To congregate the basic concepts and fundamentals of physical principles of remote sensing
2. To create a firm basis for successful integration of remote sensing in any field of application.
3. To study basics of digital image process inland image interpretation techniques.
4. To study the applications of the remote sensing to solve the real-world problems.

	Content of Theory Course	42 h
Unit – 1	**Introduction to Remote Sensing:** 1.1 Definition and components, History of Remote Sensing, 1.2 Electromagnetic Magnetic Spectrum, 1.3 Interaction of EMR with the atmosphere and with the surface feature, 1.4 Atmospheric window, spectral reflectance of land covers (minerals, rocks, water, vegetation, and urban area).	02 02 02 04
Unit – 2	**Sensors & Platforms:** 2.1 Types of orbits-sun-synchronous and geosynchronous, Sources of energy, 2.2 Classification of remote sensors - Active, Passive, Electro-mechanical and optical sensors. 2.3 Resolution concept - Spectral, Radiometric, and temporal resolution. Platform types and characteristics, 2.4 **Assignment:** Students need to prepare a report on how satellite images are captured , processed and distributed to the end users by citing Bhuvan, ISRO, ISAC, NRSC, USGC Websites	02 04 02 02
Unit – 3	**Aerial Photography:** 4.1 Elements, Types and interpretation of Aerial photography, 4.2 Principles, Classification of Aerial photographs on the basis of Height and Tilt, Scales, Components of camera, film, Aerial platforms. 4.3 Digital and Analog data, Image formats, Stereo pairs, 4.4 Applications of Aerial Photography	02 04 02 02
Unit – 4	**Applications of Remote Sensing:** 4.1 International remote sensing centers, 4.2 Indian remote sensing centres and their activities, new satellite programs of India.	02 02

	4.3 Land observation satellites, Meteorological satellites, Marine observation satellites.	06
	4.4 **Field Study**: Students need to gather information on how Landuse / Landcover maps are prepared by local governing bodies using remote sensing techniques.	02

Web Resources

1. Projections: https://map-projections.net/imglist.php
2. Textbook of Canadian Remote Sensing:
   https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/resource/tutor/fundam/pdf/fundamentals_e.pdf
3. ITC Netherlands, Principles of Remote Sensing
   https://webapps.itc.utwente.nl/librarywww/papers_2009/general/principlesremotesensing.
4. Pdf http://earthobsevatory.nasa.gov/Library/RemoteSensing

MOOC

1. Remote Sensing: https://nptel.ac.in/courses/105/108/105108077/
2. Introduction to Remote Sensing: https://nptel.ac.in/courses/121/107/121107009/
3. Digital Image Processing of Remote Sensing Data: https://nptel.ac.in/courses/105/107/105107160/
4. Remote Sensing and GIS: https://nptel.ac.in/courses/105/103/105103193/
5. Remote Sensing Essentials: https://nptel.ac.in/courses/105/107/105107201/
6. Remote Sensing: Principles and Applications: https://nptel.ac.in/courses/105/101/105101206/
7. Basics of Remote sensing, GIS & GNSS technology and their applications:
8. https://onlinecourses.swayam2.ac.in/aic20_ge05/preview
9. http://rst.gsfc.nasa.gov/Front/tofc.html.

References

1. Lillesand T. Mand Kiefer R.W (2021), Remote Sensing and Image interpretation, 7th Edition, John Wiley & Sons, Canada.
2. Jensen J. R, (2012), Remote Sensing of Environment: An Earth Resources Perspective, 2nd Edition, Pearson Education, Upper Saddle River, Prentice Hall, New Jersey.
3. Elachi Candvan Zyl J .J, (2006), Introduction to the Physics and Techniques of Remote Sensing, John Wiley & Sons, Canada.
4. Joseph G, (2005), Fundamentals of Remote Sensing, 2nd Edition, Universities Press (India) Pvt Ltd, Hyderabad.
5. Narayan LRA, (1999), Remote Sensing and its Applications, Universities Press (India) Pvt Ltd, Hyderabad.
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9. Jensen, John R., (2005), Introductory Digital Image Processing, 3rd Ed., Upper Saddle River, NJ: Prentice Hall, 526 pages.

