SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE

(*Formerly University of Pune*)

Two-Year Post Graduate Programme in Geography

Faculty of Science and Technology

Choice Based Credit System (CBCS)

Syllabi for

M. A. / M. Sc Geography

Department of Geography, Savitribai Phule Pune University

Syllabi as per guidelines of National Education Policy 2020

To be implemented from Academic Year 2023-2024

SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE

Department of Geography

Syllabi as per NEP 2020 for M.A. / M.Sc. Geography

Title of the Programme: M.A. / M.Sc. Geography

Preamble:

National Education Policy 2020 lays particular emphasis on the development of creative potential of each individual. It is based on the principle that education must develop not only cognitive capacities - both the 'foundational capacities' of literacy and numeracy and 'higher-order' cognitive capacities, such as critical thinking and problem solving – but also social, ethical, and emotional capacities and dispositions. On behalf of the new education policy, Savitribai Phule Pune University has decided to change the syllabi of various faculties from June 2023. Taking into consideration the rapid changes in science and technology and new approaches in different areas of Geography and related subjects, the syllabus of M. A. / M. Sc. Semester - I and Semester- II (w.e.f. 2023-2024) Geography programme were prepared under the Choice Based Credit System (CBCS). The model curriculum as developed by NEP 2020 is used as a guideline for the present syllabi. The syllabi focus on credits related to major core, major elective, research methodology, internship / On job training (OJT) and research projects.

Aims and Objectives of the new curriculum:

i. To update the curriculum as per the NEP 2020 guidelines.
ii. To incorporate recent development in the field of Geography.
iii. To enhance the quality and standards of knowledge of Geography.
iv. To establish a comprehensive and inclusive platform that encourages exchange mobility and open dialogue among the fraternity of Indian geographers.
v. To cultivate an aptitude for geography in students who demonstrate potential for advanced studies and creative endeavors within the field.
vi. Regardless of whether a student decides to leave after the first year, they will still be presented with job opportunities that match their acquired skill set.
vii. Building confidence in students for empowering themselves with different aspects of Geography that are required for various branches of sciences and humanities.
viii. To impart knowledge that will enable students to pursue higher studies and engage in research work within their areas of interest.
ix. Provide job-oriented skills to the students with multiple entry and exit option.

x. To inculcate interdisciplinary and multidisciplinary approach in the curriculum.

xi. To enhance employability and entrepreneurship skill among the students.

xii. To foster research and innovative skills among the students.

Name of the Programme: M. A. / M. Sc. Geography

Programme Specific Outcome (PSO):

On completion of the Two-year Post Graduation in Geography, students will:

1. possess an enriched and comprehensive knowledge of Geography and its practical applications across various disciplines.
2. develop a strong sense of environmental values, being well-informed about sustainable development goals, as well as various cross-cutting issues affecting our planet.
3. augment their skills in spatial analysis through the application of statistical techniques, geospatial tools, and by keeping abreast of emerging trends, theories, and models in the field.
4. be able to analyze, compare, and critically evaluate concepts and content relevant to competitive examinations and global contexts, nurturing a deeper understanding of global issues.
5. demonstrate knowledge and expertise in field excursions, advanced surveying techniques, and digital map-making, aiding them to interpret and represent geographical data effectively.
6. be proficient in research writing, preparing manuscripts, and designing research projects.
7. develop essential employability and entrepreneurship skills, making them well-prepared for market jobs or for establishing their own endeavours in relevant fields.
8. apply geographical knowledge, tools, and techniques to address various geo-environmental and human challenges, contributing to effective problem-solving.
9. recognize the significance of resource management, regional planning, and sustainable development, ensuring responsible and informed decision-making.
10. prioritize diverse emerging issues, trends and techniques effectively in real-time geographical problems, leading to positive contributions to both society and the environment.

Savitribai Phule Pune University, Pune

Syllabi as per NEP 2020 for M.A. / M.Sc. Geography (Level 6.0)
Department of Geography, Savitribai Phule Pune University

M. A./ M. Sc. Geography (Year I, Semester I)

Level	Semester	Group	Course Code	Course Name	Credits		Total Credits
					T	P	
6.0	First Semester	Major Core	GEO 501	Fundamentals of Geomorphology	02	--	02
			GEO 502	Fundamentals of Climatology	02	--	02
			GEO 503	Fundamentals of Economic Geography	02	--	02
			GEO 504	Fundamentals of Population and Settlement Geography	02	--	02
			GEO 505	Introduction to Statistical Methods in Geography	02	--	02
			GEO 506	Practicals in Physical Geography	--	02	02
			GEO 507	Practicals in Human Geography	--	02	02
				Total credits related to Major Core	**10**	**04**	**14**
		Major Elective (Select any one group)		**Group A**			
			GEO 511	Geography of India	02	--	02
			GEO 512	Practicals in Cartographic Techniques	--	02	02
				Group B			
			GEO 513	Introduction to Remote Sensing	02	--	02
			GEO 514	Practicals in Remote Sensing and Map Interpretation	--	02	02
				Group C			
			GEO 515	Disaster Management	02	--	02
			GEO 516	Basics of Geospatial Techniques: Practicals	--	02	02
				Total Credits related to Major Electives	**02**	**02**	**04**
		Research Methodology	GEO 521	Research Methodology	**04**	--	**04**
				Semester I- Total Credits	**16**	**06**	**22**

