CENTRAL UNIVERSITY OF PUNJAB

Master of Arts/Science in Geography

Batch 2025

Department of Geography

Graduate Attributes

The graduate students of M.A. Geography programme are expected to demonstrate a systematic and comprehensive understanding of the subject knowledge and apply their knowledge and skill in finding solutions to the contemporary and emerging social and environmental problems. They will be able to apply their critical, creative and evidence-based thinking to solve the future challenges. They have respect for the diverse culture and pluralistic society and can demonstrate the ethical competency at all stages of life. They have ability to work effectively in a team and demonstrate leadership quality in academic as well as professional environment.

Apart from having these core attributes, the master's graduates, after their completion of M.A. programme, will be able to analyse the human interaction with the environment and how human and environment shape each other. They can describe and analyse the geomorphic, climatic, and environmental processes operating at local, regional and global spatial and temporal scales and generate inventories in geospatial environment and apply the geospatial and geostatistical techniques on geographical and environmental issues. They are also able to conduct physical and social survey projects in diverse environment. They will develop digital capabilities through the skill-based programmes designed for them. They will also recognize the essential value systems including academic ethical practices, the moral dimensions of one's own decisions.

Programme outcome

- **Comprehensive Knowledge**: Understand core areas of physical, human, and regional geography.
- **Geospatial & Analytical Skills**: Gain hands-on experience in GIS, Remote Sensing, GPS, and statistical tools.
- **Research & Fieldwork**: Develop research abilities through field surveys, practicals, and dissertation work.
- **Environmental & Development Insight**: Address issues related to climate change, sustainability, and regional planning.
- **Career & Industry Readiness**: Acquire skills suited for academia, planning, geospatial technologies, and consultancy.
- **Ethics & Lifelong Learning**: Foster ethical thinking, effective communication, and a mindset for continuous learning

Course Structure for M.A./M.Sc. Geography, 2025-2027 (3+1)					
Course Code	Course Title	Course type	Credit Hours		
			L	P	Cr
Semester-I					
CORE					
MGEO.401	Geomorphology	*C*	3	-	3
MGEO.403	Population Geography	*C*	3	-	3
MGEO.405	Geography of Human Settlement	*C*	3	-	3
MGEO.406	Regional Development and Planning	*C*	3	-	3
Ability					
MGEO.408	Geographical Information System (Theory)	*C*	3	-	3
Practicals					
MGEO.409	Geographical Information System (Practical)	*SBC*	-	4	2
MGEO.410	Principles of Cartography (Practical)	*SBC*	-	4	2
Elective (select one)					
MGEO.412	Tourism Geography	*DE*	3	-	3
MGEO. 413	Social and Cultural Geography	*DE*	3	-	3
MGEO. 417	Climate Change and Environmental Sustainability	*DE*	3	-	3
Tutorial					
xxx	Individualized tutorial (non-credit 2 hours)	*T*	-	-	-
	Total Credits				**22**
Semester-II					
CORE					
MGEO.516	Climatology	*C*	3	-	3
MGEO.518	Political Geography	*C*	3	-	3
MGEO.519	Fundamentals of Remote Sensing (Theory)	*C*	3	-	3
Ability					
MGEO.521	Geography of India	*C*	3	-	3
Practicals					
MGEO.520	Fundamentals of Remote Sensing (Practical)	*SBC*	-	4	2
MGEO.522 Or MGEO.523	Quantitative Methods in Geography (Practical) Or Introduction to Earth's material (Practical)	*SBC*	-	4	2
IDC offered					
MGEO.506	Introduction to Climate Change	*IDC*	2	-	2
MGEO.507	Basics of Geoinformatics	*IDC*	2	-	2
Electives (select one)					

MGEO.526	Agriculture Geography	*DE*	3	-	3
MGEO.416	Natural hazards and Disasters				
MGEO.527	Urban System and Planning	*DE*	3	-	3
MEGS.522	Oceanography	*DE*	3	-	3
MGEO.528	Environmental Geography	*DE*	3	-	3
Entrepreneur					
MGEO.530	Entrepreneurship	*CF*	2	-	2
Tutorial					
xxx	Individualized tutorial (non-credit 2 hours)	*T*	-	-	-
	Total Credit				**23**
Semester-III					
MGEO.407	Geographical Thoughts	*C*	3		3
MGEO.535	Research Methodology	*C*	3	-	3
MGEO.536	Geostatistical Techniques and Analysis	*C*	3	-	3
Ability					
MGEO.415	Economic Geography	*C*	2	-	2
Practicals					
MGEO.411	Instrumentation	*SBC*	-	4	2
MGEO. 596	Field Visit and Survey	*SBC*	-	-	1
Tutorial					
xxx	Individualized tutorial (non-credit 2 hours)	*T*	-	-	-
Value Added Course (only one)					
MGEO.511	Introduction to Map Reading	*VAC*	2	-	2
MGEO. 512	Data Analysis and Visualization	*VAC*	2	-	2
Elective (select one)					
MGEO.414	Biogeography	*DE*	3	-	3
MGEO.418	Spatial and Transportation Planning	*DE*	3	-	3
MGEO.537	Health Geography	*DE*	3	-	3
MGEO.538	Natural Resources and Sustainability	*DE*	3	-	3
MGEO. 539	Glaciology	*DE*	3	-	3
Dissertation					
MGEO. 599-1	Dissertation/Internship Synopsis	*SBC*	-		**2**
	Total Credit				**21**
Semester-IV					
MGEO. 599-2	Dissertation/Internship	*SBC*	-	40	**20**

	Grand total		L	P	Cr
		Hours			86

L: Lecture, P: Practical, Cr: Credit, CF: Compulsory Foundation, C: Core, SBC: Skill Based Course, IDC: Inter Disciplinary Course, VAC: Value Added Course, DE: Discipline Elective.Course code starting with EGS belongs to the Department of Geology

MOOCs may be taken up to 40% of the total credits (excluding dissertation credits). MOOC may be taken in lieu of any course, but the content of the course should match minimum 70%. However, student is required to consult Head of the Department prior to the registration of the MOOC.

Swayam is mandatory for all student. Coordinator will coordinate with student for the course to be selected.

Dissertation evaluation as per university rules and guidelines.

Clause for the Multiple entry-exit as per NEP guidelines

- Students entering at level 8 must have met all the requirements for a bachelor's degree with Geography as their main subject.
- The students can choose to exit the program at level 8 with a PG diploma in Geography, provided they complete at least 43 credits.

Examination pattern from 2025-2026 session onwards

Core, Discipline Elective, and Compulsory Foundation Courses			IDC, VAC, Entrepreneurship, Innovation and Skill Development Courses (≤2 credits) or any other theory course of ≤2 credits		
	Marks	Evaluation	Marks	Evaluation	
Internal Assessment	25	Various methods	-	-	
Mid-semester test (MST)	25	Descriptive	50	Descriptive (upto 100%) Objective (upto 30%)	
End-semester exam (ESE)	50	Descriptive (upto 100%) Objective (upto 30%)	50	Descriptive (upto 100%) Objective (upto 30%)	
Dissertation Proposal (Third Semester)			**Dissertation (Fourth Semester)**		
	Marks	Evaluation		Marks	Evaluation
Supervisor	50	Dissertation proposal and presentation	Supervisor/ co-supervisor(s)	50	Continuous assessment (regularity in work, mid-term evaluation) dissertation report, presentation, final

					viva-voce
HoD and senior-most faculty of the department	50	Dissertation proposal and presentation	External expert	50	Report of dissertation (25), presentation (10), Novelty/originality (5) and final viva-voce (10).

Marks for internship shall be given by the supervisor/internal mentor and external mentor.

Semester-I

Course Title: Geomorphology	**L**	**P**	**Cr**
Course Code: MGEO.401	3	-	3
Total Hour: 45 Hours			

Course Learning outcome (CLO): The course would help the students to:

CLO1: know about the Fundamental Concepts in Geomorphology and physical processes that form the landscape.

CLO2: understand about how the material is transported both by geomorphic and gravitational processes.

CLO3: assess how different scales of time and space affect geomorphological processes.

CLO4: learn the relevance of applied aspects of Geomorphology in various fields.

Unit/ Hours	**Content**	**Mapping with CLO**
Unit I/ 11 Hours	**Fundamental Concepts in Geomorphology:** Concept & fundamentals of geomorphology; Concept of relief – mountains, plateaus, hills, foothills, valleys, plains and Floodplains; Doctrine of Isostasy - Views of Airy and Pratt; Mountain Building Theories – concepts of Kober, Daly and Holmes. **Learning Activities:** Map and model reading	CLO1
Unit II/ 11 Hours	**Earth Movements and Interior of the Earth** Plate Tectonics and Continental drift theory; Earth Movements (seismicity/Earthquake, folding, faulting and vulcanicity); Evolution of the earth and Earth's internal structure; composition and characteristics; Rocks and soil: types, formation, and characteristics. **Learning Activities:** Map and model reading	CLO2
Unit III**/** 12 Hours	**Geomorphic Processes and landforms** Gradational and Aggradational processes: concept of slope, erosion, and mass wasting. Weathering: Physical and chemical Process; Cycle of Erosion - Concepts of Davis and Penck; Geomorphic landform: fluvial, glacial, Aeolian, coastal and karst; Causes of Geomorphic Hazards (earthquakes, volcanoes, landslides and avalanches) **Learning activities:** Map and model reading, case study	CLO3
Unit IV/ 11 Hours	River forms and Morphometric analysis; Applied Geomorphology and topographic analysis using GIS/Remote Sensing/DEM; Extra-Terrestrial Geomorphology **Learning activities:** Map and model reading, case study	CLO4

Transaction mode: Lecture, Demonstration, Problem-solving, Tutorial, Seminar, Group discussion. Tools used: PPT, video, animation movie, WhatsApp.

Suggested readings:

1. Bloom, Arthur L., (1991), Geomorphology: A Systematic Analysis of Late Cainozoic Landforms, Pearson
2. Gregory, Kenneth J. (Ed.) (2014), The SAGE handbook of geomorphology, New Delhi, Sage publications India Private Limited.

3. Harvey, Adrian (2012), Introducing geomorphology: A guide landforms and processes, Edinburgh, Dunedin academic press.
4. Huggett, Richard John (2011), Fundamentals of geomorphology, 3rd edition, Routlegde Taylor & Francis group.
5. Thornbury, W.D. (1969) Principles of Geomorphology, New York: John Wiley and Sons, 2nd edition, December 2004.
6. Singh, Savindra (1998). Geomorphology, Allahabad: PrayagPustakBhawan.
7. Strahler, A.N. (1992) Physical Geography, New York: John Wiley and Sons.
8. G.C. Leong (2023 Edition), Physical and Human Geography,Oxfor University Press YMCA Library New Delhi
9. Devi, Renu (2018), Geomorphology, Random Publications, New Delhi
10. www.usgs.gov

Course Title: Population Geography	**L**	**P**	**Cr**
Course Code: MGEO.403	3	-	3
Hours: 45 hours			

Course Learning Outcome(CLO): By the end of this course, students will be able to:
CLO1: Understand the population and its determinants
CLO2: Describe the population growth theories and migration theories.
CLO3: Identify population policies and their indices for developed and less developed countries.
CLO4: Analyse the relation between population growth, development, and the environment.
CLO5: Identify and describe contemporary population issues.

Unit/Hours	**Content**	**Mapping with CLO**
Unit I / 11 Hours	Nature and scope of population geography; Components of population: fertility, mortality, migration; population demographics: size, ratio, proportion: concept of overpopulation and under-population, Understanding population Pyramids: Sources of data and analysis. *Learning activities:* Data collection, group study, and assignments	CLO1
Unit II / 12 Hours	Population Growth Theories: Malthusian, Neo-Malthusian, Cornucopian, Optimum population, and Demographic transition theory; Migration: Definition, types, determinants, and Migration theories. *Learning activities:* Literature collection, group study, and assignments	CLO2
Unit III / 11 Hours	Population Policies: Pro-natal and Anti-natal, Comparative Study of Developed and Less Developed Countries, concept and calculation of Human Development Index (HDI): Indices and Global Ranking. *Learning activities:* Data collection, group study, and assignments	CLO3
Unit IV / 11 Hours	Population Growth, Development, and Environment: Conceptual Framework and Global Concerns, Contemporary Population Issues - Ageing Population, Demographic Dividend and Resource Conflict. *Learning activities:* Literature collection, group study, and assignments	CLO4 CLO5

Mode of Transaction: Lecture, class discussion, and presentation methods will be used for teaching. Tools such as WhatsApp, PPT, and video will also be used.

Suggested readings:

1. R. C. Chandna, (2022). Geography of Population, Part 1: Concepts, Determinants and World Patterns, Kalyani Publishers
2. R. C. Chandna, (2022). Geography of Population, Part 2: India: Population and Patterns, Kalyani Publishers
3. Prithvish Nag, G. C. Debnath (2021), Population Geography, Bharati Prakashan
4. Barcus, Holly, Halfacree, Keith (2017). Introduction to Population Geographies, Lives Across Space, 1st Edition, Routledge
5. John I. Clarke, 2nd edition (2013). Population Geography. Pergamon
6. R. C. Chandna, (1980). Introduction to Population Geography, Kalyani Publishers

Course title: Geography of Human Settlement	**L**	**P**	**C**
Course code: MGEO.405	3	0	3
Total hour: 45 Hours			

Course Learning outcome(CLO):

On completion of this course, students will be able to:

CLO1: comprehend basic concepts, scope, characteristics, pattern, and socio-economic, and environmental profile of rural settlement,

CLO2: explore the theory, models and planning processes to solve the contemporary challenges in rural settlement planning at national to global context,

CLO3: comprehend concept, scope, theory, and models of urban settlement,

CLO4: explore the planning processes to solve the contemporary challenges in urban settlement planning at national to global context.