Integrated B.Sc and M.Sc Programs	
Semester – I	
Title of the Course: SEC.S - 1 Cartographic Techniques	
Number of Theory Credits	**Number of Theory hours**
2	28

Course Learning Outcomes:

At the end of the course the students will:
1. Define the field of cartography and to explain the essential principles of it.
2. To outline the mechanism of map-making

Course Objectives:

This course aims to
1. To define the concepts in cartography
2. To introduce various concepts of scale and mapping skills
3. To understand the techniques map layouts

	Content of Theory Course	42 h
Unit – 1	**Cartographic Basic**: Cartography – Nature and Scope; Scales – Concept and application; Graphical Construction of Comparative and Diagonal Scales; Elements of the map, types of maps; Cartographic Appreciation.	7
Unit – 2	**Map Projections:** Map Projections – Classification, Properties and Uses; Graphical Construction of Polar Zenithal Stereographic, Bonne's and Mercator's Projections, and reference to Universal Transverse Mercator.	7
Unit – 3	**Physical Features Extraction and Interpretation:** Interpretation of Topographical maps with the help of Cross and Longitudinal Profiles; Slope Analysis – Wentworth's method. **Assignment**:	7
Unit – 4	**Mapping Techniques:** Choropleth maps, Dot Maps; Isopleth Maps, Chorochromatic Maps; Choroschematic Maps; Proportional Symbols. **Field Study:** Students have to study the distribution of Natural Resources and their optimal utilization and prepare a report.	7

References:

1. Anson R. and Ormelling F. J., 1994: International Cartographic Association: Basic Cartographic, Pregmen Press.
2. Gupta K.K. and Tyagi, V. C., 1992: Working with Map, Survey of India, DST, New Delhi.
3. Mishra R.P. and Ramesh, A., 1989: Fundamentals of Cartography, Concept, New Delhi.
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5. Rhind D. W. and Taylor D. R. F., (eds.), 1989: Cartography: Past, Present and Future, Elsevier, International Cartographic Association.
6. Robinson A. H., 2009: Elements of Cartography, John Wiley and Sons, New York.
7. Sarkar, A. (2015) Practical geography: A systematic approach. Orient Black Swan Private Ltd., New Delhi.
8. Sharma J. P., 2010: Prayogic Bhugol, Rastogi Publishers, Meerut.
9. Sharma, J P (2010) Prayogtmak Bhugolki Rooprekha, Rastogi Publications, Meerut.
10. Singh R L & Rana P B Singh (1991) Prayogtmak Bhugol ke MoolTatva, Kalyani Publishers, New Delhi.
11. Singh R. L. and Singh R. P. B., 1999: Elements of Practical Geography, Kalyani Publishers.
12. Singh, R L & Dutta, P K (2012) Prayogatmak Bhugol, Central Book Depot, Allahabad
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B.A. / B.Sc. Semester – II **Title of the Course: DSC.T- 3 Introduction to Climatology**	
Number of Theory Credits	**Number of theory hours**
4	**56**

Course Outcomes:

After the completion of this course, students should be able to
1. Define the field of climatology and to understand the atmospheric composition and structure.
2. To outline the mechanism and process of solar radiation transfer to earth surface and to ex-plain the temperature distribution and variation according to time and space.
3. To illustrate and explain the air-pressure system, wind regulating forces and the formation of the Atmospheric Disturbance.
4. To understand and compute the air humidity as well as to explain the process of Condensation and formation of precipitation and its types.