Vertical Group (Semester - I)	Credit for Theory	Credit for Practical	Total Credit
Total Credits related to Major Core	10	04	**14**
Total Credits related to Major Electives	02	02	**04**
Research Methodology	04	--	**04**
Total Credits	**16**	**06**	**22**

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Syllabi as per NEP 2020 for M.A. / M.Sc. Geography
Department of Geography, Savitribai Phule Pune University

M. A./ M. Sc. Geography (Year I, Semester II)

Level	Semester	Group	Course Code	Course Name	Credits		Total Credits
					T	P	
6.0	Second Semester	Major Core	GEO 531 – 538	**Special Core – 1 (Theory)** **(Select any one as per specialization)** GEO 531: Coastal Geomorphology GEO 532: Synoptic Climatology GEO 533: Agricultural Geography GEO 534: Population Geography GEO 535: Environmental Geomorphology GEO 536: Regional Climatology GEO 537: Geography of Resources GEO 538: Population Resources and Planning	04	--	04
			GEO 541 – 548	**Special Core – 1 (Practicals)** **(Select any one as per specialization)** GEO 541: Coastal Geomorphology: Practicals GEO 542: Synoptic Climatology: Practicals GEO 543: Agricultural Geography: Practicals GEO 544: Population Geography: Practicals GEO 545: Environmental Geomorphology:Practicals GEO 546: Regional Climatology: Practicals GEO 547: Geography of Resources: Practicals GEO 548: Population Resources and Planning:Practicals	--	02	02
			GEO 551	Geographical Thought	02	--	02
			GEO 561 - 568	**Special Core – 2 (Theory)** **(Select any one as per specialization)** GEO 561: Fluvial Geomorphology GEO 562: Applied Climatology GEO 563: Geography of Tourism GEO 564: Geography of Rural Settlement GEO 565: Regional Geomorphology of India GEO 566: Urban Climatology GEO 567: Environmental Economic Geography GEO 568: Settlement Planning and Management	04	--	04

			GEO 571-578	**Special Core – 2 (Practicals)** **(Select any one as per specialization)** GEO 571: Fluvial Geomorphology: Practicals GEO 572: Applied Climatology: Practicals GEO 573: Geography of Tourism: Practicals GEO 574: Geography of Rural Settlement:Practicals GEO 575: Regional Geomorphology of India:Practicals GEO 576: Urban Climatology: Practicals GEO 577: Environmental Economic Geography:Practicals GEO 578: Settlement Planning and Management:Practicals	---	02	02
				Total credits related to Major Core	**10**	**04**	**14**
		Major Elective (Select any one group)		**Group A**			
			GEO 581	Geography of Health	02	--	02
			GEO 582	Surveying: Practicals	--	02	02
				Group B			
			GEO 583	Geography of South Asia	02	--	02
			GEO 584	Digital Cartography: Practicals	--	02	02
				Group C			
			GEO 585	Environmental Geography	02	--	02
			GEO 586	Bivariate Statistical Methods	--	02	02
				Group D			
			GEO 587	Introduction to Geographical Information System	02	--	02
			GEO 588	Practicals in Geographical InformationSystem	--	02	02
				Total Credits related to Major Electives	**02**	**02**	**04**
		On Job Training	GEO 591	**On Job Training** (Student should complete on job training not lessthan 60 clock hours)			**04**
			Sem. II Total Credits = Major Core + Major Elective + OJT		**12**	**06**	**22**

Vertical Group (Semester - II)	**Credit for Theory**	**Credit for Practical**	**Total Credit**
Total credit related to Major Core	10	04	**14**
Total Credits related to Major Electives	02	02	**04**
On Job Training	--	--	**04**
Total Credits	**12**	**06 + 04**	**22**

Savitribai Phule Pune University, Pune

Syllabi as per NEP 2020 for M.A. / M.Sc. Geography (Level 6.5)

Department of Geography, Savitribai Phule Pune University

M. A. / M. Sc. Geography (Year II, Semester III)

Level	Semester	Group	Course Code	Course Name	Credits		Total Credits
					T	P	
6.5	Third Semester	Major Core	GEO 601 - 604	**Special Core – 3 (Theory) (Select any one as per specialization from following)** GEO 601: Tropical Geomorphology GEO 602: Monsoon Climatology GEO 603: Geography of Development GEO 604: Geography of Migration	04	--	04
			GEO 611-614	**Special Core – 3 (Practicals) (Select any one as per specialization from following)** GEO 611: Tropical Geomorphology: Practicals GEO 612: Monsoon Climatology: Practicals GEO 613: Geography of Development: Practicals GEO 614: Geography of Migration: Practicals	--	02	02
			GEO 621	Essentials of Watershed Management	02	--	02
			GEO 631-634	**Special Core – 4 (Theory) (Select any one as per specialization from following)** GEO 631: Geomorphology: Theoretical andApplied GEO 632: Agro-Meteorology GEO 633: Contemporary Economic Geography GEO 634: Urban Geography	04	--	04
			GEO 641 - 644	**Special Core - 4 (Practicals) (Select any one as per specialization from following)** GEO 641: Geomorphology - Theoretical andApplied: Practicals GEO 642: Agro-Meteorology: Practicals GEO 643: Contemporary Economic Geography: Practicals GEO 644: Urban Geography: Practicals	--	02	02
				Total credit related to Major Core	**10**	**04**	**14**