Unit/Hours	**Content**	**Mapping with CLO**
Unit I/ 11 Hours	**Introduction to rural settlement:** Definition, scope, and nature of rural settlement, Characteristics of rural settlement, materials used in rural settlement, types, distribution, and pattern of rural settlement, form and function of rural settlement, population, social, economic, and environmental, profile of rural settlement and challenges of rural settlement. **Learning activities: Group discussion**	CLO1
Unit-II /11 Hours	**Introduction to rural settlement development and planning:** Theory, policy, and models in rural settlement, settlement, infrastructure, and transportation, planning for natural resource, economics, health, and sanitation and community development **Learning activities: Assignment**	CLO2
Unit-III /11 Hours	**Introduction to Urban Settlement** Definition, scope, nature, and history of urban settlement, characteristics, types, and distribution of urban settlement, theories of origin and growth of town, process of urbanisation and urban system, spatial and morphological pattern of urban settlement and functional classification and urban theories.	CLO3

	Learning activities: Assignment	
Unit-IV /11 Hours	**Introduction to urban settlement development and planning:** Concepts of Megacities, Global Cities and Edge Cities, changing Urban Forms (peri-urban areas, rural-urban fringe, suburban, ring and satellite towns), social Segregation in the City, urban Social Area Analysis, and urban Poverty and slum in the city. **Learning activities: Case study**	CLO4
Mode of Transaction: methods of transaction are lecture, audio-video, discussion which will be followed in teaching using ppt, social media etc.		
Suggested readings: 1. Bunce, M. (2017). Rural Settlement in an Urban World, Taylor & Francis Group. Oxfordshire. 2. Carter, H. (1995). The Study of Urban Geography (4th Ed.) Edward Arnold. London 3. Cloke, P. (2014). An Introduction to Rural Settlement Planning, Routledge Revivals. London. 4. Council for Scientific and Industrial Research, C. (2000). Guidelines for human settlement planning and design: The red book. CSIR Building and Construction Technology. http://hdl.handle.net/10204/3750 5. Jabareen, Y. R., (2006). Sustainable Urban Forms: Their Typologies, Models, and Concepts, Journal of Planning Education and Research, 26: 38-52. 6. Mondal, R.B. (1979). Introduction to Rural Settlements, Concept publications. New Delhi. 7. Pacione, M. (2009). Urban Geography: A Global Perspective (3rd Ed.). Routledge. Oxfordshire. 8. R. Y. Singh, Ry Singh (1994). Geography of Settlements, Rawat Publications, New Delhi. 9. R.C. Tiwari, (2020), Settlement Geography (Rural and Urban Geography). 10. Singh, R.H (2018), Geography Of Settlements, Rawat Publication, Jaipur 11. https://www.sciencedirect.com/topics/social-sciences/rural-settlement 12. https://opentext.wsu.edu/introtohumangeography/chapter/12-2-rural-settlementpatterns/		

Course title: Regional Development and Planning	L	P	C
Course code: MGEO.406	3	-	3
Total hour: 45 hours			
Course Learning outcome (CLO): On completion of this course, students will be able to: CLO1: Proficient to comprehend basic concepts, scope, and challenges of region and planning region. CLO2: Proficient to comprehend basic concepts, scope, and challenges of regional development and planning. CLO3: Competent to explore the theories and models of regional development and planning for regional sustainability in the national and global context CLO4: Competent to explore the regional development and planning policies and techniques			

to support regional sustainability in the national and global context.		
Unit/Hours	**Content**	**Mapping with CLO**
Unit I /11 Hours	**Introduction to region:** Concept of region; typology of regions, characteristics of region, regional delineation methods, introduction to planning region, characteristics, and delineation methods, planning regions of India. **Learning activities:** Group discussions	CLO1
Unit II /11 Hours	**Introduction to regional development and planning:** Introduction to regional planning, different approaches to regional planning, regional policies in India, challenges in regional planning, concept of Regional Development, indicators of development, Human different regional development indices such as Development Index, Hunger Index etc., Economic development, Regional economic complexes; Inter-regional and intra-regional functional interactions; Regional disparities in India. World Regional Disparities **Learning activities:** Assignments	CLO2
Unit III /11 Hours	**Introduction to regional development and planning models, theories** Approaches to integrated regional planning at different levels: local, regional, and national; Theories of Regional Development (Albert O. Hirschman, Gunnar Myrdal, John Friedman, Dependency theory of Underdevelopment, Global Economic Blocks); Spatial organisation: Central Place Theory, Concept of core and periphery Friedman's Model of Spatial Organisation and Economic Growth. Growth centres and Growth pole theory of Perroux. **Learning activities:** Assignments	CLO3
Unit IV /11 Hours	**Regional development and planning policies and techniques:** Five Year Plans: command area development, planning for backward area, desert drought-prone, Hill and tribal area development; multi-level planning in India: State, District and Block level planning; Decentralized planning and Panchayati raj; watershed management; Regional economic imbalances and inequalities in India; SEZs in regional development. Regional Development and Social Movements in India, advanced tools and techniques in regional development and planning. National regional development institutions and policies like NITI aayog. **Learning activities:** Group discussions	CLO4
Mode of Transaction: methods of the transaction are lecture, audio-video, the discussion which will be followed in teaching using ppt, social media etc.		
Suggested readings: 1. Chandna, R. C. (2000). Regional Planning: A Comprehensive Text. Kalyani		

Publishers., New Delhi.
2. Chaudhuri, J. R. (2001). An Introduction to Development and Regional Planning with special reference to India. Orient Longman, Hyderabad.
3. Cowen, M.P. and Shenton, R.W. (1996). Doctrines of Development. Routledge, London.
4. Doyle, T. and McEachern, D. (1998). Environment and Politics. Routledge, London.
5. Friedmann, J. (1992). Empowerment: The Politics of Alternative Development. Blackwell, Cambridge MA and Oxford.
6. Friedmann, J. and Alonso, W. (ed.) (1973). Regional Development and Planning. The MIT Press, Mass.
7. Hettne, B.; Inotai, A. and Sunkel, O. (eds.) (1999–2000). Studies in the New Regionalism. Vol.I-V. Macmillan Press, London.
8. Isard, W. (1960). Methods of Regional Analysis. MIT Press, Cambridge, MA.
9. Pike, Andy, Rodriguez-pose, Andres, Tomaney, John (2017), Local and Regional Development, Routledge.
10. Mishra, R. P. (1992). Regional Planning: Concepts, Techniques, Policies and Case Studies, Concept Publishing Co, New Delhi.
11. Wang, Xinhao & Hofe, R.(2010). Research Methods in Urban and Regional Planning, Springer.
12. V.Nath Edited By S.K.Aggrawal (2009), Regional Development And Planning In India, Concept Publishing Company, New Delhi.

Course Title: Geographical Information System (Theory)	**L**	**T**	**P**	**Cr**
Course Code: MGEO.408	3	-	-	3
Total Hour: 45 Hours				
Course Learning Outcome(CLO): At the completion of the course, the student will be able to: CLO1: extract, analyze and generate maps. CLO2: apply their skills to geographical research works. CLO3: comprehend the theoretical framework in geographical information systems.				

Unit/Hours	**Content**	**Mapping with CLO**
Unit I / 12 Hours	Concept and definition of Geographic Information System; History and development of GIS technology, GIS software: open source & licensed, Applications of GIS in various sectors; Agriculture, Environment, Health, Disaster, Urban and rural, etc. **Learning activities:** Group assignment	CLO1
Unit II / 11 Hours	Geographic Information System data types and structure; Spatial and non-spatial data; Vector and Raster data. Geo-referencing in GIS; Data input and output generation; Spatial analysis: overlay, buffer, proximity, and network analysis; Introduction to Geodatabase; Geodatabase models and functioning in open source and commercial software **Learning activities:** Group assignment	CLO2
Unit III / 11	Introduction to Global Navigation Satellite System (GNSS); Types, history, and components of navigation satellites: Introduction to	CLO3

Hours	Global Positioning System (GPS); Concepts, history, and segments; Components of GPS: working principles, Sources of Errors, and Collection of Ground Control Points and editing. **Learning activities:** Poster making and Group discussion	
Unit IV / 11 Hours	Resolving GPS errors; Differential GPS and its usage; Types of Satellite-Based Augmentation Systems; Indian Regional Navigation Satellite System; History, development, components of IRNSS, and concept of GAGAN and its importance. **Learning activities:** Poster making and group assignment	CLO3
Mode of Transaction: Lecture, class discussion, and presentation methods will be used for teaching. Tools such as WhatsApp, ppt., and video will be used.		
Suggested readings: 1. Ballas, Dimitris (2017). GIS and the social sciences: Theory and applications, Routledge 2. Liu, Jian Guo & Mason, Philippa J. (2016), Image processing and GIS for remote sensing, Techniques, and Applications, 2nd edition Publication, United Kingdom, Wiley Blackwell. 3. Harvey, Francis (2016), A primer of GIS: Fundamental geographic and cartographic concepts, 2nd edition, New York, The Guilford press. 4. Kennedy, Michael (2013), Introducing geographic information systems with ArcGIS: A workbook approach to learning GIS, 3rd edition, New Jersey, A john Wiley & Sons publications. 5. Holfmann-wellenhof, B.; Lichtenegger, H. ; Collins, J. ; Hofmann-wellenhof, B. (2013), GPS global positioning system: Theory and practice 5th edition, New Delhi, Springer (india) private limited. 6. Kresse, Danko (Eds.) Springer Handbook of Geographic Information, 2012 Edition. 7. Bhatta, Basudeb (2011), Remote sensing and GIS, 2nd edition, New Delhi, oxford university press. 8. Chakraborty, Deshasis & Sahoo, Rabi N. (2009), Fundamentals of Geographical Information System, Viva Books Private Limited, New Delhi 9. Van Sickle, Jan (2008), GPS for land surveyors, 3rd edition, London, CRC press. 10. Kang-tsung Chang (2002), 'Introduction to Geographic Information Systems' Tata McGraw Hill, New Delhi 11. Gottfried Konecny (2014). Remote Sensing, Photogrammetry, and Geographic Information Systems Second edition, CRC Press. **Website:** www.epgp.inflibnet.ac.in, www.nptel.ac.in, www.esri.com, www.bhuvan.nrsc.gov.in		

Course Title: Geographical Information System (Practical)	**L**	**T**	**P**	**Cr**
Course Code: MGEO.409	-	-	4	2
Total Hour: 60 Hours				
Course Learning Outcome(CLO): At the completion of the course, the student will be able to: CLO1: extract, analyse and generate maps. CLO2: apply their skills to geographical research works. CLO3: comprehend the theoretical framework in geographical information system.				
Unit/Ho	**Content**			**Mapping**

urs		with CLO
1 Unit/ 30 hours	**Exercises** Geo-referencing Maps/Images, Digitization of Raster Map: Point, Line and Polygon Features; Preparation of Attribute Tables, Editing and Joining Tables, Analyzing Attribute Data: Calculating Area, Perimeter, and Length;	CLO1 CLO2
2 Unit/ 30 hours	Spatial Representation: Symbolizing and Map Layouts; Basic Analysis in GIS: Buffering, Overlay and Query Building; GPS Applications. Collection of ground control points using hand held GPS receiver; transferring data from GPS receiver to PC.	CLO3
Mode of Transaction: Lab exercise through open source softwares.		

Course Title: Principles of Cartography (Practical)	**L**	**T**	**P**	**Cr**
Course Code: MGEO.410		-	4	2
Total Hour: 60				

Course Learning outcome (CLO): After completing the course, student will be able to:
CLO1: gain understanding of the purposes of cartography, recognize the elements of cartographic representation, and how maps work.
CLO2: use digital cartographic methods for exploring, critiquing, confirming and presenting geographical relationships.
CLO3: increase their proficiency in graphical literacy, geo-visualisation and map modelling.
CLO4: Adapt the current knowledge to emerging applications of photogrammetry and UAV technology.
CLO5: apply knowledge, techniques, skills and modern tools of photogrammetry to solve technical photogrammetric problems in geosciences and other trans-disciplinary subjects.

Unit/Hours	**Content**	**Mapping with CLO**
Unit-1/ 30 hours	Exercise 1: Introduction to cartography: basic to advance tools of Digital cartography, Map concepts & content, types numbering and nomenclature of toposheets, scales, design and implementation. Map projections and coordinate system: Shape and size of the Earth: Geoid, spheroid ellipsoid for world and India, the Geographic and Projected Coordinate System, Projection Mechanics and Distortions.	CLO1/ CLO2/ CLO3
Unit-2/ 30 hours	Exercise 3: Map generalization and visualization: Cartographic Problematic, typography & Generalization Operators, Label Appearance and Label Placement, Map Elements and Visual Hierarchy, The Visual Variables & Thematic Map Types, Map Composition & Production and nomenclature of topographical maps.	CLO4/ CLO5

	3D and applied cartography: Terrain analysis and modelling, City and infrastructure model (BIM, City GML), 3D modeling in disaster mitigation and water resource management	

Transaction mode: Lecture, Demonstration, Problem solving, Tutorial, Seminar, Local field visit discussion. Tools used: PPT, video, animation movie, whatsapp and Expert's Video Conferencing lectures from various national & international organizations

International to National to Local reachability: The course will have wider reachability from local to international level to understand the complex geographical phenomena occurred over space and time and to reconstructing the three-dimensional model for the real world.

Suggested Readings:

- Cromley G.R. 2000, Digital Cartography, Prentice Hall- Gale, Englewood, New Jersey.
- Misra, R.P. and Ramesh, A. (1989). Fundamental of Cartography, Concept Publishing Company, New Delhi.
- Robinson, A.H. et al. (2012). Elements of Cartography, John Willy & Sons, New York
- Terry A. Slocum, Robert B. McMaster, Fritz C. Kessler, and Hugh H. Howard (2009). Thematic Cartography and Geographic Visualization, Pearson, New Jersey, US
- Robert G Cromley (1992). Principles of Digital Cartography, Prentice hall,
- Paul R. Wolf and Bon DeWitt (2014) Elements of Photogrammetry with Applications in GIS, McGraw-Hill Education, New York, United States

Toni Schenk (1999). Digital Photogrammetry, TerraScience, New York, United States.

Course Title: Tourism Geography	**L**	**T**	**P**	**Cr**
Course Code: MGEO.412	3	-	-	3
Total Hour: 60 Hours				

Course Learning Outcomes (CLO): On completion of the course, the students will be:

CLO1: Proficient to comprehend basic concepts, scope, and understand the basic knowledge of Tourism Geography.

CLO2: Able to Understand the factors affecting the Tourism Development.

CLO3: Familiarize with the classification of Tourism and tourism Destinations in India.

CLO4: Comprehend the Infrastructure and support service as well as Impact of Tourism on Physical, Economic and Social.

Unit/Hours	**Content**	**Mapping with CLO**
Unit I / 11 hours	**Introduction to Tourism Geography:** Definition, Nature and Scope of Tourism Geography; Importance of Tourism Geography; Evolution of studies in Tourism Geography; Recent Trends in Tourism Geography: Ecotourism, Agro Tourism; **Concepts** of Geodiversity, Geosites, Geoheritage, Geoconservation, Geotourism and Geoparks.	CLO1
Unit II / 11 hours	**Factors Affecting on Tourism Development:** Physical Factors: Relief, Climate, Vegetation Wild Life, water Bodies Socio Cultural Factors: Religion, Historical, Cultural and Sports	CLO2

	Economical Factors: Transportation, Industry, Hotel and Accommodation; **Tourism Destinations** in Himachal Pradesh, Uttrakhand, Goa, and Rajasthan.	
Unit III / 12 hours	**Classification of Tourism:** Classification Of Tourism Based On: Nationality, Time, Distance, Number of Tourist, Mode of Transportation, Purpose of Travels: **Nationality**: International, Domestic; **Time**: Long Term, Short Term, Holiday Tourism, Day Trippers; **Distance**: Global, Continental, Regional, and Local; **Number of Tourist**: Groups, Individual; **Mode of Transportation**: Road, Railway, Air Way and Water Way; **Purpose of Travels**: Recreation, Religion, Health, Sport	CLO3
Unit IV / 11 hours	**Infrastructure and support service:** Transportation Mode - Road, Railway, Air Way and Water Way; National Tourism Policies and Agencies; Accommodation type – Hotels, Motels, Dharmashala, Government Accommodation, Private Accommodation. Tourism Carrying Capacity and Environmental Impacts. **Impact of Tourism**: Physical, Economic and Social	CLO4
Mode of Transaction: Lecture, demonstration, Power point, discussion, assignments		

Suggested readings:

1. Stephen Page: Geography of Tourism and Recreation: Environment, Place and Space, Routledge.
2. A.K. Bhatia: Tourism Development: Principles and Practices. Sterling Publishers Pvt. Ltd.
3. Ecotourism: Impacts Potentials, and Possibilities-Stephen Wearing and John Neil.
4. Sustainable Tourism – Wahab Salah and John Pigram.
5. Eco-tourism – Fennel.
6. Sustainable tourism –A marketing perspective- Victor C. Middleton & H. Rebecca.
7. Trends in tourism promotion: emerging issues - S. C Bagri.
8. Tourism in the Himalaya in the context of Darjeeling and Sikkim – B. Bhattacharya.

Further Readings:

1. Negi Jagmohan: Travel Agency Operations: Concepts and Principles. Kanishka Publishers.
2. Douglas Pearce: Tourism Development. Longman Pub Group subsequent edition.
3. Garg Deepa: Geography of Tourism. Mohit Publications.
   Arpita Mathur: Tourism Marketing and Travel Agency Business, Neha Publishers and Distributions.

Course Title: Social and Cultural Geography	**L**	**P**	**Cr**
Course Code: MGEO.413	3	-	3
Hour: 45 hours			

Course Learning Outcomes (CLO): On completion of this course students will be;

CLO1: understand the concept of Social, Cultural & political Geography

CLO2: understand the concept of social wellbeing and quality of life

CLO3: understand the cultural landscape and have better understanding of various social

and cultural aspects of geography.
CLO4: understand and explain the political dimensions of geography.
CLO5: discuss and comprehend the socio-cultural concepts in multi-ethnic diversity research.