Course Objectives:

This course aims to:
1. To define the field of climatology and components of the climate system
2. To introduce various dimensions of climatology like structure and composition.
3. To understand the global atmospheric pressure, temperature, and wind system.
4. To study the concept of atmospheric moisture and its types

	Content of Theory Course	**56 h**
Unit – 1	**Composition and Structure of the Atmosphere:** 1.1 Nature and Scope of Climatology; Climatology and Meteorology. 1.2 Structure: Troposphere, Stratosphere, Mesosphere, Ionosphere, Exosphere and their characteristics. 1.3 Composition of the atmosphere. 1.4 Weather and Climate.	02 03 02 01
Unit – 2	**Atmospheric Temperature:** 2.1. Insolation: Definition, Mechanism, Solar Constant. Factors affecting the Insolation: Angle of incidence, length of the day, Sun spots, 2.2 Heating and cooling process of the atmosphere-Radiation, Conduction, convection, and advection. 2.3 Temperature Distribution: Influencing factors. Vertical, Horizontal, and Inversion of temperature. Atmospheric stability and instability. 2.4 Global Energy Budget: Incoming short-wave, solar radiation, outgoing long-wave, Terrestrial radiation, albedo. Net Radiation and Latitudinal Heat Balances. 2.5 **Assignment:** Students have to observe heating and cooling process of built-up area, agriculture area, water-body and open space of their surrounding and prepare a report.	02 03 03 04 02
Unit – 3	**Atmospheric Pressure and Winds:** 3.1 Atmospheric Pressure: Influencing factors, Vertical and Horizontal Distribution, 3.2 Pressure Belts, Pressure Gradient. Tri-cellular - Hadley, Ferrel's and Polar Cells. 3.3 Atmospheric Circulation, Winds - Influencing factors, Types - planetary, seasonal, local. Monsoons and jet streams. 3.4 Variable winds – Cyclones and anti-cyclones. 3.5 Air-Masses and Fronts: Definition, Nature, Source Regions and Classification.	03 03 04 04 04
	Atmospheric Moisture: Humidity:	

Unit –4	**4.1** Sources, influencing factors and types -Absolute, Relative and Specific.	03
	4.2 Hydrological cycle: process of evaporation, condensation.	03
	4.4 Precipitation: Types and distribution.	02
	4.5 Koppen's, Thornthwaite's and Trewartha's classification.	02
	4.6 Global Climate Change**:** Causes and consequences, role and response of man.	04
	4.7 **Field Study:** Students will have to visit and study a local area Weather Station and prepare report how it gathers data and sends to the main station.	02

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1. Lutgens, Frederic K. & Tarbuck, Edward J. (2010).The Atmosphere: An Introduction to Meteorology. New Jersey: Pearson Prentice Hall.
2. Oliver, John E.& Hidore, John J.(2003).Climatology: An Atmospheric Science. Delhi: Pearson Education.
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8. Trewartha,G.T.(1980):AnIntroductiontoClimate;McGrawHill,NewYork,5thedition, (International Student Edition)
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2. https://mausam.imd.gov.in/
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	B.A. / B.Sc. Semester – II Title of the Course: DSC.P- 3 Interpretation of Weather Maps	
Number of Practical Credits		**Number of Practical hours**
2		56

Course Outcomes:

After the completion of this course, students should be able to
1. Define the field of climatology and to understand the atmospheric composition and structure.
2. To outline the mechanism and process of solar radiation transfer to earth surface and to ex-plain the temperature distribution and variation according to time and space.
3. To illustrate and explain the air-pressure system, wind regulating forces and the formation of the Atmospheric Disturbance.
4. To understand and compute the air humidity as well as to explain the process of Condensation and formation of precipitation and its types.