Level	Semester	Group	Course Code	Course Name	Credits		Total Credits
					T	P	
6.5	Third Semester	Major Elective (Select any one group)	**Group A**				
			GEO 651	Political Geography	02	--	02
			GEO 652	Regional Planning	02		02
			Group B				
			GEO 653	Multivariate Statistics in Geography	02	--	02
			GEO 654	Multivariate Statistics in Geography: Practicals	--	02	02
			Group C				
			GEO 655	Introduction to Python Programming	02	--	02
			GEO 656	Introduction to Python Programming: Practicals	--	02	02
			Group D				
			GEO 657	Plant Geography	02		
			GEO 658	Zoogeography	02		
		Research Project	GEO 661	Research Project			04
			Sem. III- Total Credits=Major Core+ Major Elective + RP				**22**

Vertical Group (Semester - III)	Credit for Theory	Credit for Practical	Total Credit
Total credit related to Major Core	10	04	**14**
Total Credits related to Major Electives	02/04	02/00	**04**
Research Project	----	----	**04**
Total Credits	**12/14**	**06 / 04 + 04**	**22**

Savitribai Phule Pune University, Pune

Syllabi as per NEP 2020 for M.A. / M.Sc. Geography
Department of Geography, Savitribai Phule Pune University

M. A. /M. Sc. Geography (Year II, Semester IV)

Level	Semester	Group	Course Code	Course Name	Credits T	Credits P	Total Credits
6.5	Fourth Semester	Major Core	GEO 671	Physical Oceanography	02	--	02
			GEO 672	Oceanography: Marine Resources and Management	02	--	02
			GEO 673	Geography of Soils	02	--	02
			GEO 674	Geography of Sustainable Development	02	--	02
			GEO 675	Advances in Geography **(Select any one as per specialization from following)** A. Advances in Physical Geography B. Advances in Human Geography	--	02	02
			GEO 676	Applied Geography: Field Study	--	02	02
				Total credit related to Major Core	**08**	**04**	**12**
		Major Elective (Select any one group)		**Group A**			
			GEO 681	Advance Surveying: Theory	02	--	02
			GEO 682	Advance Surveying: Practicals	--	02	02
				Group B			
			GEO 683	Social Geography	02	--	02
			GEO 684	Cultural Geography	02	--	02
				Group C			
			GEO 685	Advances in RS and GIS	02	--	02
			GEO 686	Advances in RS and GIS: Practicals	--	02	02
				Total Credits related to Major Electives	**02**	**02**	**04**
		Research Project	GEO 691	Research Project: Dissertation			**06**
			Sem. IV Total Credit = Major Core + Major Elective + RP		**10**	**06**	**22**

Vertical Group (Semester - IV)	Credit for Theory	Credit for Practical	Total Credit
Total credit related to Major Core	08	04	**12**
Total Credits related to Major Electives	02/04	02/00	**04**
Research Project			**06**
Total Credits	**10/12**	**06/04+06**	**22**

Year-I
Semester-I

GEO 501: Fundamentals of Geomorphology
(Credits-2)

Course Objectives:

1. To learn basic concepts and theories of Geomorphology, Processes, and landforms with respect to time and scale.
2. To understand the exogenic and endogenic forces responsible for landform formation.
3. To learn different types of landforms and landscape environments.
4. To make acquaint students with concepts related to geomorphological applications.

Topic No.	Topic Name	Number of Lectures
1	The Dynamic Earth Surface: The changing continents, Oceans, Diastrophism and Catastrophism	5
2	The material of the Earth's crust: Rocks and Minerals	4
3	Processes on the Earth's surface: Denudation processes- Erosion and Weathering.	8
4	Landforms on the Earth's surface: Fluvial, Coastal, Aeolian landforms	6
5	Landforms on the Earth's surface: Karst, Glacial and Structural landforms, Introduction to Planetary Geomorphology	7

Course Outcomes:

By the end of the course, the student will:

1. learn the fundamental concepts, processes, theories, and changing nature of the subject.
2. understand the origin and evolution of landforms in different environmental conditions including Fluvial, Coastal, Aeolian, Glacial and Karst landscapes.
3. acquire important knowledge of the application of geomorphology.

Suggested Readings:

1. Kale, V. S., & Gupta, A. (2010). Introduction to Geomorphology. Hyderabad: Universities Press.
2. Ollier, C. D. (1981). Tectonics and Landforms. London: Longman.
3. Singh, S. (2002). Geomorphology, Allahabad: Prayag Pustak Bhawan.
4. Strahler, A. H., & Strahler, A. N. (1992). Modern Physical Geography, New Jersey: John Wileyand Sons.
5. Tarbuck, E. J., & Lutgens, F. K. (2009). Earth Science. New Jersey: Prentice Hall.

GEO 502: Fundamentals of Climatology
(Credits-2)

Course Objectives:

1. To introduce students to basic principles of climatology, atmospheric phenomena, weather systems and climate change.
2. To grasp key concepts about atmosphere, its layering, composition, solar and terrestrial radiation, greenhouse effect and head budget.
3. To understand how different weather elements are measured and factors that affect them.
4. To learn about climate change, how it is detected and its causes.