Unit/Hours	**Content**	**Mapping with CLO**
Unit I / 12 Hours	**Social Geography** Social Geography: nature and Scope**;** Distribution of socio-cultural elements in Indian context: Social groups**;** Social diversity; religion and plurality in India and its geographical interpretation. **Learning activities:** Group discussions, Presentations and Assignments	CLO1 CLO2
Unit II / 11 Hours	Evolution of socio-cultural regions, Social and ethnic diversity; tribe and national integration; linguistic diversity, nature of social transformation and change in India **Learning activities:** Group discussions, Presentations and Assignments	CLO1 CLO3
Unit III / 11 Hours	**Cultural Geography** Cultural regions: nature and scope; Concept of Space in relation to Socio-Cultural Ecology; Cultural landscape, assimilation, and adaptation. **Learning activities:** Group discussions, Presentations and Assignments	CLO1 CLO4
Unit IV / 11 Hours	Cultural concept: perception, behaviouralism and cultural relativism, Cultural diffusion in India and Cultural ecology Convergence and divergence processes, **Learning activities:** Group discussions, Presentations and Assignments	CLO1 CLO4

Mode of Transaction: Lecture, class discussion, presentation methods would be used for teaching. Tools such as WhatsApp, ppt., and video will be use.

Suggested readings:

1. McCarthy, Joy (2010). Social and Cultural Geography, Apple Academic Press, inc.
2. Vincent J. Del Casino Jr., Mary E. Thomas, Paul Cloke, Ruth Panelli (2011). A Companion to Social Geography, Blackwell Publishing Ltd.
3. Nuala C. Johnson Richard H. Schein Jamie Winders (2013). The Wiley- Blackwell Companion to Cultural Geography, John Wiley & Sons, Ltd.
4. Hussain, Majid (2014). Cultural geography, Anmol publications Pvt. Ltd.
5. Mitchell, Donald (2000). Cultural Geography: A Critical Introduction, Wiley–Blackwell.
6. Ahmad, Aijazuddin (2002), Social Geography, Rawat Books

Course Title: Climate Change and Environmental Sustainability	**L**	**T**	**P**	**Cr**

Course Code: MGEO.417	3	-	-	3
Total Hour: 45 Hours				

Learning outcome: The course would help the students to get insight about research in Climate Change and Environmental Sustainability.

1. To understand the climate system dynamics and feedback mechanisms shaping climate change.
2. To assess the impacts of climate change across global, regional, and local scales.
3. To evaluate the economic costs of climate impacts and the role of financial systems in managing risks.
4. To critically analyze sustainable development pathways and governance for environmental sustainability.
5. To apply geospatial analytics and sustainability metrics to assess climate impacts and support decision-making.

Unit I: The Science of Climate Change (10 Lectures)

- Climate System Dynamics: Atmospheric chemistry and physics, Ocean-atmosphere interactions (ENSO, AMOC, etc.)
- Paleoclimate and the Anthropocene: Geological evidence of past climate shifts; Human influence in the Anthropocene epoch
- Climate Forcing and Feedback Loops: Radiative forcing, albedo changes, carbon cycle feedback
- Climate Models and Scenarios: GCMs, RCPs, and SSPs, Attribution science and forecasting uncertainties, IPCC reports and global climate targets

Unit II: Section 2: Global to Local Climate Impacts(10Lectures)

- Biosphere and Ecosystem Stress: Range shifts, extinction risks, ocean acidification, Tipping points and planetary boundaries
- Hydroclimatic Extremes and Disasters: Floods, droughts, cyclones, wildfires; Risk modeling and early warning systems
- Human Health and Migration: Disease vectors, food insecurity, mental health; Climate-induced displacement and refugee dynamics
- Economics of Climate Impact: Loss and damage; Climate risk to financial systems and insurance models

Unit III: Pathways to Environmental Sustainability(10 Lectures)

- Environmental Sustainability: Concept of Environmental Sustainability; Three pillars: Environmental, Social, Economic; Sustainable Development Goals (SDGs) and Planetary Boundaries; Life Cycle Assessment for Sustainability; Environmental ethics and environmental justice
- Sustainability Paradigms: Ecological modernization, degrowth, doughnut economics; Resilience theory and socio-ecological systems
- Energy Transitions and Decarbonization: Renewable energy systems, energy justice; Net-zero transitions and just energy transitions
- Sustainable Resource Governance & Infrastructure: Water-energy-food nexus; Forests, oceans, and land use governance (REDD+, SDGs, etc.); Smart cities, green architecture, nature-based solutions

Unit IV: Governance, Approaches and Adaptation Strategies for Climate Action & Sustainability (15 Lectures)

- International Climate Governance & National to Local Adaptation Plans (NAPs): UNFCCC, Kyoto Protocol, Paris Agreement, COP processes; Climate finance mechanisms: GCF, CDM, carbon market; Mainstreaming adaptation and mitigation; Climate-resilient infrastructure and community/ecosystem-based adaptation;

Sustainability Advocacy and Communication

- Geospatial Analytics for Climate and Sustainability Applications: Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA); Life Cycle Assessment (LCA) and Carbon footprint and climate mitigation strategies; Indicators and dashboards (e.g., Ecological Footprint, HDI, GPI, ESG)
- Technological Innovation and Climate Engineering: Carbon removal technologies (BECCS, DAC); Geoengineering ethics and feasibility; Climate Investment and Risks (CIR)
- Monitoring, Reporting, and Verification (MRV): Research Methods for climate and Sustainability; Transparency frameworks; Climate data platforms and AI for sustainability, Sustainability Metrics and Reporting Framework

Transaction mode: Lecture, Demonstration, Problem solving, Tutorial, Seminar, Group discussion. Tools used: PPT, video, animation movie, other digital platforms/Online Modules

Suggested readings:

11. Maslin, M. (2021). Climate change: A very short introduction (4th ed.). Oxford University Press.https://doi.org/10.1093/actrade/9780198867864.001.0001
12. Robertson, M. (2021). Sustainability principles and practice (3rd ed.). Routledge.https://doi.org/10.4324/9781003003581
13. Dessler, A. E. (2021). *Introduction to climate change: Science and solutions*. Pearson Education. ISBN: 9780137474934
14. Heinrichs, H., Martens, P., Michelsen, G., & Wiek, A. (Eds.). (2021). *Sustainability science: Field methods and exercises*. Springer. https://doi.org/10.1007/978-94-017-7242-6
15. DellaSala, D. A. (Ed.). (2018). *Encyclopedia of the Anthropocene* (Vols. 1–5). Elsevier.https://doi.org/10.1016/B978-0-12-409548-9.09989-6
16. Thunberg, G. (Ed.). (2023). The climate book. Penguin Press.
17. Blewitt, J. (2018). *Understanding sustainable development* (3rd ed.). Routledge.https://doi.org/10.4324/9781315271220
18. Leal Filho, W. (Ed.). (2020). *Partnerships for the goals: Encyclopedia of the UN Sustainable Development Goals*. Springer. https://doi.org/10.1007/978-3-319-71067-9
19. Rogers, P. P., Jalal, K. F., & Boyd, J. A. (2012). *An introduction to sustainable development* (2nd ed.). Earthscan/Routledge.
20. Newell, P., Pattberg, P., & Schroeder, H. (Eds.). (2012). *The governance of climate change: Science, politics and power*. Cambridge University Press.

Semester-II

Course Title: Climatology	**L**	**T**	**P**	**Cr**
Course Code: MGEO.516	3	-	-	3
Total Hour: 45 Hours				

Course Learning Outcomes (CLO): At the completion of the course, the student will be able to:

CLO1: comprehend the atmosphere dynamics and climatic processes

CLO2: enlist the processes that drive the general global as well as regional circulation.

CLO3: understand the mechanism of ISM

CLO4: gain knowledge on classification of climatic region
CLO5: analyse method of interpretation of weather symbols, and the contemporary climatic issues.

Unit/Hours	**Content**	**Mapping with CLO**
Unit I / 10 Hours	**Introduction to climatology** Fundamentals of climatology; Earth's Atmosphere: Evolution, Structure and Composition; Solar radiation and Terrestrial radiation; Variation, distribution and effect on atmosphere; Greenhouse effect and global heat budget; Temperature: Concept, measurement, scales, daily and annual cycles of temperature; vertical distribution; world distribution. **Learning activities::** Assignment writing	CLO1
Unit II / 11 Hours	**Atmospheric dynamics** Stability and instability in atmosphere; Cloud: Type and formation; Atmospheric moisture and precipitation: Concept and measurement of atmospheric moisture; Condensation - forms of condensation; adiabatic temperature changes; Formation and types of precipitation; global distribution of precipitation. **Learning activities:** Quiz; Students' presentation/Group discussion	CLO1 CLO2
Unit III / 12 Hours	**Wind circulation and Monsoon** Wind circulation Models of general circulation of the atmosphere: Jet stream, Air masses and fronts, characteristics, movements, frontogenesis; Tropical cyclones; mechanism and characteristics; Genesis of Indian Monsoon and the causes of its variability; Oscillations: ENSO **Learning activities:** Paper reading, case study; Movie	CLO2 CLO3
Unit 4/ 12 Hours	**Climatic Classification** Classification of climates: Empirical and generic; Climatic classification with special reference to Koppen or Thornthwaite (any one); Indian Meteorological Department and All India Weather Forecast. **Learning activities:** Case study, IMD report reading/ familiarisation with weather apps, Test	CLO4 CLO5

Transaction mode: Lecture, Demonstration, Problem solving, Tutorial, Seminar, Local field visit discussion. Tools used: PPT, video, animation movie, whatsapp and Expert's Video Conferencing lectures from various national & international organizations

Suggested readings:

1. Grotzinger, J. P., Jordan, T.H. (2019). *Understanding Earth*, New York: Freeman & Company.
2. Kusky, T. (2017). *The encyclopedia of earth science*, Viva book private limited.
3. Singh, S. (2017). *Physical Geography*, Allahabad: PrayagPustakBhavan.

4. Strahler, A.N. (2013). *An Introduction to Physical Geography*, UK: John Wiley & Sons.
5. Roy, R. (2013). *Introduction to general climatology,* New Delhi: Anmol publication private limited.
6. D. S. Lal. (2011). *Climatology*, ShardaPustak
7. Veena (2009). *Understanding earth science*, Delhi: Discovery.
8. Critchfield, H. J. (2008). *General Climatology*, Pearson Education India.
9. Frank Press and Raymond Siever (2003). *Understanding Earth*. W.H.Freeman& Co Ltd.
10. Lal, D.S. (1998). 'Climatology', Chaitanya Publishing House, Allahabad.
11. Malhotra,Nitashsa&Sen,Shyamoli (2018) Climatology, MK Books, New Delhi
12. Singh, Savindra (2017) Climatology,Pravalika publication, Allahabad
13. Hussain,Majid (2014) climatology, Anmol publications, New Delhi

Website/web references:

1. IMD: http://www.imd.gov.in/pages/main.php
2. NASA Earth Observatory: https://earthobservatory.nasa.gov/?eocn=topnav&eoci=logo
3. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=17
4. https://www.youtube.com/watch?v=ooZfziqY1Hk
5. https://www.tropmet.res.in/
6. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=14

Course title: Political Geography	L	P	C
Course code: MGEO.518	3	-	3
Total hour: 45 hours			

Course Learning outcome (CLO): At the completion of the course, the student will be able to:
CLO1: Understand the concepts and theories of Political Geography
CLO2: Analyze and Evaluate the concepts related to spatial structure of state and nation
CLO3: Analyze Geopolitics of India and World
CLO4: Analysis and application of Bilateral and Multilateral Relation, debate about shift in Global order relating it with current development

Unit/Hours	**Content**	**Mapping with**
Unit I /11 Hours	Political Geography: nature, scope and development; Boundaries and frontiers, Territorial Sea and Maritime Boundaries, Concepts of Territoriality, Theories: Heartland, Rimland, World System theories**;** Global Strategic Model **Learning activities:** Group discussions	CLO1
Unit II /11 Hours	Concept of state and Nation; location, size, shape and core areas; Elements of Spatial Structure of the State, concept of organic state-Ratzel Spencer and Schaffer; Geography of federalism, Colonialism and resultant disparities	CLO2

	Learning activities: Assignments	
Unit III /11 Hours	India and her neighbors from geopolitical perspective Geopolitical significance of the Indian ocean as a zone of peace, , problems, and prospects, Electoral Geography **Learning activities:** Assignments	CLO3
Unit IV /11 Hours	Concept of Geopolitics: climate change; world resource, development and power, Indian ocean; World Organization, Regional organization of cooperation (SAARC, ASEAN, OPEC, EU, BIMSTEC, G-20, Neo- politics of world ORDER and current development. **Learning activities:** Group discussions	CLO4

Mode of Transaction: methods of transaction are lecture, audio-video, discussion which will be followed in teaching using ppt, social media etc.

Suggested readings:

2. Adhikari, S. : Political Geography, Rawat Publ., Jaipur, 1997.
3. Agnew, J. (ed) : Political Geography: A Reader, Arnold, London, 1997.
4. Bergman, E.P. : Modern Political Geography, W.M.C. Brown Co., Publ, Dubuque, 1975.
5. Dikshit, R.D. : Political Geography: A Contemporary Perspective, Tata McGraw, Delhi, 1996.
6. Dikshit, R.D. : Political Geography-A Century of Progress, Sage Publ., Delhi, 1999.
7. Gopalakrishnan, R. : Geography of India, Jawahar, Delhi, 2001.
8. Painter, J. : Politics, Geography and Political Geography: a Critical Perspective, Arnold, London, 1995.
9. Singh, C.P. : Contributions to Indian Geography-13, Reading in Political Geography, Heritage Publ., New Delhi, 1994.
10. Slowe, P. : Geography and Political Power, Routledge, London, 1990. 11.Taylor, P. : Political Geography, Longman, London, 1995 (revised edition)

Course title: Fundamentals of Remote Sensing (Theory)	**L**	**P**	**Cr**
Course code: MGEO.519	3	0	3
Total hour: 45 Hours			

Course Learning outcome (CLO):

On completion of this course, students will be able to:

CLO1: comprehend basic concepts and the skills necessary to acquire remote sensing data and extract geo-information for real-time problem solving,

CLO2: explore different remote sensing techniques, platforms, sensors, and data for real-time problem solving,

CLO3: explore basic of aerial photography, types, sensor, and application for real-time problem solving,

CLO4: explore different satellite image analysis and aerial photo interpretation techniques

for real-time problem solving.		
Unit/Hours	**Content**	**Mapping with CLO**
Unit I / 11 Hours	Fundamental concepts of Remote Sensing Introduction to remote sensing: history, process, and types; Introduction to electromagnetic radiation: EMR theory, spectral bands, blackbody radiation; Introduction to EMR interaction with earth surface: EMR process, spectral signature, spectral reflectance curve, EMR with soil, water, vegetation, land, and atmosphere, atmospheric windows Learning activities: group discussion	CLO1
Unit II / 12 Hours	Remote sensing platforms, sensors, and satellite series Remote Sensing platforms: ground-borne, air-borne and space borne, orbital characteristics; Type of remote sensing satellites: geostationary and sun-synchronous, active, passive; Remote sensing satellite sensors: whiskbroom and push broom, scanner, and camera; Remote sensing satellite data products: IRS, LANDSAT, Sentinel, SPOT, IKONOS, Quick bird, world view, SDGSat, microwave, and hyperspectral data. Learning activities: assignment and group discussion	CLO2
Unit III / 11 Hours	Introduction to Aerial Photography and Photogrammetry Characteristics, history, and types of aerial photography, flight planning and execution, Aerial camera and film, geometry of aerial photographs, basic photogrammetry: determination of scale, parallax, orthophoto, relief displacement, 2.5D and 3D features extraction (DEM, DTM, DSM, nDSM), SfM, Introduction to UAV and its application in aerial survey. UAV data acquisition ethics and policy in India, and its different geo-information purposes Learning activities: assignment and group discussion	CLO3
Unit IV / 11 Hours	Image Processing and Interpretation Introduction satellite image and aerial photograph; Introduction to visual image interpretation; Introduction to digital image processing; Introduction to ground truthing and uncertainty analysis; Introduction to change detection analysis; Case studies Learning activities: case study and group discussion	CLO4
Mode of Transaction: methods of transaction are lecture, audio-video, discussion which will be followed in teaching using ppt, social media etc.		
Suggested readings: 1. Rees, W.G., (2001). Physical Principles Of Remote Sensing, Cambridge University Press. 2. Sabins F., Remote Sensing (1997). Principles And Interpretation, New York. 3. Lillesand T.M., And Kiefer R.M., (1999).Remote Sensing And Image Interpretation, Fourth Edition, Wiley. 4. Jensen J.R., (2000).Remote Sensing Of Environment: An Earth Resource Perspective, Prentice Hall.		