Course Objectives:

This course aims to:
1. To define the field of climatology and components of the climate system
2. To introduce various dimensions of climatology like structure and composition.
3. To understand the global atmospheric pressure, temperature, and wind system.
4. To study the concept of atmospheric moisture and its types

	Content of Practical Course	**56 h**
Exercise 1	Understanding functions of the Indian Meteorological Department (IMD) and Acquisition of Climate Variables.	7
Exercise 2	Plotting of variables using graphical methods: line-graph / bar-graph. (Manual and Automated).	7
Exercise 3	Elementary Instrumental Observation: Centigrade and Fahrenheit thermometer for measuring temperature.	7
Exercise 4	Mercurial Barometer and Aneroid Barometer for measuring atmospheric pressure	7
Exercise 5	Derivation of Actual and Potential Evapotranspiration	7
Exercise 6	Derivation of Drought Indices (Standard Precipitation Index, Aridity Index)	7
Exercise 7	Interpretation of Indian Daily Weather charts. (*Download weather charts of any two seasons*).	7
Exercise 8	**Field Activity**: Measurement of Water-Balance in the field, Study of erosional and run-off nearby area.	7

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1. Lutgens, Frederic K. & Tarbuck, Edward J. (2010).The Atmosphere: An Introduction to Meteorology. New Jersey: Pearson Prentice Hall.
2. Oliver, John E.& Hidore, John J.(2003).Climatology: An Atmospheric Science. Delhi: Pearson Education.
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3. https://www.weatheronline.in/
4. https://earthexplorer.usgs.gov/
5. https://www.nhc.noaa.gov/satellite.php

Integrated B.Sc. and M.Sc Programs	
Semester – II **Title of the Course: DSC.T - 4 Physical Geography**	
Number of Theory Credits	**Number of Theory hours**
4	56

Course Learning Outcomes:

After the completion of the course, the students will be able to:
1. Students will be able to understand the fundamental concepts in Earth Science.
2. Understands basic terminology used to describe physical processes and landscape.
3. Describe elements of the atmosphere and the oceans.

Course Objectives:

This course aims to
1. Study basic principles of the Earth Science.
2. Understand the landforms formed by various atmospheric and geomorphic agents.
3. Know relief features of ocean bottoms.

	Content of Theory Course	**42 h**
Unit – 1	**Motion of the earth:** 1.1 Origin, Shape and Size of the Earth, 1.2 Movement of the Earth-Rotation and Revolution, 1.3 Effects of the movement of Earth, 1.4 Coordinates - Latitude, Longitude and Time. 1.5 Structure of the Earth.	04 04 02 02 02
Unit – 2	**Weathering and Denudation:** 2.1 Rocks-types, significance, 2.2 Weathering–types. Agents of Denudation-River, Glacier, Wind and Groundwater. 2.3 Volcanicity, Earthquakes and Tsunamis. 2.4 **Assignment:** Students will have to study a local weather and prepare report.	04 04 04 02
Unit – 3	**Weather and Climate:** **3.1** Structure and Composition of Atmosphere, 3.2 Weather and Climate. Atmospheric Temperature, 3.3 Heat Budget of the atmosphere. 3.4 Atmospheric Pressure, 3.5 Winds and Precipitation.	02 04 02 02 04
Unit – 4	**Distribution of Land & Sea:** **4.1** Distribution of Land and Sea, Submarine Relief of the Ocean, 4.2 Temperature and Salinity of Sea Water. Ocean Tides, Waves and Deposits, 4.3 Ocean currents-Atlantic, Pacific and Indian Oceans. 4.4 Marine Resources: Biotic, mineral and energy resources. **4.5 Field Study:** Students need to visit the nearby fields and identify various types of landforms and process behind their formation and submit a report.	02 04 04 02 02

References
1. Worcester P.G. (1965), A Text Book of Geomorphology, Can North and 2nd Edition, East West Edn. New Delhi.

2. Board Shaw M.J. Et. Al. (1979) The Earth's Changing Surface, Hodder & Stoughton London.
3. B.S.Negi (1993) Physical Geography S.J. Publication, Meerut
4. D.S. Lal (1998) Climatology. Chaitnya Publishing House, Allahabad
5. K. Siddhartha (2001) Atmosphere, Weather and Climate. Kisalaya publication, New Delhi
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Integrated B.Sc. and M.Sc Programs

Semester – II
Title of the Course: DSC.P - 4 Interpretation of Topographical Maps

Number of Theory Credits	Number of Theory hours
2	56

Course Learning Outcomes:

After the completion of the course, the students will be able to:
1. Students will be able to understand the fundamental concepts in Earth Science.
2. Understands basic terminology used to describe physical processes and landscape.
3. Describe elements of the atmosphere and the oceans.