Topic No.	Topic Name	Number of Lectures
1	The Atmospheric Sciences: Meteorology and Climatology, Nature and Scope of Climatology, Development of Climatology	3
2	Earth's Atmosphere: Evolution, Structure and Chemical Composition of Atmosphere, Ionosphere	5
3	Solar and Terrestrial Radiation, Electromagnetic Spectrum, Latitudinal and Seasonal Variation, Effect of Atmosphere, Green House Effect and Heat Budget, Mechanisms of Heat Transfer	5
4	Temperature Measurements and Controls, Lapse Rate, Temperature Inversion, Types of Inversion	3
5	Atmospheric Pressure and Winds: Pressure Measurement and Distribution; Wind Observation, Measurement, Factors Affecting Wind; Geostrophic Wind and Gradient Wind, Local Winds, Models of General Circulation of the Atmosphere, Jet Stream, Cyclones and Anticyclones	7
6	Atmospheric Moisture: Hydrological Cycle, Forms of Condensation, Precipitation, Types of Precipitation, Measurement of Humidity	4
7	Climate Change: The Climate System, Detection of Climate Change, Natural Causes, Anthropogenic Causes	3

Course Outcomes:

By the end of the course, the student will:

1. know the fundamentals of climatology and its development as a science and branch of geography and know difference between climatology and meteorology.
2. understand different terms in climatology, climatic elements, their measurements and factors that affect them.
3. know the evolution of atmosphere, its composition, structure.

4. possess knowledge of solar and terrestrial radiation, factors that affect it, and also greenhouse effect and heat budget.
5. possess knowledge about general circulation of the atmosphere, relation between pressure and wind, atmospheric moisture and its measurement, air masses, fronts.
6. understand the concept of climate change, its causes.

Suggested Readings:

1. Lal, D. S. (1998). Climatology. Allahabad: Chaitanya Publishing House.
2. Lutgens, Frederic K. & Tarbuck, Edward J. (2010). The Atmosphere: An Introduction to Meteorology. New Jersey: Pearson Prentice Hall.
3. Oliver, John E. & Hidore, John J. (2003). Climatology: An Atmospheric Science. Delhi: Pearson Education.
4. Singh, S. (2005). Climatology. Allahabad: Prayag Pustak Bhawan.

GEO 503: Fundamentals of Economic Geography
(Credits-2)

Course Objectives:

1. To provide students with a comprehensive understanding of various economic systems, including capitalism, socialism, and mixed economies.
2. To enable students to analyze the spatial patterns of economic activities at different scales, ranging from local to global. This includes understanding the location of industries, trade flows, and the factors influencing regional development.
3. To examine the processes and impacts of globalization and regional economic integration on economic geography. Students should understand how global economic forces shape local economies and how countries and regions interact through trade and investment.
4. To explore the relationship between natural resources, the environment, and economic activities. Students should gain insights into the exploitation and management of resources, as well as the environmental impacts of economic processes.

Topic No.	Topic Name	Number of Lectures
1	Definition, Nature and Scope of Economic Geography	2
2	Approaches to the Study of Economic Geography	2
3	Concepts and Principles in Economic Geography	5
4	Economic Landscape and Economic Systems	4
5	Modes of Transport and Cost of Transport	3
6	Trade Theories	5
7	Models of Industrial Location	5
8	Industrial Regions	4

Course Outcomes:

By the end of the course, the student will:

1. develop skills in analyzing spatial data to understand the distribution of economic activities.
2. be able to analyze complex economic issues, identify problems, and propose appropriate solutions.
3. be able to apply economic theories and concepts to real-world situations. This includes

utilizing quantitative and qualitative research methods to investigate economic phenomena.
4. understand the interconnectedness of economies and the implications of economic geography on different regions and countries.
5. be able to effectively communicate their understanding of economic geography through oral presentations, written reports, and class discussions.
6. Illustrate classification of economies and evaluate the impact of economic policies.

Suggested Readings:

1. Hartshorne, T. A., & Alexander, J. W. (2010). Economic Geography. New Delhi: PHI Learning.
2. Knox, P., Agnew, J., & McCarthy, L. (2008). The Geography of the World Economy. London: Hodder Arnold.
3. Lloyd, P., & Dicken, B. (1972). Location in Space: A Theoretical Approach to Economic Geography. New York: Harper and Row.
4. Siddhartha, K. (2000). Economic Geography: Theories, Process and Patterns, New Delhi: Kisalaya Publications.
5. Smith, D. M. (1971). Industrial Location: An Economic Geographical Analysis, New York: John Wiley and Sons.

GEO 504: Fundamentals of Population and Settlement Geography (Credits-2)

Course Objectives:

1. To introduce the students to the scope and importance of the discipline of Population and Settlement geography.
2. To get clear idea of the evolution and the scope of the discipline, past, present and future scenario of population trends
3. To understand the concepts related to age-sex structures, and rural-urban composition
4. To get acquainted with the concepts of site and situation, classification of settlement, basic models and theories along with examples.

Topic No.	Topic Name	Number of Lectures
1	Population Geography: Definition, Scope, Nature, Approaches, Relation with Other Branches, and Data Sources	4
2	Growth and Distribution of Population: World & India	3
3	Population Dynamics: Fertility, Mortality, Migration and Nuptiality	4
4	Models in Population Geography: DTM, Gravity Model	4
5	Settlement Geography: Definition, Scope, Nature, Relation with other disciplines	4
6	Rural and Urban Settlement Geography: Definition, Concepts, Types, Pattern and Shapes	4
7	Factors affecting: Site and Situation, Classification of Settlement, and Dispersion and Nucleation of settlement	3
8	Models in Settlement Geography: Origin and Morphology	4

Course Outcomes:

By the end of the course, the student will:

1. understand the basic concepts in population and settlement geography
2. acquire knowledge about the population distribution in the world, factors affecting population distribution.
3. identify patterns and processes of population and settlement growth.
4. evaluate the factors influencing the growth of population and settlement.