5. Joseph, George and C Jeganathan (2018), Fundamentals of Remote Sensing, Third edition. University Press, India.
6. B. Bhatta (2021). Remote sensing and GIS, 3rd edition, Oxford University Press.
7. Rees, W.G., (2001). Physical Principles of Remote Sensing, Cambridge University Press
8. J.R. Jensen. INTRODUCTORY DIGITAL IMAGE PROCESSING A Remote Sensing Perspective.
9. Sabins, F.F. (2007). Remote Sensing: Principles and Interpretation,3rd Edition.

Course Title: Geography of India	**L**	**P**	**Cr**
Course Code: MGEO.521	3	-	3
Total Hour: 45 Hours			

Course Learning Outcome (CLO): At the completion of the course, the student will be able to:

CLO1: Understand basics of India and concept of the geological history of India.

CLO2: Comprehend the Origin of physiographic features and Physiographic divisions of India.

CLO3: Identify the climatic condition, Drainage, vegetation and Mineral resources in India.

CLO4: Apply the basic knowledge of population, agriculture and Industries in sustainable development and environment sustainability**.**

Unit/Hours	**Content**	**Mapping with CLO**
Unit I / 11 Hours	Basics of India; Location, latitude, longitude, time zone, etc., Neighbours, Important straits and Bay, States and their position, States with international boundaries. Geological history of India, Physiography: Physiographic divisions, Climate, geological formation, soil. **Learning activities:** Map & Model readings	CLO1 CLO2
Unit II/ 11 Hours	Climate of India: Types, Distribution and Mechanism of monsoon, environmental issue; Indian forest: Types and Distributions; Mineral resources: Types and Distribution Belt; Drainage systems; watershed and basin. **Learning activities:** Data reading and Map reading	CLO3
Unit III / 12 Hours	Indian Population: Growth, Distribution and Policies of Indian Population; Demographic attributes; Types, Causes and consequences of migration in India; Concepts of the over population, under population and optimum population **Learning activities:** Map reading and case study	CLO4
Unit IV /11 Hours	Agriculture: Salient features of agriculture, agricultural regions, major crops; Agricultural revolution with reference to India; Industry: Industrial belt of India: and New industrial policies; Case study. **Learning activities:** Group discussion and map reading.	CLO4

Mode of Transaction: Lecture, Assignment, Seminar, Group discussion. Tools used: PPT, video, animation movie, WhatsApp, google classroom.

Suggested readings:

1. Shah S.K. (2018). Historical Geology of India, Scientific Publishers.
2. Khullar D. R. (2018). India a Comprehensive Geography, Kalyani Publication.
3. Sanyal, Sanjeev, Rajendran, Sowmya (2015). The Incredible History of India's Geography, Penguin Books Limited.
4. Verma, Sangeeta, Bodh, P.C. (2018). Glimpses of Indian Agriculture, OUP India
5. Siddhartha K. & Mukherjee S. Ahsan, Qamar (2017). Indian Industry, Kitab Mahal Publishers.
6. Dyson Tim (2018). A Population History of India: From the First Modern People to the Present Day, Oxford University Press.
7. Srinivasan, Krishnamurthy (2017). Population Concerns in India: Shifting Trends, Policies and Programs, Sage Publications India Private Limited.
8. Kumar A.K Shiva Et Al (2013). Handbook of Population and Development in India, Oxford University Press.
9. ICAR Report (2017). Handbook of Agriculture: Facts and Figures for Farmers Students and All Interested in Farming.
10. Rao Mohan (2019). The Lineaments of Population Policy in India Women and Family Planning, Routledge India
11. Hussain, Majid (2022), Geography Of India, Mcgraw Hill Education, Chennai
12. D.R Khullar, (2020), India: A comprehensive Geography, Kalyani Publication, fourth Edition.

1. www.gsi.gov.in
2. www.geosoindia.org
3. www.censusindia.gov.in
4. www.slusi.dacnet.nic.in
5. www.mospi.nic.in

Course Title: Fundamentals of Remote Sensing (Practical)	**L**	**T**	**P**	**Cr**
Course Code: MGEO.520	-	-	4	2
Total Hour: 60 Hours				

Course Learning Outcome(CLO):

On completion of this course, students will be able to:

CLO1: Understand basic concepts and the skills necessary to acquire remote sensing data mining and pre-processing to extract geo-information for real-time problem solving,

CLO2: Explore basic concepts and the skills necessary to process and analyse remote sensing data for real-time problem solving,

CLO3: comprehend post-processing and uncertainty analysis of remote sensing and aerial photograph for real-time problem solving,

CLO4: proficient on application of remote sensing techniques in change detection analysis and case study.

Unit/Hours	**Content**	**Mapping with CLO**
Unit-1/ 30 hours	Remote sensing data mining: downloading and familiarization of satellite imagery, aerial photograph, reading metadata and basic	CLO1 CLO2

	characteristics of images and aerial photograph; Pre-processing: geometric and radiometric correction, FCC generation, mosaicking, sub-setting, and atmospheric correction;	
Unit-2/ 30 hours	Basic aerial photo interpretation: scale determination, mosaicking and interpretation; Image classification and interpretation: visual interpretation, digital image processing (supervised, unsupervised and hybrid classification);Post processing and accuracy assessment: mixed pixel correction, confusion matrix, user accuracy, producer accuracy, overall accuracy, kappa indices; Change detection analysis: Image-based and map-based approach; Case studies : land use mapping land use change analysis, urban growth monitoring, forestry etc.	CLO3 CLO4
Mode of Transaction: Lab exercise through open source softwares.		

Course Title: Quantitative Methods in Geography (Practical)	L	T	P	Cr
Course Code: MGEO.522	-	-	4	2
Hours: 60 hours				

Course Learning Outcomes (CLO): On completion of the course, the learner will be able to:
CLO1: understand quantitative methods, tools, and techniques for analysing data.
CLO2: apply quantitative techniques in geographic research.
CLO3: The students will learn to create indices and apply geographic models.

Unit/Hours	**Content**	**Mapping with CLO**
1 Unit/ 30 hours	Exercise Introduction of quantitative methods in Geography: data collection methods, data organization, frequency, graphs and data analysis. Distributional pattern of population, Health and Education, Inter-district inequalities using composite HII (health infrastructure index) and Composite Development Index.	CLO1 CLO2
2 Unit/ 30 hours	Exercise Nearest neighbour analysis, Matrices and Determinants, Connectivity index-Beta Index; Measures of Accessibility: Proximity analysis; Measures of combination and disparity: S.S. Bhatia's Method, S.M. Rafiullah's method, J.C. Weaver, Sophers Disparity Index, Principle component analysis, Gravity Model; Cause and effect relationship: Linear Regression.	CLO3

Mode of Transaction: Classroom and lab exercises.

Suggested readings:

1. Sarkar, Ashis (2013), Quantitative geography: Techniques and presentations, New Delhi,Orient blackswan.
2. Kothari, C.R. (2013), Quantitative techniques, 3rd edition Publication New Delhi, Vikaspublishing house pvt. ltd.

Further Readings:

1. Berry, B.J.L. and Marble, D.R. (ed), 1968, Spatial Analysis: A Reader in Statistical Geography,Prentice Hall, New York.
2. Cole, J.P. and Kind, C.A.M. 1968. Quantitative Geography, John, Wiley, New York.
3. Mahmood, A, 1986. Statistical Methods in Geographic Studies. Rajesh Publishers, NewDelhi.

Course Title: Introduction to Earth's Material - Practical	**L**	**P**	**Cr**
Course Code: MGEO.523	-	4	2

Total Hour: 60 Hours

Course Learning outcome(CLO): The student will benefit in understanding:
CLO1: The characteristics of rocks and minerals.
CLO2: Identification of minerals and rocks.
CLO3: Uses of tools that would help in carrying out further research.

Unit/ Hours	**Content**	**Mapping with CLO**
1 Unit/ 30 hours	Definitions of rock and minerals, Classification of rocks;Identification of minerals;Identification of Igneous, sedimentary and metamorphic rocks	CLO1 CLO2 CLO3
2 Unit/ 30 hours	Nature and use of various natural construction material – grain size analysis using sieve test; strength of the natural materials;Water quality test;Identification of hazardous earth material for human health	

Suggested readings:

1. Minerals and Rocks-Exercises in Crystallography, Mineralogy and Hand Specimen Petrology by Cornelius Klein, 2007, Wiley publisher.
2. Earth Materials: Introduction to mineralogy and petrology by Cornelius Klein and Anthony Phillpotts, 2013, Cambridge University press, Cambridge.

Course Title: IDC- Introduction to Climate Change	**L**	**T**	**P**	**Cr**
Course Code: MGEO.506	2	-	-	2

Total Hour: 30 Hours

Course Learning outcome (CLO): After completing the course, student will be able to:
CLO1: Explain what climate change is.
CLO2: Identify the main drivers of climate change.

CLO3: Describe how they plan to adapt to the negative (or positive) impacts of climate change.
CLO4: Identify ways to plan climate actions.
CLO5: Explain how climate negotiations work.
CLO6: Formulate a climate project or policy.

Unit/Hours	**Content**	**Mapping with CLO**
Unit I / 06 Hours	**Introduction to Climate Change Science** Introduction to Climate Change Science; Fundamental feedbacks in the Climate System; Natural & Anthropogenic Drivers of Climate Change; **Learning activities:** Group discussions, Presentations, Assignments	CLO1/ CLO2
Unit II / 08 Hours	**Climate Change Impacts at Global Scale** Observed (in past & present) evidence & projected trends of Climate Change; Carbon cycle feedbacks &Changes in atmospheric greenhouse gases; Extreme weather & Modern surface temperature trends;Introduction to live case studies from global agency datasets (e.g. NASA/ EGU/UN/WHO/IPCC/ISRO/JAXA); **Learning activities:** Group discussions, Presentations, Assignments	CLO2/ CLO3
Unit III / 08 Hours	**Climate Change Impacts at National to Local Level** Ecosystems and biodiversity; Glacier melting, impacts on regional water balance and food resources; Sea level rise and coastal impacts; Human health impacts; Introduction to live case studies from national to local level agency datasets (ISRO/PRL/IITM/IMD/NCOSS etc.); **Learning activities:** Group discussions, Presentations, Assignments	CLO2/ CLO3/CLO 4
Unit IV / 08 Hours	**What Is Our Path Forward?** Millennium and Sustainable Development Goals; Geoengineering: A scientist's perspective; Emissions reductions and scenarios, stabilizing CO2 concentrations; Solution at local to global scale, its approaches & policies: A path of hope; **Learning activities:** Group discussions, Presentations, Assignments	CLO4/ CLO5/ CLO6
Transaction mode: Lecture, Demonstration, Problem solving, Tutorial, Seminar, Local field visit discussion. Tools used: PPT, video, animation movie, whatsapp and Expert's Video Conferencing lectures from various national & international organizations		
International to National to Local reachability: The course will have wider reachability from local to international level to understand the today's most dreadful problem of the world and our contribution to curb this at our maxima potential.		

Suggested Readings:

- IPCC, (2013): Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp, doi:10.1017/CBO9781107415324.
- Kininmonth, William. (2004). Climate Change: A Natural Hazard. Brentwood: Multi-Science Pub. Co.
- Letcher, T. M. (Trevor M.). Climate Change: Observed Impacts on Planet Earth.
- Lovejoy, Thomas E., and Lee Hannah (2019). Biodiversity and Climate Change: Transforming the Biosphere. Biodiversity and Climate Change: Transforming the Biosphere. Yale University Press.
- Maslin, Mark (2014). Climate Change: A Very Short Introduction. Climate Change: A Very Short Introduction. Oxford University Press. doi:10.1093/actrade/9780198719045.001.0001.
- Richard Aspinall, Introduction to climate Change.
- D R Khullar, JACS Rao, (2021), Environment & Disaster Management: Ecology, Climate Change & Bio-diversity,3rd Edition Edition, McGraw Hill Education India Private Limited.

Course Title: IDC- Basics of Geoinformatics	**L**	**P**	**C**
Course Code: MGEO.507	**2**	**-**	**2**
Total Hour: 30 Hours			

Course Learning outcome(CLO): After completing the course, student will be able to:

CLO1: Demonstrate a comprehensive understanding of the principles, techniques, and applications of remote sensing, geographic information systems (GIS), cartography, global positioning systems (GPS), and image interpretation.

CLO2: Analyze and interpret remote sensing data, including satellite images, to extract valuable information about the Earth's surface and natural resources.

CLO3: Apply GIS tools and techniques to manage, analyze, and visualize spatial data, integrating both raster and vector datasets effectively.

CLO4: Evaluate different map projections, scales, and generalization techniques to create accurate and visually appealing maps for various purposes.

CLO5: Utilize GPS and other positioning systems to acquire accurate geographic coordinates and understand their applications in navigation and Geopositioning.

CLO6: Apply image interpretation techniques, including radiometric and spatial enhancement, band ratios, and classification methods, to extract meaningful information from digital satellite images.

Topic and Contents	**Mapping with CLO**

Unit I / 06 Hours	BASIC PRINCIPLESREMOTE SENSING SATELLITES Remote Sensing: Definition, Advantages and Limitations, Concept & Principles; Electromagnetic Radiation (EMR), Atmospheric windows, Interaction of EMR with atmosphere & Earth's Surface; Resolutions, Remote Sensing Systems, IRS Series of Satellites,.	**CLO1**
Unit II / 08 Hours	GEOGRAPHIC INFORMATION SYSTEM Basic concepts about Spatial and non-spatial data, Components of GIS; Spatial data models, Linkage between spatial and non-spatial data; Data Query.	**CLO2** **CLO3**
Unit III / 08 Hours	CARTOGRAPHY & GLOBAL POSITIONING SYSTEM: Introduction to cartography, Map and Scale, Important Map Projections, Generalization-Elements , Classification, Introduction to Global Positioning System, GPS Segments, GPS Positioning Types, Geopositioning, GNSS: NAVSTAR, GLONASS, GALILEO etc.	**CLO4** **CLO5**
Unit IV / 08 Hours	IMAGE INTERPRETATION: Concepts about digital image and its characteristics, Image Interpretation; Elements of Image Interpretation; enhancement techniques, Band ratio, Types of Vegetation indices; Classification- supervised & unsupervised	**CLO6**
Transaction mode: Lecture, Demonstration, Problem solving, Tutorial, Seminar, Local field visit discussion. Tools used: PPT, video, animation movie, whatsapp and Expert's Video Conferencing lectures from various national & international organizations		
International to National to Local reachability: The course will have wider reachability from local to international level to understand the today's most dreadful problem of the world and our contribution to curb this at our maxima potential.		