Course Objectives:

This course aims to
1. Study basic principles of the Earth Science.
2. Understand the landforms formed by various atmospheric and geomorphic agents.
3. Know relief features of ocean bottoms.

	Content of Theory Course	42 h
Unit – 1	**Motion of the earth:** 1.1 Origin, Shape and Size of the Earth, 1.2 Movement of the Earth-Rotation and Revolution, 1.3 Effects of the movement of Earth, 1.4 Coordinates - Latitude, Longitude and Time. 1.5 Structure of the Earth.	04 04 02 02 02
Unit – 2	**Weathering and Denudation:** 2.1 Rocks-types, significance, 2.2 Weathering–types. Agents of Denudation-River, Glacier, Wind and Groundwater. 2.3 Volcanicity, Earthquakes and Tsunamis. 2.4 **Assignment:** Students will have to study a local weather and prepare report.	04 04 04 02
Unit – 3	**Weather and Climate:** **3.1** Structure and Composition of Atmosphere, 3.2 Weather and Climate. Atmospheric Temperature, 3.3 Heat Budget of the atmosphere. 3.4 Atmospheric Pressure, 3.5 Winds and Precipitation.	02 04 02 02 04
Unit – 4	**Distribution of Land & Sea:** **4.1** Distribution of Land and Sea, Submarine Relief of the Ocean, 4.2 Temperature and Salinity of Sea Water. Ocean Tides, Waves and Deposits, 4.3 Ocean currents-Atlantic, Pacific and Indian Oceans. 4.4 Marine Resources: Biotic, mineral and energy resources. **4.5 Field Study:** Students need to visit the nearby fields and identify various types of landforms and process behind their formation and submit a report.	02 04 04 02 02

References
1. Worcester P.G. (1965), A Text Book of Geomorphology, Can North and 2nd Edition, East West Edn. New Delhi.

2. Board Shaw M.J. Et. Al. (1979) The Earth's Changing Surface, Hodder & Stoughton London.
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9. K. Siddhartha, S. Mahapatra, S. Mukherhjee (2013), Basics Physical Geography, Kitab Mahal

Websites:

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/

	Integrated B.Sc and M.Sc Programs

Integrated B.Sc and M.Sc Programs

Semester – II
Title of the Course: OE.- 2.1 Spatial Statistics

Number of Theory Credits	Number of Theory hours
3	42

Course Learning Outcomes:

After the completion of this course, students should be able to
1. Describe and discuss the key terminology, concepts tools and techniques used in statistical analysis
2. Understand and critically discuss the issues surrounding sampling and significance
3. Solve a range of problems using the techniques covered
4. Conduct basic statistical analysis of data.

Course Objectives:

This course aims to
1. To develop the student's ability to deal with numerical and quantitative issues in Geography.
2. To enable the use of statistical, graphical, and algebraic techniques wherever relevant.
3. To have a proper understanding of Statistical applications in Geography.