Suggested Readings:

1. Bhende, A. & Kanitkar, T. (2019). Principles of Population Studies. Mumbai: Himalaya Publishing House.
2. Chandana, R. C. & Sidhu, M. S. (1980). Introduction to Population Geography. New Delhi: Kalyani.
3. Clarke, J. F. (1965). Population Geography. Oxford: Pergamon Press.
4. Garnier, B. (1966). Geography of Population. London: Longman.
5. Julfikar Hussain. (2021) Settlement Geography. Notion Press
6. Mandal, R. B. (1979). Introduction to Rural Settlement. New Delhi: Concept Publishing Company.
7. Nag Prithvish & Debnath G. C. (2021). Population Geography. Bharati Prakashan
8. Sawant, S. B. (1994). Population Geography. Pune: Mehta Publishing House.
9. Sivaramakrishnan, K. C., Kundu, A., & Singh, B. N. (2005). Handbook of urbanization in India: an analysis of trends and processes. Oxford University Press.
10. Singh, R. Y. (1994). Geography of Settlement, Jaipur: Rawat Publication.

GEO 505: Introduction to Statistical Methods in Geography (Credits-2)

Course Objectives:

1. To familiarize students with basic concepts of statistical methods
2. To acquaint the students with techniques of data analysis
3. To develop a strong foundation in statistical methods and their application to geographical research
4. To increase student's capacity to analyze and interpret statistical data.

Topic No.	Topics	Number of Lectures
1	Introduction: Nature of Geographical Data, Scales of Measurement Types of Data: Primary and Secondary, Discrete and Continuous Scales, Frequency distribution and its Graphical Representation	6
2	Concept and Measures of Central Tendency: arithmetic mean, median and mode, Selection of correct average for representing data	5
3	Concept of dispersion, Absolute and Relative measures of dispersion	5
4	Skewness and Kurtosis: Concept and Types	4
5	Time Series Analysis: Moving Averages	3
6	Concept and types of correlation Concept of regression: Simple and multiple regression, Use of correlation and regression in geographical research	7

Course Outcomes:

By the end of the course, the student will:

1. understand the basic principles of statistics in the context of geography.
2. apply appropriate descriptive statistical technique to analyze geographical data.
3. interpret statistical results effectively.
4. evaluate the use of descriptive statistics in geographical research.

Suggested Readings:

1. Croxton, C., Cowden, D. J., & Klein, S. (1967). Applied general statistics. Prentice Hall, New Jersey.
2. Frank, H., &Althoen, S. C. (1994). Statistics: Concepts and applications. Cambridge University Press.
3. Hammond, R., &McCullagh, P. S. (1985). Quantitative techniques in geography: an introduction. Clarendon Press, Oxford University Press.

4. Mann, P. S. (2020). Introductory statistics. John Wiley & Sons.
5. O'Brien, L. (2005). Introducing quantitative geography: measurement, methods, and generalized linear models. Taylor & Francis.
6. Rogerson, P. A. (2019). Statistical methods for geography: a student's guide. Sage Publications, London.

GEO 506: Practicals in Physical Geography
(Credits-2)

Course Objectives:

1. To acquaint the students with the role of geomorphic techniques in geography as the scientific method for understanding landforms.
2. To study the various aspects of profile analysis.
3. To focus on various climatic diagrams.
4. To understand the concept of water budget.

Topic No.	Topics	Number of Practicals
Section A: Geomorphology		
1	Profile Analysis: Longitudinal, Superimposed, Projected and Composite, Intervisibility of Terrains	4
2	Slope and Aspect Maps	3
Section B: Geomorphology		
1	Wind Rose Diagram (Simple and Compound), Climographs, Hythergraphs, Circular Graphs: Climatograph	5
2	Water Budget Diagram	3

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Course Outcomes:

By the end of the course, the student will:

1. understand the different types of profile analysis.
2. examine the slope and aspects maps to understand topographical variations.
3. learn important applied aspects of climatology with the help of climatic diagrams.
4. Construct water budget diagram.

Suggested Readings:

1. King, C. A. M. (1966): Techniques in Geomorphology, Edward Arnold Ltd., London
2. Lutgens, F. K. and Tarbuck, E. J. (2010): The Atmosphere: An Introduction to Meteorology, Pearson Prentice Hall, New Jersey
3. Miller, A. A. (1953): The Skin of the Earth, Methuen and Co. Ltd., London

4. Monkhouse, F. J. and Wilkinson, H. R. (1964): Maps and Diagrams: Their Compilation and Construction, Metheun and Co. Ltd., London
5. Singh, S. (1998): Geomorphology, Prayag Pustak Bhawan, Allahabad
6. Strahler, A. N. (1964): Quantitative Geomorphology of Drainage Basins and Channel Networks, In: Handbook of Applied Hydrology, Ven Te Chow, Ed., Section 4-II, McGraw-Hill Book Company, New York

GEO 507: Practicals in Human Geography
(Credits-2)

Course Objectives:

1. To impart adequate knowledge and data representation skills.
2. To enhance the understandings framing the questionnaire, data collection, application of models and report writhing.

Topic No.	Topic Name	Number of Practicals
Section A: Population and Settlement Geography		
1	Methods of Representing Population and Settlement Data	2
2	Application of Models Using Data: Dependency Ratio, Spatial Interaction Models: Potential Model, Gravity Model	3
3	Methods of Field Study: Preparation of Questionnaire /Interview Schedules and Report Writing	2
Section B: Economic Geography		
4	Methods of Representing and Mapping of Economic Data	3
5	Measures of Transport Network	3
6	Location Quotient	2

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Course Outcomes:

By the end of the course, the student will:

1. understand the various concepts and methods of Human Geography.
2. apply practical knowledge for the analysis of project work as well as research.
3. apply models to different geographical situations.