Suggested readings:

1. Jensen, J.R., (2006) "Remote Sensing of the Environment – An Earth Resources Perspective", Pearson Education, Inc. (Singapore) Pte. Ltd., Indian edition, Delhi.
2. George Joseph, (2004) "Fundamentals of remote sensing", Universities press (India) P Ltd.,.
3. Lo and Albert K.W. Yeung (2006) "Concepts and Techniques of Geographic Information Systems" Prentice Hall of India, New Delhi.
4. Burrough, Peter A. and Rachael McDonnell,(1998), ' Principles of Geographical Information Systems' Oxford University Press, New York.
5. Ramesh, P. A., (2000): Fundamentals of Cartography, Concept Publishing Co., New Delhi.
6. Leica. A., (2003), GPS Satellite Surveying, John Wiley & Sons, use. New York Terry-Karen Steede (2002).
7. J.R. Jensen, INTRODUCTORY DIGITAL IMAGE PROCESSING A Remote Sensing Perspective, Pearson.
8. Kresse, Danko (Eds.) Springer Handbook of Geographic Information, Springer.

Course Title: Agriculture Geography	**L**	**T**	**P**	**Cr**
Course Code: MGEO.526	3	-	-	3
Total Hour: 60 Hours				

Course Learning outcome (CLO): Upon the completion, the student will be able to

CLO1: apply the basic knowledge in agriculture and environment sustainability.

CLO2: understand theories related to location of agricultural activities.

CLO3: Proficient to comprehend the concept, scope, and challenges of Agricultural planning.

CLO4: Explore the scope and opportunities in Agricultural development and Food security.

Unit/ Hours	**Content**	**Mapping with CLO**
Unit I /11 Hours	The nature, subject matter and progress in Agricultural Geography. Approaches: commodity, systematic, regional. Determinants: physical, economic, socio-cultural. Determinants of agricultural development: physical, technological, institutional; World agricultural systems. A critical evaluation of the classification of world agriculture with special reference to Whittlesey.	CLO1
Unit II /11 Hours	Cropping patterns and their measurements: crop concentration, crop diversification, crop combinations, measurement of agricultural efficiency, agricultural productivity; Agricultural location models: Von Thunen and Lösch.	CLO2
Unit III /11 Hours	Land-use survey and classification (British and Indian). (vi) Land capability classification (U.S. and Britain). Agriculture during plan periods; Diffusion of agricultural innovations; Green revolution and its effects on economy, society and environment; Agro-climatic regions and their planning; Measurement and levels of agricultural development; Problems and prospects of Indian agriculture.	CLO 3
Unit IV /11 Hours	New perspectives in Agriculture: Contract Farming, Agri-business and Food Security. Nutrition, malnutrition and hunger; Rural poverty and unemployment; Poverty alleviation strategies; Food aid and nutrition programmes; Food security and its components; Sustainable agriculture.	CLO 4

Mode of Transaction: Lecture, demonstration, Power point, E-tutoring, discussion, assignments, case study.

Suggested readings:

1. Dyson,T. 1996. Population and Food –Global Trends and Future Prospects, Routledge, London.
2. Gobind,N. 1986. Regional Perspectives on Agricultural Development ; Concept Publications; New Delhi
3. Gregory,H.F. 1970. Geography of Agriculture; Prentice Hall Englewood Cliff; New Jersey.
4. Grigg F.D.B. 1974. The Agricultural Systems of the World, Cambridge University Press; New York.
5. Hussain, M. (1996). Systematic Agricultural Geography, Rawat Publications, Jaipur.
6. Ilbery, B. W. (1985). Agricultural Geography, Oxford University Press, Oxford, 1985.

7. Shafi, M. (2006). Agricultural Geography, Pearsons Publications, New Delhi.
8. Shafi, M. (1984). Agricultural Productivity and Regional Imbalances: A Study of Uttar Pradesh, Concept Publication Company, New Delhi.
9. Singh, J. and Dhillon, S.S.(1984). Agricultural Geography, Tata McGraw Hill, New Delhi.
10. Singh, J. (2003). Agricultural Geography, 3rd edition, Oxford, New Delhi.
11. Symons, L. (1967). Agricultural Geography, G. Bells, London.
12. Zhong, Cheng.et.al (2016), Agricultural Geography, Magnum Publishing, New York.

Course Title: Natural Hazards and Disasters	**L**	**P**	**Cr**
Course Code: MGEO.416	3	-	3
Hours: 45 hours			

Course Learning Outcome(CLO): By the end of this course students will be able to:
CLO1: understand the basic concept related to disaster
CLO2: understand the mechanism of disaster classification
CLO3: describe the influence if mitigation, preparation, response, and recovery on natural hazards
CLO4: discuss various agencies for disaster risk reduction.
CLO5: study the application geospatial technology for disaster studies.

Unit/Hours	**Content**	**Mapping with CLO**
Unit I / 11 Hours	Introduction to Disaster: Basic concept of Hazard and Catastrophe; Concept of vulnerability and risk; Geographical analysis of Disaster study. **Learning activities:** Models reading	CLO1
Unit II /12 Hours	Classification of Disasters: Natural and man-made disaster; Natural Disaster study (Causes, Assessment and Management):Flood,Cyclones, droughts, forest fires, earthquakes, volcanoes, landslides. Man-made disaster study: Accident, Oil spill, Terrorism, Food poisoning, stampedes. **Learning activities:** Map reading, Data Collection and analysis	CLO2
Unit III /11 Hours	Concept of Disaster Risk Reduction and mitigation, prevention, preparedness, response and recovery; Disaster response and management: Policies, Agencies and organisation. **Learning activities:** Model reading	CLO3
Unit IV /11 Hours	Disaster management plan: formulation and framework; Tools and techniques: Monitoring, tracking and decision support system (DSS), hazard risk vulnerability and capacity analysis (HRVC). **Learning activities:**Assignment and case study	CLO4 CLO5

Mode of Transaction: Lecture, class discussion, presentation methods will be used for teaching. Tools such as whatsapp, ppt., and video will also be used.

Suggested readings:

1. Hayes, Flynn, (2020). Global flood hazard: Mappings forcasting and risk

assessment, Syrawood publishing house.
2. Feidan, Nicola (2019). Natural hazards and disasters: A case study approach, Callisto reference.
3. Schwab, Anna K. (2017). Hazard mitigation and preparedness: An introductory text for emergency management and planning professionals, Crc press.
4. Vaidyanathan, S. (2011). An introduction to disaster management: Natural disasters and manmade hazards, Ikon books.
5. Lopez-Carresi, Alejandro (2014). Disaster management: International lessons in risk reduction, response and recovery, Routledge.
6. Reddy, Sunita (2013). Clash of Waves, Indos Books.
7. Kapur, Anu, (2010), Vulnerable India: A geographical Study of Disaster, Sage and IIAS Publication.
8. S Vaidyanathan, An Introduction to Disaster Management: Natural Disaster and Man Made Hazards.
9. D R Khullar, JACS Rao, (2021), Environment & Disaster Management: Ecology, Climate Change & Bio-diversity, 3rd Edition, McGraw Hill Education India Private Limited.
10. R.B. Singh (2006), Natural Hazards and Disaster Management, Rawat Publication.
11. Bird Robinson (2020), Handbook of Natural Hazards and Disasters, Larsen & Keller, New York.
12. www.usgs.gov
13. www.bhuvan.nrsc.gov.in
14. www.emdat.be

Course Title: Urban System and Planning	**L**	**T**	**P**	**Cr**
Course Code: MGEO.527	3	-	-	3
Total Hour: 45 Hours				

Course Learning Outcomes (CLO): At the completion of the course, the student will be able to:

CLO1: explain multiple theoretical perspectives on the city and to define, in multiple ways, the processes that constitute the city

CLO2: describe and analyse urban governance in India

CLO3: understand the basic concepts of planning

CLO4: analyse various contemporary issues of urban areas from planning perspective and explain the impact that urban policy of India has on cities.

Unit/Hours	**Content**	**Mapping with CLO**
Unit I / 11 Hours	**Urbanisation in India** Introduction to Urbanisation; Urban environment and ecology; Urban problems: environmental, transportation, housing; Urban infrastructure and services; Urban transportation. **Learning activities: Assignment**	CLO1

Unit II / 10 Hours	**Urban governance** Introduction to urban governance; Urban poverty and housing; Community building; Urban reforms and management; Urban development policies of India. **Learning activities:** Group discussion, Case study, Quiz	CLO2
Unit III/ 12 Hours	**Basic of Urban Planning and Development** Basic concepts of planning; urban land use planning; Urban and Metropolitan planning; aster Plans approach: A case study of Chandigarh and Jaipur; Concept of garden city; resilient, compact, and sustainable city; Neighbourhood unit; Centrally sponsored plans and schemes (Smart City mission, HRIDAY mission, AMRUT Mission). **Learning activities:** Group discussion, Case study, Quiz	CLO3
Unit 4/ 12 Hours	**Spatial spaces** Urban sprawl; Managing and planning urban environment (green and blue spaces); Urban public spaces; Spatial analysis in urban planning **Learning activities:** Group discussion, Case study, Quiz	CLO4

Mode of Transaction: Lecture, class discussion, presentation methods will be used for teaching. Tools such as whatsapp, ppt., and video will also be used.

Suggested readings:

1. Bridge, B. and Watson, S. (eds.) (2000): A Companion to the City. Blackwell, Oxford.
2. Carter, H. (1995): The Study of Urban Geography. 4th ed. Reprinted in 2002 by Rawat Publications, Jaipur and New Delhi.
3. Dubey, K.K. (1976): Use and Misuse of Land in KAVAL Towns. National Geographical Society of India, Varanasi.
4. Dubey, K.K. and Singh, A.K. (1983): Urban Environment in India. Deep and Deep, New Delhi.
5. Dutt, A. Allen, K, Noble, G., Venugopal G. and Subbiah S. (eds.) (2003): Challenges to Asian Urbanisation in the 21st Century. Kluwer Academic Publishers, Dordrecht and London.
6. JOHN R. SHORT, (2019), An Introduction to Urban Geography,Raj Publication

Additional readings:

7. Hall, P. (1992): Urban and Regional Planning. Routledge, London.
8. Hall, T. (2001): Urban Geography. 2nd edition. Routledge, London.
9. Haughton, G and Hunter, C. (1994): Sustainable Cities. Jessica Kingsley, London.
10. Jacquemin, A. (1999): Urban Development and New Towns in the Third World – A Lesson from the New Bombay Experience. Ashgate, Aldershot, UK.
11. Johnson, J.H. (1981): Urban Geography, Pergaman Press, Oxford.
12. Mayer, H. and Cohn, C. F. (1959): Readings in Urban Geography, University of Chicago Press, Chicago.
13. Paddison, R. (ed.) (2001): Handbook of Urban Studies. Sage, London.
14. Pacione, M. (2005): Urban Geography: A Global Perspective, Routledge, London and New York.
15. Ramachandran, R., (1991): Urbanisation and Urban Systems in India. Oxford University Press, Delhi.

Websites/web references:

1. http://mohua.gov.in/upload/uploadfiles/files/URDPFI%20Guidelines%20Vol%20I.pdf
2. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=17
3. http://mohua.gov.in/
4. http://mohua.gov.in/upload/uploadfiles/files/G%20G%202014(2).pdf
5. https://nptel.ac.in/courses/105/105/105105202/
6. https://bhuvan.nrsc.gov.in/bhuvan_links.php
7. NASA Earth Observatory: https://earthobservatory.nasa.gov/?eocn=topnav&eoci=logo

Course Title: Oceanography	**L**	**T**	**P**	**Cr**
Course Code: MEGS.522	3	-	-	3
Total Hour: 45 Hours				

Course Learning Outcome (CLO): Upon successful completion of this course, the student will be able to

CLO1: understand basic component related to oceanic floor

CLO2: describe the history and development of oceanography including marine biogeochemistry

CLO3: determine the history and development of oceanography including marine biogeochemistry

CLO4: To understand the characteristics of Indian Ocean.

Unit/Hours	**Content**	**Mapping with CLO**
Unit I /11 Hours	Origin, evolution of ocean basins and their environmental response; Topographic; features of the ocean floor; continental margin provinces, ocean basin provinces; coral reefs. Classification of marine sediments, sediment budget, transport and it's; accumulation in the ocean; sedimentation processes on continental shelves – physical processes, sediment response; deep-sea sediments. **Learning activities:** Assignment, Take home exercise, peer learning on oceanic topography.	CLO1
Unit II /12 Hours	Wave dynamics, deep water waves, shallow water waves; Ocean circulation: forcesdriving currents; surface currents, effects of surface currents on climate; thermohalinecirculation - thermohaline circulation patterns, global heat connection andatmospheric Circulation. Wind induced vertical circulation - equatorial upwelling,coastal upwelling, downwelling; Coastal upwelling - its physical, chemical, biologicalcharacteristics, Tides - equilibrium theory of tides, dynamical theory of tides, tidal currents in coastal areas, observation and prediction of tides. **Learning activities:** Exercise on mechanicsof atmospheric and oceanic	CLO2

	circulation.	
1 Unit III /1 Hours	Seawater chemistry: salinity - components, sources and processes controlling thecomposition of sea water; dissolved gases - Nitrogen, Oxygen, Carbon dioxide; Densitystructure of ocean; inputs of organic carbon, concept of food chain; primaryproduction, measuring productivity, factors limiting productivity, Role of light,temperature, nutrients, physiological adaptations; Marine resources: Petroleum andNatural Gas, sand and gravel, magnesium and magnesium compounds, salts,manganese and phosphate nodules, metallic sulfides and muds. **Learning activities:** Group discussion onmarine resources and exploration.	CLO3
Unit IV /11 Hours	Origin and evolution of the Indian Ocean, structure and physiography of the IndianOcean, bathymetry and bottom characteristics, sediment distribution on the IndianOcean floor. Introduction to Marine exploration methods, petroleum potential of seabed provinces beyond the continental slope; petroleum occurrences and explorationactivity around the margins of the Indian Ocean. India's Exclusive Economic Zone(EEZ); marine minerals in the EEZ of India. Assignment on bathymetry, structure andEEZ of Indian ocean. **Learning activities: Case study**	CLO4
Transactional Modes: Lecture, Demonstration, Lecture cum demonstration, Project Method, Inquiry training, Seminar, Group discussion, Blended learning, Flipped learning, Focused group discussion, Team teaching, Field visit, Brain storming, Mobile teaching, Collaborative learning, Case based study, Through SOLE (Self Organized Learning Environment).		
Suggested readings: 1. Garrison, T., 1996.Oceanography-An invitation to Marine Science, Wadsworth Publishing Company 43 2. Gross, M.G., 1972. Oceanography - A view of the Earth, Prentice-Hall. 3. Thurman, B.Y., 1978. Introductory Oceanography, Charles E. Merill Publishing Company. 4. Kale, V. S. and Gupta, A., 2001.Introduction to geomorphology, Orient Longman, Bangalore. 5. Singh, S., 2011.Physical geography, PrayagPustakBhavan, Allahabad. 6. Strahler, A.N. and Strahler, 1996.An introduction to physical geography, John Wiley &Sons, UK. 7. S. Davis, R.A. Jr. 1972.Principles of Oceanography, Addison - Wesley Publishing Company. 8. Roonwal, G.S., 1986. The Indian Ocean: Exploitable mineral and petroleum Resources, Narosa Publishing House. 9. Francis P. Shepard, 1977. Geological Oceanography: Evolution of coasts, continental margins & the deep-sea floor, Pan Publication. 10.Bhatt J.J., 1978. Oceanography – Exploring the planet Ocean, D. van Nostrand		

Company.
11. Singh, Savindra (2017), Oceanography, Pravalika Publications, Allahabad.
12. Devi, Renu (2018), Oceanography: The Surface of The Sea, Random Publication, New Delhi.