	Content of Theory Course	42 hrs
Unit – 1	**Introduction:** 1.1 Statistical Methods for Geography 1.2 Scientific method and mathematical notation - Descriptive Statistics 1.3 Measures of central tendency: Mean, Median, and Mode 1.4 Measures of Dispersion: Range, Variance, Standard Deviation, z-score, Skewness, Kurtosis and Histograms.	02 02 02 04
Unit – 2	**Probability:** 2.1 Probability Concepts 2.2 Discrete Probability Distributions: Uniform, Binomial and Poisson Distributions- 2.3 Continuous Probability Distributions – 2.4 Probability Models - Central Limit Theorem and Confidence Intervals, box, log, log-linear transformation 2.5 **Assignment**:	01 02 01 04 02
Unit – 3	**Hypothesis Testing and Sampling:** 3.1 Sources of Data-Spatial Sampling (Stratified, Random, Clusters) 3.2 Hypothesis Testing: Null Hypothesis, Alternative Hypothesis, 3.3 p-value, Chi-square, degree of freedom, wald coefficient, $z$test and t - test – 3.4 Analysis of Variance (ANOVA)., 3.5 One Way and Two-Way ANOVA, outliners detection and inferances	02 02 02 02 02
Unit – 4	**Correlation and Regression:** 4.1 Covariance - Pearson's Correlation Coefficient 4.2 Spearman's Rank Correlation Coefficient– Correlation and Geographic Problems 4.3 Regression Analysis., Measuring Geographical Distribution, Mean Center,	02 02 02

	Median Center, Standard Deviation,	
	4.4 Geographical Weighted Regression, Moran-I Index, Exploratory Spatial Data Analysis.	02
	4.5 **Field Study:** Students will have to select nearby region and collect data analyze and submit the report.	02

References

1. Rogerson, P.A. (2001) Statistical Methods for Geography, Sage Publications,New Delhi.
2. Pal, S. K. (1998) Statistics for Geoscientists, Tata McGraw Hill, New Delhi.
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Integrated B.Sc and M.Sc Programs

Semester – II
Title of the Course: OE – 2.2 Introduction to Geographic Information Systems

Number of Theory Credits	Number of Theory hours
3	42

Course Learning Outcomes:

After the completion of this course, students should be able to
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	42 hrs
Unit – 1	**Introduction:** 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.	10
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:**	10
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.	10
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:**	12

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4. https://ksrsac.karnataka.gov.in/
5. https://www.isro.gov.in/
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Integrated B.Sc and M.Sc Programs

Semester – II
Title of the Course: AECC - 1 Environmental Studies

Number of Theory Credits	Number of Theory hours
2	28

Course Learning Outcomes:

After the completion of this course, students should be able to
1. Determine the biome realms of earth
2. Significance and functions of ecosystem
3. Cause and effects of ecological imbalance
4. Ways and means to manage ecosystem

Course Objectives:

The Course aims to
1. To congregate the basic concepts and fundamentals environment.
2. To study basics of environmental processes happening in the open area.
3. To find out new methods to solve the real-world environmental problems.

	Content of Theory Course	28 h
Unit – 1	**Introduction to Environment:** 1.1 Definition and Meaning of environment. 1.2 Habitat. Ecological Niche. 1.3 Bio-sphere and Biodiversity; 1.4 Biomes – Equatorial to Tundra. 1.5 Man and Environmental Relationships.	01 01 02 02 01
Unit – 2	**Ecosystem:** 2.1 Structure and Functioning of Ecosystem, 2.2 Global and regional ecological change & imbalance. 2.3 Food Chains, Food Webs, Food Pyramid. 2.4 Resource Use and Ecological Imbalance with reference to Soil, Forests and Energy Resources 2.5 **Field Activity:** Students have to select nearest lake / water-body and study "Pound as a Ecosystem" and prepare a report regarding its sustainable development.	01 01 02 02 02
Unit – 3	**Man Induced Changes in Environment:** 3.1 Environmental Pollution; Air, Water, Noise, 3.2 Solid Waste with special reference to India. 3.3 Environmental Hazards, 3.4 Extinction of Species. 3.5 Man Made Ecosystem - Urban, Ecotourism, National 3.6 Parks and Sanctuaries.	02 01 01 01 01 01

Unit – 4	**Principles of Environmental Management**:	
	3.1 Environmental Policy of India, (post 2000 AD).	01
	3.2 Environment Impact Assessment (EIA).	01
	3.3 Global Summits & Agencies of Environment Conservation.	01
	3.4 Environmental degradation, management and conservation.	02
	3.5 **Case Study:** Students have to select a region and study environment degradation and prepare a report regarding conservation measures.	02

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