Suggested Readings:

1. Chorley, R. J., & Hagget, P. (1972). Socio-economic Models in Geography. London: Mathuen and Co.
2. Liendsor, J. M. (1997). Techniques in Human Geography. London: Routledge.
3. Lloyd P., & Dicken, B. (1972). Location in Space: A Theoretical Approach to Economic Geography. New York: Harper and Row.
4. Monkhouse, F. J., & Wilkinson, H. R. (1971). Maps and Diagrams. London: Methuen and Co.
5. Wood, A., & Roberts, S. (2011). Economic Geography: Places, Network and Flows. London: Routledge.

GEO 511: Geography of India
(Credits-2)

Course Objectives:

1. To provide an in-depth understanding of physiography, drainage and climatic condition of India.
2. To get acquainted with the knowledge of demographic, social and cultural attributes of India.
3. To understand the role of agriculture in Indian economy along with contemporary issues faced in India.

Topic No.	Topic Name	Number of Lectures
1	India: Location, Extent and Administrative Divisions	2
2	Major Physical Regions I: Geology, Physiography and Soil	5
3	Major Physical Regions II: Drainage, Climate, and Vegetation	5
4	Religion, Language and Races	5
5	Population in India: Characteristics and Challenges	5
6	Role of Agriculture in Indian economy; Multinationals and Liberalization; International Trade.	4
7	Contemporary Issues: Energy crisis, Water Security	4

Course Outcomes:

By the end of the course, the student will:

1. explore the diverse physical, social and cultural aspects the country.
2. understand the inter-play between agriculture and industry along with international trade that shapes Indian economy.
3. apply the knowledge of global issues to that are applicable to India.

Suggested Readings:

1. Dutta, R., & Sundaram, K. P. M. (2002). Indian Economy. S. New Delhi: Chand Publications.
2. Kale, V. S. (2014). Landscapes and Landforms of India, Dordrecht: Springer.
3. Khullar D. R. (2011). India A Comprehensive Geography, Ludhiana: Kalyani Publishers.
4. Sharma, H. S., & Kale, V. S. (2009). Geomorphology in India, Allahabad: Prayag Pustak Bhavan.
5. Shivkumar, A. K., Panda, P., & Ved, R.R. (2013). Handbook of Population and Development in India, Oxford: Oxford University Press.

6. Singh, G. (2010). A Geography of India, Delhi: Atma Ram and Sons.
7. Singh, R. L. (1993). India: A Regional Geography. Varanasi: National Geographical Society of India.
8. Spate, O. H. K. (1954). A General and Regional Geography, London: Methuen publisher.

GEO 512: Practicals in Cartographic Techniques (Credits-2)

Course Objectives:

1. Introduce students with various cartographic techniques.
2. To understand the basic components of map and its attributes.
3. To get trained with map scales and projections.

Topic No.	Topic Name	Number of Practicals
1	Nature and Scope of Cartographic Techniques: History and Development and its Importance in GIS Representations.	2
2	Scales, Data and their Representation: Conversion types, Enlargement and reduction of Maps, 2D and 3D diagrams; Map Characteristics: Scale, Accuracy, Extent, Database, and Topology	2
3	Map Projections: Construction of Cylindrical, Conical, Zenithal, and modified	4
4	Plots: Semi-log and log on X and Y axis, Whisker and box methods, Scatter plot	4
5	Maps and their types: Choropleth, Isopleth Dot, Map Features: Point, Line, and Polygon	3

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Course Outcomes:

By the end of the course, the student will:

1. acquire skills in map-making and spatial representation of geographical data.
2. create two-dimensional and three-dimensional diagrams that will assist in analysing information.
3. utilize the principles of projection and scales for map-making

Suggested Readings:

1. Singh, R. L. (1979): Elements of Practical Geography, Kalyani Publishers, New Delhi
2. Robinson, A. H., Morrison, J. L., Muehrcke, P. C., Kimerling, A. J. Guptill, S. C. (1995): Elements of Cartography, Wiley, New York
3. Ramamurthy, K. (1982): Map Interpretation, Rex Printers, Madras
4. Gupta, K. K. Tyagi, (1992): Working with maps, Survey of India Publication, DST, New Delhi
5. Understanding Map Projection (2003-2004): GIS by ESRI, Redlands
6. Shyam Bhatia (1963): Elementary Map Work Metropolitan book co. pvt. ltd.

GEO 513: Introduction to Remote Sensing
(Credits-2)

Course Objectives:

1. To gain knowledge about remote sensing and aerial photography technique, the process, electromagnetic radiation and its use for remote sensing, different platforms, orbits, sensors and cameras.
2. To learn key concepts like atmospheric windows, blackbody and radiation laws.
3. To get familiarize with Indian Remote Sensing Program.