Web Resources:
https://www.nationalgeographic.org/
https://www.nio.org/
https://science.nasa.gov/earth-science/focus-areas/oceanography

Course Title: Environmental Geography	**L**	**P**	**Cr**
Course Code: MGEO.528	3	-	3
Total Hour: 45 Hours			

Course Learning Outcomes: At the completion of the course, the student will be able to:
CLO1:distinguish between sustainable and unsustainable practices
CLO2:understand the basics of ecology and ecosystem
CLO3: comprehend theconcept of landscape ecology, can detect, and characterize landscape patterns
CLO4:demonstrate a basic understanding of environmental issues and their impacts
CLO5:enlist the various government initiatives/policies and their progress

Unit/Hours	**Content**	**Mapping with CLO**
Unit I / 10 Hours	**Basics of Environmental Geography** Nature, scope, significances, approaches, and history of Environmental Geography; Human-environment interactions and impacts; Different approach towards sustainable environmental development and its different constituents **Learning activities:** Group discussion/paper reading	CLO1
Unit II / 10 Hours	**Basics of ecology and ecosystem** Concept and Scope of ecology and ecosystem; Basic ecological principles and Ecosystem Structure and functions: trophic level, ecological/energy pyramid, food chain and web; Types and characteristics of ecosystem- terrestrial (forest, desert, grassland) and aquatic (pond, marine), wetlands, estuaries, forest types in India. **Learning activities:** Assignment writing, Quiz/test	CLO2
Unit III / 13 Hours	**Human and landscape ecology** Introduction to Human and landscape Ecology; Key Concepts and theories; Anthropocentricism, Environment ethics, and Deep Ecology; Detecting and characterizing landscape patterns; Landscape and society; Theory of Landscape Metrics.	CLO3

	Learning activities: Quiz/test; Students' presentation/Group discussion; Things to Think About' exercise	
Unit IV / 12 Hours	**Environment issues and policy** **Environment issues:** Atmospheric pollution & Global warming and Climate change; Water quality and pollution; Land degradation; Ground water depletion and pollution; Urban Heat Island; Deforestation **Environment policy, Conventions, treaties, and Goals:** UN Framework Convention on Climate Change (UNFCCC), 1992, Kyoto Protocol 1997, Brundtland Commission, Rio de Janeiro (Rio Declaration, Agenda 21, Paris Agreement; COP, Sustainable Development Goals **Learning activities:** Quiz/test; Students' presentation/Group discussion; Things to Think About' exercise	CLO4 CLO5
Mode of Transaction: Lecture, class discussion, presentation methods will be used for teaching. Tools such as whatsapp, ppt., and video will also be used.		
Suggested readings: 1. Akitsu, T. (2019). *Environmental Science: Society, Nature, and Technology*. Jenny Stanford Publishing 2. Simon, S. J. (2018). *Protecting Clean Air: Preventing Pollution*. Momentum Press. 3. Brinkmann, Robert. (2016). *Introduction to Sustainability*. Wiley-Blackwell 4. John, H. (2015). *Global Warming: The Complete Briefing*. Cambridge University Press. 5. Abbi, Y., Jain Shashank. (2015). *Handbook on Energy and Environment management*. The Energy Resources Institute. 6. Saxena, H.M (2017), Environment Geography, Rawat Publications, New Delhi. 7. Singh Savindra (2018), Environmental Geography, Pravalika Publications, Allahabad. **Website/Web references** 1. http://moef.gov.in/en/ 2. http://www.envis.nic.in/ 3. https://www.fsi.nic.in/ 4. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=14 5. https://nptel.ac.in/courses/127/105/127105018/ 6. https://nptel.ac.in/courses/122/102/122102006/ https://sdgs.un.org/goals		

Course Title: Entrepreneurship	**L**	**T**	**P**	**Cr**
Course Code: MGEO.530	2	-	-	2
Total Hour: 15 hours				
Course Learning outcome(CLO): On completion of this course, students will be able to: CLO1: Gain a comprehensive understanding of entrepreneurship, including its concept, the nature of entrepreneurs, and their classification. CLO2: Differentiate between entrepreneurs and managers and recognize the relationship				

between entrepreneurship, medium/small/tiny businesses, and their significance in the economy.

CLO3: explore scope and opportunity of funding for higher education in geography in India and abroad

CLO4: explore the scope and opportunity of geography in higher education to find out better job after having higher education in geography.

Unit/Hours	**Content**	**Mapping with CLO**
Unit I /3 Hours	Concept of entrepreneurship and its process; How geography and its allied subjects help to create entrepreneurs; Nature of entrepreneurs - Creativity and innovation; Drive and determination; Risk-taking; Leadership; Communication skills; Problem-solving skills. Classification of entrepreneurs and their importance. Entrepreneurship and geography. **Learning activities:** Group discussion, case study	CLO1
Unit II /4 Hours	Innovation, Improvement, and Scalability - (Ideation Stage, Validation Stage, Early Traction, Scaling); Entrepreneurs Vs Managers: Risk-takers; Innovators; Focused on growth. Benefits of entrepreneurship: - Economic growth, Innovation, Job creation, Stimulating the economy, Distributing wealth more evenly; Challenges of entrepreneurship: - Risk; Time Commitment; Lack of Support. Forms of business organization- Sole proprietorship, Partnership, Company Business Plan: Concept, format. Components: Organizational plan; Operational plan; Production plan; Financial plan; Marketing plan; Human Resource planning **Learning activities:** Group discussion, case study	CLO2
Unit III /4 Hours	**Opportunity and scope of geography at higher education** Scope of higher education in geography after bachelor and master, Scope of higher education in geography in India and abroad, Higher education in geoinformatics, Higher education in urban and regional planning, Higher education in physical geography, Higher education in population and health geography, Higher education in interdisciplinary subjects (e.g., climate change, disaster management etc.) **Learning activities:** Group discussion, case study	CLO3
Unit IV /4 Hours	**Funding, resource, and job opportunity of geography** Funding opportunity and resource availability for higher education in India and abroad, Types of job opportunity for geography student, Job opportunity in India and abroad, Opportunity to establish own business after higher education in geography **Learning activities:** Group discussion, case study	CLO4
Mode of Transaction: Lecture, demonstration, Power point, E-tutoring, discussion, assignments, case study		

Semester-III

Course Title: Geographical Thoughts	**L**	**T**	**P**	**Cr**
Course Code: MGEO.407	3	-	-	3
Total Hours: 45 Hours				

Course Learning Outcome(CLO): At the completion of the course, the student will be able to:

CLO1: Describe the theoretical traditions and contemporary lines of thought of the discipline.

CLO2: Analyse the philosophical and methodological standpoints of leading geographers.

CLO3: Explain the continuities in geographic thought over time.

CLO4: comprehend the debates and issues that geographers have wrestled with for decades.

CLO5: Explain and analyse the contemporary geographical thought.

Unit/Hours	**Content**	**Mapping with CLO**
Unit I / 11 Hours	Understanding Geographical themes; Epistemology of Geography; Geographical enquiry in the classification of Sciences; Evolution of Geographical Thought; **Learning activities:** Assignment writing, Quiz/test	CLO1
Unit II / 11 Hours	Concept of paradigms in Geography: Phases and changing paradigms in geography, Emergence of Modern Geography: contribution of Varenius, Kant, Humboldt, and Ritter. **Learning activities:** Paper reading, Quiz/test	CLO2 CLO3
Unit III / 11 Hours	Concept of Region, Place, and Space; Areal Differentiation and Spatial Organization. Concept of Exceptionalism and the Schaefer-Hartshorne Debate; emergence of Spatial science, quantitative and qualitative revolution **Learning activities:** Quiz/test, Group discussion/ debate	CLO4
Unit IV / 12 Hours	Understanding the concept of environmentalism, Positivism, and the Behavioural approach in geography. Perspective of Humanistic Geography, Feminist Geography, and the Postmodernism approach. Understanding of the Indian subcontinent and its philosophies through Indian geography. **Learning activities:** Group discussion	CLO5

Suggested readings:

1. Cresswell, Tim. (2012). *Geographic Thought: A Critical Introduction*. Malden, MA: Wiley Blackwell
2. Dikshit, R. D. (2018): *Geographical Thought. A Critical History of Ideas*. 2nd Edition. Prentice-Hall of India, New Delhi.
3. Hartshorne, R. (1939): The Nature of Geography, AAG, New York.
4. Harvey, D. (1969). *Explanation in Geography*. Arnold, London
5. Hussain, M. (2014). *Evolution of Geographical Thought*. 6th edition. Rawat Publisher.
6. Livingstone, David. (1992). *The Geographical Tradition: Episodes in the History of a Contested Enterprise*. Oxford: Blackwell.
7. Peet, R. (1998). *Modern Geographical Thought*. Wiley-Blackwell, New York.
8. Soja, Edward. (1989). *Post-modern Geographies, Verso.* London. Reprinted 1997: Rawat Publ., Jaipur, and New Delhi.
9. Tuan, Yi-Fu. (1977). *Space and Place: The Perspective of Experience*. Minneapolis:

University of Minnesota Press, Introduction, Epilogue.
10. Sudeepta, Adhikari, (2015), Fundamentals of Geographical Thought, Orient Black Swan
11. Anne Knowles, ed. (2008). *Placing History: How Maps, Spatial Data, and GIS Are Changing Historical Scholarship*. Esri Press.

Suggested papers/articles:

1. Schaefer, Fred. (1953). Exceptionalism in Geography: A Methodological Examination. *Annals of the American Association of Geographers* 43: 226–49.
2. Wilson, Robert. (2005). Retrospective Review: Man's Role in Changing the Face of the Earth. *Environmental History* 10 (3), 564-66.
3. Meinig, D W. (1983). Geography as an Art. *Transactions of the Institute of British Geographers* 8: 314–28.
4. Hawkins, Harriet, et al. (2015). What might the geohumanities do? Possibilities, practices, publics, and politics. *GeoHumanities*1 (2): 211–32.
5. Harvey, David. (1984). On the History and Present Condition of Geography: An Historical Materialist Manifesto. *The Professional Geographer* 3: 1–11.
6. Butler, Judith. (2011). Your Behavior Creates Your Gender. Big Think. http://bigthink.com/videos/your-behavior-creates-your-gender.
7. Domosh, Mona. (1991). Toward a feminist historiography of geography. *Transactions of the Institute of British Geographers*. 16 (1): pp. 95–104.
8. Commentary by David Stoddart and Domosh's response: Transactions of the Institute of British Geographers 16(4): 484–490.

Websites/web references:

1. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=17

Course Title: Research Methodology	**L**	**T**	**P**	**Cr**
Course Code: MGEO.535	3	-	-	3
Total Hour: 45 Hours				

Course Learning Outcome(CLO): At the completion of the course, the student will be able to:

CLO1: Explain various approaches, research methods and tools of data collection and analysis.

CLO2: Use web based literature search engines

CLO3: Write the synopsis and project report.

Unit/Hours	**Content**	**Mapping with CLO**
Unit I / 11 Hours	Introduction to research in Geography: Critical thinking.types of research design, concept of hypothesis, Formulation of research problem**;** Research approaches; types of journals - open access, hybrid, merits and demerits of publishing in different types of journals, concept of citations, impact factor, *h*-Index, I-10 index etc. **Learning activities:** Assignments, Group discussion	CLO1
Unit II /12 Hours	Web-based literature searches engines- Google Scholar, Scopus, Web of Science etc. Review of Literature, identifying gap areas for literature review	CLO2

	Learning activities: Assignments, Group discussion	
Unit III /11 Hours	Scientific writing, Writing research/review paper and book chapter, Poster preparation and presentation, Dissertation. Writing, Reference writing and management. **Learning activities:** Assignments, Group discussion	CLO3
Unit IV11 Hours	Writing thesis, project report and research paper; Synopsis writing: procedure, content, methods, literature review. Plagiarism and similarity search, Use of tools like Urkund, Turnatin/Ithenticate, Reference Manager – endnote, Mendeley, Statistical and graphical tools **Learning activities:** Assignments, Group discussion	CLO3
Mode of Transaction: Lecture, class discussion, presentation methods will be used for teaching. Tools such as whatsapp, ppt., and video will also be used.		
Suggested readings: 1. Blackburn, J. and Holland, J. (eds.) (1998): Who Changes? Institutionalising Participation in Development. IT Publications, London. 2. Blaxter, L.; Hughes, C. and Tight, M. (1996): How to Research. Open University Press, Buckingham. 3. Dikshit, R. D. (2003): The Art and Science of Geography: Integrated Readings. Prentice-Hall of India, New Delhi. 4. Dorling, D. and Simpson, L. (eds.) (1999): Statistics in Society. Edward Arnold, London. 5. Fisher, P. and Unwin, D., (eds.) (2002): Virtual Reality in Geography. Taylor and Francis, London. 6. Flowerdew, R. and Martin, D. (eds.) (1997): Methods in Human Geography. A Guide for Students Doing a Research Project. Longman, Harlow. 7. Hay, I. (ed.) (2000): Qualitative Research Methods in Human Geography. Oxford University Press, New York. 8. Kitchin, R. and Tate, N., (2001): Conducting Research into Human Geography. Theory, Methodology and Practice. Prentice-Hall, London. 9. Limb, M. (2001): Qualitative Methodologies for Geographers. Issue and Debates. Edward Arnold, London. 10. C R Kothari,(2015): Research Methodology Methods & Techniques, NEW AGE International Publishers		

Course Title: Geostatistical Techniques and Analysis	**L**	**T**	**P**	**Cr**
Course Code: MGEO.536	3	-	-	3
Total Hour: 45 Hours				
Course Learning Outcome (CLO): On completion of this course, students will be able to: CLO1: comprehend basics of geostatistics, descriptive and general geostatistics and measurement of central tendency and variability, CLO2: explore inferential geostatistics, regression analysis, correlation analysis, probability analysis and hypothesis testing, CLO3: explore graph building and mapping geostatistical output, analysis of general and				

inferential maps and development of symbology and colour, CLO4: explore different geostatistical software to analyse geostatistical data.		
Unit/Hours	**Content**	**Mapping with CLO**
Unit I /12 Hours	**Descriptive Geostatistics** Introduction of Geostatistics: population, statistics, data and variables, scales measurement; General Geostatistics: count, frequency, curve, ogives, graphs, histogram; Measures of central tendency: mean, median, mode, skewness, and kurtosis; Measures of variability: range, standard deviation, variance, co-variance, and z-score. **Learning activities:** Group discussion	CLO1
Unit II / 11 Hours	**Inferential geostatistics** Sampling: probabilistic and non-probabilistic; Regression analysis: simple, multiple, and logistic regression; Correlation analysis: simple and multiple correlation; Probability distribution: normal, binomial and Bayesian probability distribution; Hypothesis testing: student's t-test, Chi-square test, F-test; Geostatistical models: Lorenz curve and Gini co-efficient, location quotient, rank-size rule, Matrix and Kendall's ranking method. **Learning activities:** Assignments, Group discussion	CLO2
Unit III /11 Hours	**Graphing and mapping geostatistics** Diagram and charts: bar, pie, boxplot, line graph, dots; General maps: choropleth map, isopleth map, dot map, bar, and pie map; Inferential maps: Interpolated maps (IWD, Kriging, thin plate spline), pattern mapping (hotspot and cold spot map); Symbols and colours: sign, shades, pattern, and legend. **Learning activities:** Assignments, Group discussion	CLO3
Unit IV /11 Hours	**Introduction to geostatistical software** Introduction to open-source programming language; Introduction to SPSS, R and Python. **Learning activities:** Assignments, Group discussion	CLO4
Mode of Transaction: Classroom lecture and solving problem exercise.		
Suggested readings: 1. P. L. Meyer, Introductory Probability and Statistical Applications, Oxford & IBH Pub, 1975. 2. R. V. Hogg, J. Mckean and A. Craig, Introduction to Mathematical Statistics, Macmillan Pub. Co. Inc., 1978. 3. F. E. Croxton and D. J. Cowden, Applied General Statistics, 1975. 4. P. G. Hoel, Introduction to Mathematical Statistics, 1997.		