Topic No.	Topic Name	Number of Lectures
1	Remote Sensing: Definition, Principle, History, Stages and Types, Advantages of Remote Sensing, Platforms, Satellites – Types andOrbits	6
2	Electromagnetic Radiation (EMR): Characteristics, EMR Spectrum, Blackbody, Radiation Laws	5
3	Interaction of EMR with Atmosphere and Earth's Surface: Reflection, Absorption, Transmission, Scattering and Refraction. Atmospheric Windows	5
4	Sensors and Scanning Systems, Sensor Performance Parameters, MSSand DEM Images, FCC and TCC	4
5	Fundamentals of Aerial Photography, Aerial Cameras, Geometric Characteristics of Aerial Photographs	4
6	Photo Scale, Image Displacement, Parallax and Stereoscopy, Elements of Photo Interpretation, Digital Photogrammetry	3
7	Indian Remote Sensing Satellites – Indian Remote Sensing Program, Satellite Series, Sensors, Resolution	3

Course outcome:

By the end of the course, the student will:

1. gain knowledge about basics of remote sensing, its stages, different platforms, electromagnetic spectrum, black body and radiation laws.
2. understand how electromagnetic radiation interacts with atmosphere, Earth's surface.
3. possess knowledge about aerial photography, measurements from photographs, satellite image, interpretation.

Suggested Readings:

1. Campbell, J. B. (2002), Introduction to Remote Sensing. London: Taylor and Francis.
2. Joseph, G. (2003). Fundamentals of Remote Sensing, Hyderabad: University Press.
3. Ollier Lillesand, T. M., & Ralph, K. W. (2008). Remote Sensing and Image Interpretation. Singapore: John Wiley and Sons.

4. Sabins, F. F. (1996). Remote Sensing: Principles and Interpretation, San Francisco: W. H. Freemanand Company.
5. Tempfi, K., Kerle, N., Huurneman, G., & Janssen, L. F. (Eds) (2009). Principles of Remote Sensing – An Introductory Text Book. Netherlands: The International Institute for Geoinformation Science.

GEO 514: Practicals in Remote Sensing and Map Interpretation (Credits-2)

Course Objectives:

1. To introduce students to different types of colour composite image and their interpretation.
2. To acquaint students with Survey of India toposheets and their interpretation.
3. To familiarize students with different methods of determining aerial photograph scale, determination of object height and satellite data formats.

Topic No.	Topic Name	Number of Practicals
1	Introduction of SOI toposheets, Indexing, Signs and Symbols, Interpretation of Toposheets	5
2	Interpretation of Satellite Image, Identification of Ground Features, Deriving Land Use and Land Cover Map	3
3	Geometry of Aerial Photograph, Determination of Scale of Aerial Photograph – Different Methods	2
4	Interpretation of Aerial Photograph: Stereopair and Single Image	2
5	Procurement of Satellite Data, Satellite Data Products and Formats	1
6	Estimation of Object Height from Single Vertical Aerial Photograph and Stereopair	1
7	Onscreen Demonstration of Handling Satellite Data with Image Processing Software	1

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Course outcome:

By the end of the course, the student will:

1. equipped with the understanding of remote sensing data and its use, particularly satellite images and aerial photographs.
2. trained in calculation of scale of aerial photograph and related basic estimations.

Suggested Readings:

1. Campbell, J. B. (2002), Introduction to Remote Sensing. London: Taylor and Francis.
2. Joseph, G. (2003). Fundamentals of Remote Sensing, Hyderabad: University Press.
3. Ollier Lillesand, T. M., & Ralph, K. W. (2008). Remote Sensing and Image Interpretation. Singapore: John Wiley and Sons.
4. Sabins, F. F. (1996). Remote Sensing: Principles and Interpretation, San Francisco: W. H. Freemanand Company.
5. Tempfi, K., Kerle, N., Huurneman, G., & Janssen, L. F. (Eds) (2009). Principles of Remote Sensing – An Introductory Text Book. Netherlands: The International Institute for Geoinformation Science.

GEO 515: Disaster Management
(Credits-2)

Course Objectives:

1. To introduce students the concept of disaster and its connection with Geography.
2. To acquaint the students with the six stages of Disaster Management and their application in different areas as well as their management.
3. To make the students aware of the need for protection and disaster management as well as the use of geospatial technology in Disaster Management.

Topic No.	Topic Name	Number of Lectures
1	Disaster: Meaning, Types- natural and manmade disasters and Stages of Disaster Management	3
2	Preparedness: Concept of preparedness. Public Awareness and Training. Early Warning System for different disasters.	4
3	Risk assessment: Meaning, and calculation of risk, Identification and quantification of Potential Hazards and Vulnerabilities, Potential impact of various disasters	4
4	Response and Emergency Management: Meaning, Response during and after disaster event, setting up of emergency services.	3
5	Mitigation and Risk Reduction: Measures of Mitigation and Risk Reduction, Structural and Non-structural Measures,	4
6	Recovery and Rehabilitation: Long-term rehabilitation efforts. Economic, Social, and Environmental Aspects of Recovery.	4
7	Role of Geography in Disaster Management: Hazard mapping, Resource Allocation, rehabilitation planning	4
8	Geospatial Technology in Disaster Management: Preparedness and Planning, Disaster Mapping, Recovery and Rehabilitation	4

Course Outcomes:

By the end of the course, the student will:

1. understand all the types of natural and manmade disasters.
2. educate all the stages and their disaster-wise severity for the prevention of disasters.
3. develop the ability in the field of management, planning and use of advanced technology in Disaster Management.

Suggested Readings:

1. Alexander, D. E. (2013). Natural Disasters. Springer.
2. Coppola, D. P. (2015). Introduction to International Disaster Management. Butterworth-Heinemann.