Course Title: Economic Geography	**L**	**T**	**P**	**Cr**

Course Code: MGEO.415	2	-	-	2

Total Hour: 30 Hours

Course Learning Outcomes (CLO): At the completion of the course, the student will be able to:

CLO1: understand the geographical dimension in economy and development with the help of models and theories.

CLO2: apply the approaches of economic geography in various field of research.

Unit/Hours	**Content**	**Mapping with CLO**
Unit I / 10 Hours	Economic Geography: Nature, scope, and approaches; Resources: Significance of Natural and Human resources in Economic Development; Measures of economic development: Rostow's and Myrdal's models. **Learning activities:** group discussion	CLO1
Unit II / 10 Hours	Concept of economic development Theories of development- Rostow's model, Structuralism and dependency theory, Neoliberalism and grass root approach Patterns of uneven development in India **Learning activities:** assignment	CLO1
Unit III / 10 Hours	Spatial organisation of economic activities (primary, secondary, tertiary and quarternary), Natural Resources (classification, distribution, and associated problems), Natural Resources Management. **Learning activities:** assignment	CLO2

Suggested readings

1. Bryson, J., et. al. (1999). The Economic Geography Reader, John Wiley, Chichester.
2. Chakraborty, S. and Somik V. (2007). Made in India: The Economic Geography and Political Economy of Industrialization, Oxford, New Delhi.
3. Clark, G., et. al. (2000). The Oxford Handbook of Economic Geography, Oxford, New York.
4. Dodson, R.A. (1998). Society in Time and Space, Cambridge University Press, Cambridge.
5. Grossman, G. (1984). Economic Systems, Prentice Hall, New Jersey.
6. Hanink, D. M. (1997). Principles and Applications of Economic Geography, John Wiley, New York.
7. Hartshorn, Truman, A. and John W. A. (1994). Economic Geography, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi.
8. Hussain, M. (1996). Systematic Agricultural Geography, Rawat Publications, Jaipur.
9. Ilbery, B. W. (1985). Agricultural Geography, Oxford University Press, Oxford, 1985.
10. Shafi, M. (2006). Agricultural Geography, Pearsons Publications, New Delhi.
11. Singh, J. and Dhillon, S.S. (1984). Agricultural Geography, Tata McGraw Hill, New Delhi.

Course Title: Instrumentation (Practical)	**L**	**T**	**P**	**Cr**
Course Code: MGEO.411		-	4	2
Total Hour: 60 Hours				

Course Learning outcome (CLO): Upon the completion the student will be able to able to
CLO1: understand and utilise the instrument for carrying out research and project work.
CLO2: carry out field work using instrument

Unit/Hours	**Content**	**Mapping with CLO**
I	**Exercise with instruments** Prismatic Compass, Theodolite, Plain Table Survey, Dumpy level, and Total Station, Clinometer, Rotameter, Pocket and Mirror stereoscope; Thermometer, Barometer, Anemometer, Hygrometer, Rain gauge	CLO1
II	pH meter, Conductivity meter, TDS meter, DO meter, Salinity meter, Clinometer, Mohs Hardness Test; Ground Penetrating Radar, Automatic Weather Station (AWS), Continuous Ambient Air Quality monitoring system, Laser distance meter, Range Finder, Brunton Compass.	CLO2

Mode of Transaction: Lecture, demonstration, Power point, E-tutoring, discussion, assignments, case study.

Suggested readings:

- American Public Health Association (APHA) (2012). Standard method for examination of water and wastewater, 22nd edn. APHA, Washington.
- Yadav, M. S. (2008). Instrumental methods of chemical analysis, New Delhi: Campus Books International.
- Rajvaidya, N., Markandey, D. (2005). Environmental Analysis and Instrumentation, APH Publisher.
- Chatwal, G. R., Anand, S. K. (2013). Instrumental Methods of Chemical Analysis, New Delhi: Himalaya Publishing House.
- Skoag, D. A., Holler, F. J., Crouch, S. R. (2007). Principles of Instrumental Analysis, CENGAGE Learning.

Course Title: Field Visit and Survey (Practical)	**L**	**T**	**P**	**Cr**
Course Code: MGEO. 596		-	2	1
Total Hour: 30 Hours				

Course Learning outcome (CLO): Upon the completion the student will be able to:
CLO1: understand basic knowledge of field survey for carrying out research and project work.
CLO2: carry out field work using available instruments

Unit/Hours	**Content**	**Mapping with CLO**

I	Introduction to Field Survey, Methods, Survey Questions and Tools, Purposes of Field Visit and Survey: Market Research, User Experience Research**,** Healthcare, Education, Hospitality and Tourism, Retail; Data Collection with Field Survey; Introduction to Field Survey Software: Jotform, Survey Monkey, Magpi, Go Canvas, Paperform	CLO1
II	**Field Survey** Filed work will be conducted using available instrument	CLO2
Mode of Transaction: Lecture, demonstration, Power point, E-tutoring, discussion, assignments, case study and Field visit.		
The students are required to submit a field report based on the field study. It will based on Field observations and data recorded (If any) by the candidate. **Evaluation Criteria:** Evaluation of Field Report: 25 marks		

Course title: Introduction to Map Reading (VAC)	**L**	**T**	**P**	**Cr**
Course code: MGEO.511	**2**	**-**	**-**	**2**
Total Hour: 15 Hours				

Course Learning outcome(CLO): After completing the course, student will be able to:
CLO1: apply theoretical knowledge at the ground observation in field and to learn essential observational and practical skills.
CLO2: Formulate their knowledge in field trip and will be able to identify different land features in toposheets for adaptation in field work environment in certain professional and scientific organizations.

Unit/Hours	**Content**	**Mapping with CLO**
Unit I / 3 Hours	Introduction to map: Concept, history, types and applications; Scale in map and its usage, procedure of map reading. Learning activities: Group discussion	CLO1
Unit II / 4 Hours	Introduction to Topographical maps: Compositions and conventional symbols. Reading of Toposheets at scale of 1:50,000, Atlas, thematic map, guide map, 3D map and military map. Learning activities: assignment	CLO1
Unit III / 4 Hours	Preparation of Thematic Map/and Generation of Data from the topographical maps (land use map and area under different land-use categories) Learning activities: assignment	CLO2
Unit IV / 4 Hours	Interpretation of Toposheets: Representation of features in classroom exercises. Generation of 3D maps. Learning activities: Case study	CLO2
Mode of Transaction: Hand on exercise with toposheets and lab exercises.		

Suggested Reading:

1. Misra, R.P. and Ramesh, A. (1989). Fundamental of Cartography, Concept Publishing Company, New Delhi.
2. Robinson, A.H. et al. (1992). Elements of Cartography, John Willy & Sons, New York, 6th edition.
3. Singh, R.L. Elements of Practical Geography.

https://www.oakton.edu

Course title: Data Analysis and Visualization (VAC)	**L**	**T**	**P**	**Cr**
Course code: MGEO. 512	**2**	**-**	**-**	**2**
Total Hour: 30 Hours				

Course Learning outcome(CLO): After completing the course, student will be able to:

CLO1: Apply theoretical knowledge at observation in datasets and to learn the data analysis and interpretation.

CLO2: Comprehend the theoretical and Practical knowledge of data visualizations.

CLO3: Understand various Functions in MS-Excel for Data Entry and Data analysis

CLO4: Proficient to apply the different datasets in statistical analysis and visualization.

Unit/Hours	**Content**	**Mapping with CLO**
Unit I / 6 Hours	Data Analysis: Introduction, Importance of data analysis; Data analysis tools and software; Data Analytics Types**:** Exploratory Data Analysis, Predictive Analytics, Prescriptive Analytics, Diagnostic Analytics; Various Phases of Data Analytics	CLO1
Unit II / 10 Hours	Data Visualization: Introduction, Examples, and Learning Resources, Importance of data visualization; Different types of visualizations: **Chart, Table, Graph, Geospatial, Dashboards, Maps;** Data visualization and big data; Visualization tools and software	CLO2
Unit III / 9 Hours	Data Set for MS Excel Fundamentals, Workbook and Worksheet, Navigation - Adjacent Cells, Navigation - within Table, Selecting Cells, Applying Filters, Formatting, Paste Special Features, Paste Special Operations	CLO3
Unit IV / 5 Hours	Data Set for Text Functions; How to convert string into Lower Case; How to convert string into Upper Case; How to convert string into Upper Case; Data Preparation-Data Validation: Data Set for Data Validation**;** Validating Whole Number in the Worksheet	CLO4

Mode of Transaction: Hand on exercise with tools and software of Data analysis

Suggested Reading:

1. "Beautiful Visualization, Looking at Data Through the Eyes of Experts by Julie Steele, Noah Iliinsky".
2. "The Visual Display of Quantitative Information" by Edward R.Tufte

3. "Information Graphics" by Sandra Rendgen, Julius Wiedemann
4. "Visual Thinking for Design" by Colin Ware
5. "Storytelling With Data: A Data Visualization Guide for Business Professionals" by Cole Nussbaumer Knaflic
6. "Visualize This: The Flowing Data Guide to Design, Visualization, and Statistics" by Nathan Yau

Course Title: Bio-Geography	**L**	**T**	**Cr**
Course Code: MGEO.414	3	-	3
Total Hour: 45 Hours			

Course Learning outcome (CLO): By the end of this course students will be able to:
CLO1**:** understand the historical development of biogeography during different time periods.
CLO2: explain and analyse the spatio-temporal variations of plant and animal regions and the factors affecting these variations.
CLO3: understand and analyse the biogeographical consequences of global change like climate change and evolve critical thinking.

Unit/ Hours	**Content**	**Mapping with CLO**
Unit I / 11 Hours	Nature, scope, significances, approaches and history of Biogeography; Spatial dimension and elements of biogeography; Distribution of forest and major plant community; Distribution of major animal distributions; Bio-geographical regions, realms and biomes, Major Gene Centre **Learning activities: group discussion**	CLO1
Unit II /12 Hours	Basic concept of biogeography, allopatric speciation, evolution, extinction, endemic, geo-dispersal, range and distribution, vicariance; Geo-biochemical cycles (gaseous & sedimentary): carbon, nitrogen, oxygen and phosphorus cycles; Concept of biomass, carbon content and carbo sequestration; Concept of forest carbon index; contribution and policies, carbon footprint and carbon credit, Man-Environment Relationship **Learning activities: assignment**	CLO1/ CLO2
Unit III /11 Hours	Biogeography of the seas; island biogeography; Habitat fragmentation; biogeography of linear landscape features; Biodiversity: types, hotspots, depletion and conservation, **Learning activities: assignment**	CLO2/ CLO3
Unit IV /11 Hours	Biogeographical information, collection, retrieval and application; Biogeographical consequences of global to regional change; changing communities and biomes; Forest disturbances in India; National forest and wildlife policy of India	CLO3

	Learning activities: case study	

Transaction mode: Lecture, Demonstration, Problem solving, Tutorial, Seminar, Local field visit discussion. Tools used: PPT, video, animation movie, whatsapp and Expert's Video Conferencing lectures from various national & international organizations.

Suggested Readings:

1. Richard John Huggett (2010) Fundamentals of Biogeography, Routledge, New York, US
2. Brown, J. H., & A. C. Gibson, Biogeography, St. Louis, Mosby, 1983.
3. Brown, J.H. and Lomolino, M.V., Biogeography, Second Edition, Sinauer Associates, Inc. Sunderland, Massachusetts, 1998.
4. Cox, C.B., Moore, P.D., Biogeography, An Ecological and Evolutionary Approach, 5th ed., Blackwell Science, Cambridge, 2016.
5. MacDonald, Glen, Biogeography: Introduction to Space, Time and Life, John Wiley, New York, 2002.
6. Sandeep Sharma, Soil and Bio-Geography. First Edition, Random Publication, 2017.
7. Agrawal, L.C (2018), Biogeography, Rawat Publications, Jaipur.
8. Darling, Emma (2018), Introductory Biogeography, Larsen & Keller, New York.
9. Robinson, H., Biogeography, The English Language Book Society and Macdonald and Evans, London, 1982. (1999). Digital Photogrammetry, TerraScience, New York, United States.

Course Title: Spatial and Transportation Planning	**L**	**P**	**Cr**
Course Code: MGEO.418	3	-	3

Total Hour: 45 Hours

Course Learning outcome (CLO): On completion of this course, students will be able to:

CLO1: Proficient to comprehend basic concepts, scope, and challenges of spatial planning.

CLO2: Competent to explore the theory, models, tools, and techniques to support spatial planning for spatial sustainability in the national and global context.

CLO3: Proficient to comprehend the concept, scope, and challenges of transportation planning.

CLO4: Competent to explore the advanced planning processes, models, tools, and techniques to support transportation planning and management on the national and global scale.

Unit/ Hours	**Content**	**Mapping with CLO**
Unit I/ 11 Hours	**Introduction to spatial planning:** The concept of spatial planning, characteristics and history of spatial planning, introduction to urban and regional planning, introduction to integrated land use and transportation planning, introduction to spatial planning and spatial sustainability, spatial planning at national and global scale: challenges and opportunities **Learning activities:** assignment and group discussion	CLO1

Unit II/ 11 Hours	**Advanced spatial planning:** Introduction to spatial planning theories, models, policies, and institutions; spatial planning framework, principles, process, and system; formulation of urban and regional development plan; concepts of sustainable city, dispersed city, compact city, and polycentric system; land use planning and change models; integrated spatial planning and TOD; risk-based land use and master planning; participatory land use planning; advanced tools, and techniques in spatial planning. **Learning activities:** assignment and group discussion	CLO2
Unit III/ 11 Hours	**Introduction to transportation planning:** Introduction to transportation planning and sustainable transportation; transportation planning history; introduction to motorized and non-motorized transportation, transportation & urban pollution, transportation safety, security, and public health: benefits, risks, and trade-offs; regional and global issues in transportation. **Learning activities:**assignment and group discussion	CLO3
Unit IV/ 12 Hours	**Advanced transportation planning:** Measures and indices of connectivity and accessibility; transportation planning theories, models, policies and institutions; transportation planning framework, principles, process and system; mobility and traffic impact analysis; Travel Demand and Choice Model, stated preference analysis methods, Low-carbon and E-transportation planning, Bus Rapid Transit (BRT) and public transportation planning, risk-based transportation planning, environmental Impacts Analysis, transportation finance, transport data collection & analysis, advanced transport network and service area analysis, advanced tools, and techniques in transportation planning. **Learning activities:** assignment, group discussion and case study	CLO4
Transaction mode: methods of the transaction are lecture, audio-video, the discussion which will be followed in teaching using ppt, social media etc		
Suggested readings: 1. Acheampong, R. A. (2019). Spatial Planning in Ghana: Origins, Contemporary Reforms and Practices, and New Perspectives, Springer Publisher. https://link.springer.com/book/10.1007/978-3-030-02011-8 2. Berke, Philip R. & David R. Godschalk (2006). Urban Land Use Planning, 5th edition, University of Illinois Press, USA. 3. Grossardt, Ted &Keiron B. (2018). Transportation Planning and Public Participation: Theory, Process, and Practice, 1st edition, Elsevier. 4. Kaiser, E. J. (1995). Urban Land Use Planning, 4th edition, University of Illinois Press, USA. 5. Morimoto, A. (2021). City and Transportation Planning: An Integrated Approach, 1st edition, Routledge, India.		

6. Morphet, J. (2010). Effective Practice in Spatial Planning, 1st edition, Routledge. https://www.routledge.com/Effective-Practice-in-Spatial-Planning/Morphet/p/book/9780415492829
7. Schoeman, C. B. (2015). Land Use Management and Transportation Planning, WIT Press, USA.
8. Tumlin, J. (2012). Sustainable Transportation Planning: Tools for Creating Vibrant, Healthy, and Resilient Communities: 1st edition, Wiley.
9. UNECE (2020). A Handbook on Sustainable Urban Mobility and Spatial Planning Promoting Active Mobility, United Nations, Geneva.
10. H.M. Saxena (2022), Transport Geography, Rawat Publication, Jaipur
11. https://www.cdema.org/virtuallibrary/index.php/charim-hbook/methodology/7-land-use-planning/7-1-spatial-planning
12. https://unece.org/sites/default/files/2022-01/spatial_planning_e.pdf

Course Title: Health Geography	**L**	**P**	**Cr**
Course Code: MGEO.537	3	-	3
Hours: 45 hours			

Course Learning Outcome(CLO): By the end of this course, students will be able to:
CLO1: Understand the concept of health geography and its related themes
CLO2: Comprehend various measures for analysing health and disease
CLO3: Explain various indices for analysing health and disease data
CLO4: Understand the concept of health care and related indices
CLO5: Identify the tools for analysing health outcomes in India and globally.

Unit/Hours	**Content**	**Mapping with CLO**
Unit I / 11 Hours	Nature and scope of Health Geography: Concept of health and disease in Geography and the Physical and Social determinants, Concept of Disease Ecology, and Disease Diffusion. **Learning activities:**	CLO1
Unit II / 12 Hours	Measures of health indicators: Mortality, Morbidity, disability, nutritional status, healthcare delivery, socioeconomic factors. Measures of disease frequency: Prevalence and incidence of disease. Measures of Disease Burden: Concept of DALY and QALY **Learning activities:**	CLO2 CLO3
Unit III / 11 Hours	Health Care Systems and Planning: Concept of Healthcare Availability and Accessibility, Healthcare planning and policies in India and Global agencies, Concept of Healthcare Access and Quality (HAQ) Indices. **Learning activities:**	CLO4
Unit IV / 11 Hours	Health Mapping and Spatial Analysis: Climate change and public health concern in India and global context; Identification of vulnerability and risk zones; Disease outbreak, hazard, and pattern of distribution; Mapping healthcare access and distribution. **Learning activities:**	CLO5

Mode of Transaction: Lecture, class discussion, and presentation methods will be used for teaching. Tools such as WhatsApp, PPT, and video will also be used.

Suggested readings:

1. Koch, Tom (2017). Cartographies of Disease Map, Mapping and Medicine, Esri Press.
2. John Eyles, Kevin J. Woods (2016). The Social Geography of Medicine and Health, Routledge Taylor & Francis
3. Anthamatten, Peter and Hazen, Helen (2016). An Introduction to The Geography of Health, Routledge Taylor & Francis
4. Izhar, Nilofar (2015). Geography and health: A study in medical geography, Aph publishing corporation.
5. Cromley, Ellen K., McLafferty, Sara L. (2011), GIS and Public Health, Guilford Press.
6. Brown, Tim, Mclafferty, Sara, Moon, Graham (2010). A companion to health and medical geography. Blackwell publishing
7. Akhtar, Rais (2018). Geographical aspects of health and disease in india, Concept publishing company pvt. Ltd
8. Caleb Coleman (2020). Handbook of Health Geography, Foster Academics
9. Valorie A. Crooks, Gavin J. Andrews, Jamie Pearce (2018). Routledge Handbook of Health Geography, Routledge Publication.
10. Global health estimates: https://www.who.int/data/global-health-estimates
11. National Family Health Survey: https://www.nfhsiips.in/nfhsuser/index.php
12. Global Health Data Exchange (GHDx): https://www.healthdata.org/data-tools-practices/data-sources

Course Title: Natural Resources and Sustainability	**L**	**T**	**P**	**Cr**
Course Code: MGEO.538	3	-	-	3
Total Hour: 45 Hours				

Course Learning outcome(CLO): On completion of the course, the learner will be able to:

CLO1: relate the importance of natural resources in the environment

CLO2: discuss the causes of natural resource depletion

CLO3: apply the various management strategies to protect and restore the natural resources

CLO4: inspect various legal measures taken at the national and international level to conserve and restore natural resources

Unit/Hours	**Content**	**Mapping with CLO**
Unit I /11 Hours	**Overview to Natural Resources** Definition and Classification; natural resource degradation - Environmental impacts and conservation;Value and Uses of Natural Resources; Availability and Distribution of Natural resources; Interrelationship among different Natural resources. **Learning activities: group discussion**	CLO1
Unit II/ 12 Hours	**Water and Marine resources:** Distribution and supply, Surface and ground water; Use and over-utilization of surface and ground Water; Use and over-utilization of surface and ground water, benefits and problems.Conflicts over water: National Water Mission; sustainable Water Conservation and management techniques; Rain water harvesting; Watershed management; River cleaning, River action plans, Interlinking of rivers;	CLO2

	Learning activities: assignment	
Unit III/ 11 Hours	**Land Resources:** Soil properties,uses and classification. Land degradation Soil Erosion, Loss of soil fertility, Restoration of soil Fertility, Soil Conservation Methods; Mineral Resources its Use and exploitation, environmental effects of extracting and using mineral resources:Socio-economic impacts on local communities; Sustainable mining practices and responsible resource extraction; Causes and Impacts of Natural Resource Depletion; sustainable mapping and management of land resources. **Learning activities: assignment**, **case studies.**	CLO3
Unit IV/ 11 Hours	**Forest Resources:** forest status and distribution, Major forest types and their characteristics in India. Deforestation causes andimpacts, forest and wildlife issues, sustainable mapping and management of forest resources **Learning activities: case study**	CLO4
Mode of Transaction: Lecture, class discussion, presentation methods will be used for teaching. Tools such as whatsapp, ppt., and video will also be used.		

Suggested Readings:

1. Singh, C. K. (2018). *Geospatial Applications for natural Resources Management,* CRC Press.
2. Primak, R. B. (2014). *Essentials of Conservation biology*, Sinauer Publishers, 6th edition.
3. Raju, N. J., et al., (2014). *Management of Water, Energy and Bio-resources in the Era of Climate Change: Emerging Issues and Challenges,* Springer.
4. Anderson, D. A. (2013). *Environmental economics and natural resource management,* Taylor and Francis 4th Edition.
5. Beckman, D. W. (2013). *Marine environmental biology and conservation,* Jones and Barlett learning.
6. Balyani, R. (2012). *Indian Forest and Forestry,* Jaipur: Pointer Publishers.
7. Jetli, K. N. (2011). *Mineral Resources and policy in India,* New Century Publications, Delhi.
8. Kathy, W. P. (2010). *Natural resources and sustainable developments,* Viva books.
9. Jaidev, S. (2010). *Natural resources in 21st century,* Oxford Publishers.
10. Mishra, S. P. (2010). *Essential Environmental Studies*, Ane Books.
11. Ghosh, A. (2010). *Natural resource and conservation and environment management,*Aph Publishing corp.
12. Lynch, D. R. (2009). *Sustainable natural resource management for scientists and engineers,* Cambridge University Press.
13. Grigg, N. S. (2009). *Water resources management: Principles, regulations, and cases*. McGraw Hill Professional.
14. Kudrow, N. J (Ed). (2009). *Conservation of natural resources, Nora Science*, New York.
15. Mohanka, R. (2009). *Bioresources and human Environment,* APH Publishing Corporation, Delhi.
16. Kohli, R. K., Batish, D. R., et al. (2009). *Invasive Plants and Forest Ecosystems,* CRC Press.
17. Rao, N. (2008). *Forest Ecology in India. Colonial Maharashtra 1850-1950*. Cambridge

University Press.
18. Bravo, F., et al. (2008). *Managing forest ecosystems: the challenge of climate change*.
19. Gurdev, S. (2007). *Land resource management,* Oxford publishers.
20. Kumar, H. D. (2001). *Forest resources: Conservation and management,* Affiliated East-West Press.

Website/Web references

1. http://moef.gov.in/en/
2. http://www.envis.nic.in/
3. https://www.fsi.nic.in/
4. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=14

https://sdgs.un.org/goals

Course Title: Glaciology	**L**	**T**	**P**	**Cr**
Course Code: MGEO.539	3	-	-	3
Total Hour: 45 hours				

Course Learning outcome(CLO): After completing the course, students are expected to:
CLO1: Explain the formation, movement, and effects of the different kinds of glaciers.
CLO2: describe the different time scale physical properties of glaciers (including glacial hydrology) on landform-building processes
CLO3: describe and explain the physical behaviour of ice sheets in relation to regional and global climate and to climate change
CLO4: explain principles for glacier movement, glacier dynamics and glacier mass balance modelling
CLO5: explain the continuous and growing threat of Glacier- and permafrost-related hazards to human lives and infrastructure in high mountain region

Unit/Hours	**Content**	**Mapping with CLO**
Unit I /11 Hours	**Introduction to Glacial process and geomorphology** Introduction to physical and environmental glaciology. Glacier formation, classification, and characteristics and overview of global and national glacier monitoring initiatives; Glacial geomorphic processes: erosion, transport and deposition & glacial sedimentation; Glacio-fluvial, periglacial and paraglacial landforms (special emphasis on rock glaciers and permafrost area); Glaciations and past glacial activity - classical models of Quaternary glaciation and the records in glacial sediments, ice-cores and other proxy datasets. **Learning activities:** Group discussions, Presentations and Assignments	CLO1/ CLO2
Unit II /14 Hours	**Glacial-climate interactions, dynamics, and mass balance** Principles of glaciers mass balance, gradient, profile, and equilibrium line altitude; Glacier mass balance measurement, analysis and modelling: Direct/Glaciological method, Geodetic, Hydrological and	CLO2/ CLO3

	AAR based method, limitations and strengths. Glacier motion and dynamics, ice flows, surges, calving, glacier instabilities and modelling the flow of Glaciers; Glacier-climate interactions study using temperature index modelling, energy balance modelling and linear mass balance modelling. Glacier hydrology and water balance in glaciated catchment: water storage changes, water balance of a glacier, runoff and its variability, contribution of glacier and snow melt to stream flow and impacts of climate change on water resources in the glaciated valleys and downstream areas; **Learning activities:** Group discussions, Presentations and Assignments	
Unit III /10 Hours	**Glacier and Permafrost Hazards** Glacial lake, types, characteristics and outburst floods; Ice break-offs and subsequent ice avalanches from steep glaciers; Stable and unstable glacier length variations and surging; Debris flows and Destabilisation of frozen or unfrozen debris slopes; Rock avalanches and Destabilisation of rock walls;Group discussions, **Learning activities:** Presentations and Assignments	CLO3/ CLO4
Unit IV /10 Hours	**Geo-informatics, Geo-physical and Geo-chronology methods for glacial studies** Remote sensing and GIS methods of glacier's mapping, inventorying and monitoring, glacier's surface elevation changes, glacier's velocity and motion, glacier's ice thickness and volume estimation, geodetic and AAR based glacier's mass balance measurements, limitation and strengthens; Geophysical field based measurements and sample collections of glacial parameters (e.g. glacial mass balance, thickness, velocity) using glaciological method, ground penetrating radar, DGPS measurements, total station or terrestrial LiDAR survey Geo-chronology methods to reconstruct the past glaciations and geomorphic process and resultant landforms or features using OSL, CRN and Tree rings dating methods, samples collections and processing; **Learning activities:** Group discussions, Presentations and Assignments	CLO4/ CLO5
Transaction mode: Lecture, Demonstration, Problem solving, Tutorial, Seminar, Local field visit discussion. Tools used: PPT, video, animation movie, whatsapp and Expert's Vedio Conferencing lectures from various national & international organizations		
International to National to Local reachability: The course will have wider reachability from local to international level to provides a systematic survey of modern research into glacial processes, and the response of glaciers and ice sheets to climate change and resultant impacts on the regional water balance and associated hazards in the mountainous regions and its downstream areas.		
Suggested Readings:		

- Benn, D. I., and Evans, D. J. A. (2018). Glaciers and glaciation: New York, New York, Wiley, 734
- Andrews, J. T., (1990). Glacial systems: Belmont, California, Wadsworth, 191
- Kargel, J.S., G.J. Leonard, M.P. Bishop, A. Kaab, B. Raup (Eds), 2014, Global Land Ice Measurements from Space (Springer-Praxis). 33 chapters, 876 pages. ISBN: 978-3-540-79817-0.
- Brodzikowski, K. and van Loon, A. J. (1991). Glacigenic sediments: Amsterdam, Netherlands, Elsevier, 674.
- Pellikka P. and W.G. Rees, eds. (2010). Remote sensing of glaciers: techniques for topographic, spatial, and thematic mapping of glaciers. Boca Raton, FL, CRC Press/Taylor & Francis. 330pp
- Cuffey, K.M., and Patterson, W. S. B., 2010, The physics of glaciers (4th ed.): New York, NY, Academic Press, 704 p.
- Embleton, C., and King, C. A. M., 1975, Glacial geomorphology: New York, New York, Wiley, 573 p
- Evans, D. J. A., ed., 2003, Glacial landsystems: London, England, Arnold, 532 p.
- Hooke, R. LeB., 2005, Principles of glacier mechanics (2nd ed.): Cambridge, U.K., Cambridge University Press, 448 p.
- Knight, P. G., 1999, Glaciers: London, U.K., Stanley Thornes, 272 p.
- Nesje, A., and Dahl, S. O., 200, Glaciers and environmental change: London, U.K., Arnold, 203 p.
- van der Veen, C.J., 2013, Fundamentals of glacier dynamics (2nd ed.): Boca Raton, Florida, CRC Press, 403 p.
- Elias, S. A., ed., 2006, Encyclopedia of Quaternary science (four volumes):Netherlands, Elsevier.

Course Title: Dissertation Part I	**L**	**T**	**P**	**Cr**
Course Code: 599-1	**-**	**-**	**4**	**2**

Course Learning Outcomes (CLO): On completion of the course, the learner will be able to:

CLO1: Relate the theoretical knowledge gained in lectures to practical studies in field

CLO2: Design experiments to implement theoretical and laboratory knowledge to field studies

CLO3: Choose appropriate demonstration skills for field/ action report preparation.

Contents

The students are required to submit a dissertation proposal / synopsis of the research work to be carried for the fulfilment of M.A. dissertation. It will have following components:

(a) Origin of the research problem and literature review

(b) Objective of the research work and research questions.

(c) Methodology of the work and data source.

(d) Proposed laboratory investigation (if any) to be carried out by the candidate,

(e) Expected Outcome

Mode of Transaction: Demonstration, Experimentation, Tutorial

Evaluation Criteria:

The evaluation of dissertation proposal in the third semester will carry 50% weightage by supervisor and 50% by HoD and senior-most faculty of the department which include Dissertation proposal and Presentation.

Semester-IV

Course Title: Dissertation Part II	**L**	**T**	**P**	**Cr**
Course Code: MGEO. 599-2	**-**	**-**	**80**	**20**

The student will be evaluated based on

- Dissertation
- Formatting and timely submission
- Plagiarism
- Quality of viva presentation
- Response to questions of the committee

Continuous evaluation by the guide

The students are required to submit a dissertation based on the research work carried out towards the fulfilment of M.A. dissertation. It will have following components:

(a) Origin of the research problem and literature review

(b) Objective of the research work

(c) Methodology of the work, field observations (if any) and data recorded by the candidate,

(d) Details of laboratory investigation (if any) carried out by the candidate,

(e) Synthesis of results and interpretation

(f) Concluding remarks and future direction

Evaluation Criteria:

The evaluation of dissertation in the fourth semester will be as follows:

- 50% weightage for continuous evaluation by the supervisor which includes regularity in work, mid-term evaluation, report presentation, and final viva-voce.
- 50% weightage based on average assessment scores by an external expert, HoD and senior-most faculty of the department; this includes report of dissertation (30%), presentation (10%), and final viva-voce (10%).
- The final viva-voce will be through offline or online mode.
- The workload of one contact hour per student will be calculated for dissertation in fourth semester.