3. Haddow, G. D., Bullock, J. A., & Coppola, D. P. (2017). Introduction to Emergency Management. Butterworth-Heinemann.
4. Kreps, G. A., & Drabek, T. E. (Eds.). (2016). Social Vulnerability to Disasters. CRC Press.
5. Rodriguez, H., Quarantelli, E. L., & Dynes, R. R. (Eds.). (2007). Handbook of Disaster Research. Springer Science & Business Media.
6. Wisner, B., Gaillard, J. C., & Kelman, I. (2012). Handbook of Hazards and Disaster Risk Reduction. Routledge.

GEO 516: Basics of Geospatial Techniques: Practicals (Credits-2)

Course Objectives:

1. To introduce students to basics of remote sensing and geographical information systems.
2. To familiarize students with satellite image and aerial photo interpretation.

Topic No.	Topic Name	Number of Practicals
1	Remote Sensing: Definition, Principle, History, Stages and Types, Advantages of Remote Sensing, Platforms, Satellites – Types and Orbits	2
2	Electromagnetic Radiation (EMR): Characteristics, EMR Spectrum, Blackbody, Radiation Laws	2
3	Interaction of EMR with Atmosphere and Earth's Surface: Reflection, Absorption, Transmission, Scattering and Refraction, Atmospheric Windows	2
4	GIS: Definition, History and Development, Advantages of GIS	1
5	Geographical Data Models: Raster and Vector, Spatial and Non-Spatial, Types of Attribute Data, Topology	3
6	Elements of Image Interpretation and Interpretation of Satellite Image	3
7	Scale of Aerial Photograph, Interpretation of Aerial Photograph	2

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Course Outcomes:

By the end of the course, the student will:

1. become familiar with fundamentals of remote sensing and geographical information systems.
2. acquire basic knowledge of photo and image interpretation.

Suggested Readings:

1. Burrough, P. A., & McDonnell, R. A. (1998). Principles of Geographical Information Systems. New York: Oxford University press Inc.
2. Campbell, J. B. (2002), Introduction to Remote Sensing. London: Taylor and Francis.
3. Chang, K. T. (2008). Introduction to Geographic Information Systems. Avenue of the Americas, McGraw-Hill,
4. Environmental Systems Research Institute, Inc. (1998). Understanding GIS: The ARC/INFO Method. Redlands: ESRI Press
5. Joseph, G. (2003). Fundamentals of Remote Sensing, Hyderabad: University Press.
6. Ollier Lillesand, T. M., & Ralph, K. W. (2008). Remote Sensing and Image Interpretation. Singapore: John Wiley and Sons.

GEO 521: Research Methodology
(Credits-2)

Course Objectives:

1. To develop research aptitude among the students.
2. To provide comprehensive understanding of the technique involved in conducting research.
3. To develop creative and critical thinking skills among the students.
4. To enhance the ability of students to conduct research ethically and meticulously.
5. To prepare the students for future research endeavors.

Topic No.	Topic Name	Number of Lectures
1	Methods of Geographical Studies	4
2	Research: Definition, Types (Pure and Applied), Classification	6
3	Routes of Explanation: Inductive and Deductive	4
4	Hypothesis, Theories, Laws and Models	6
5	Research Question, Objectives and Significance of Research	4
6	Research Design: Data Collection and Analysis	6
7	Recent Trends in Geographical Research: Physical and Human Geography	6
8	Ethics in Scientific Research: Plagiarism, Copyrights	4
9	Scientific Journals (Impact Factor, Citation)	4
10	Intellectual Property Rights	5
11	Presentation of Research Findings: Report Writing, Presentation and Formatting	6
12	Research Proposal	5

Note: a) The concerned teacher may add some points related to the subject.

Course Outcomes:

By the end of the course, the student will:

1. develop research aptitude among the students through comprehensive understanding of core concepts in research, review of research.
2. find the research questions, statement of research problem and frame the aims and objectives of the research.
3. frame research methodology and select appropriate methods.

4. prepare research reports and presentation for publication ethically.
5. able to creative and critical thinking abilities essential for research among the students.

Suggested Readings:

1. Gomez, B., & Jones, J. P. III (2010). Research Methods in Geography: A Critical Introduction. John Wiley and Sons.
2. Goudie, A. (Ed) (2004): Encyclopedia of Geomorphology, Routledge, London
3. Gregory, D., Johnston, R., Pratt, G., Watts, M. & Whatmore, S. (2009). The Dictionary of Human Geography. Singapore: Wiley-Blackwell.
4. Montello, D. and Sutton, P. (2013). An Introduction to Scientific Research Methods in Geography and Environmental Studies. SAGE Publications.
5. Warf, B. (Ed) (2006). Encyclopedia of Human Geography. London: SAGE Publication

Year-I
Semester-II

GEO 531: Coastal Geomorphology
(Credit-4)

Course Objectives:

1. To make the students acquainted with basic concepts of and related t0 coast, shore and shore zones, coastline, coastal zones and coastal environment.
2. To understand the waves, tides and currents and related concepts.
3. To know the characteristics of coastal sediments, their transportation, and deposition.
4. To understand coastal processes and landforms of erosion, deposition and construction.
5. To know the coastal environment concerning hazard management, and coastal zone management.

Topic No.	Topic Name	Number of Lectures
1	Coastal Environment: An Introduction Coasts and coastlines, importance of coasts	3
2	Coastal Energy: Waves- formation, properties, energy, Classification; Tides- causes, classification, Models; Coastal Currents- Types and importance	9
3	Coastal Processes: Erosion- Process types, causes and effects; Coastal Deposition: Process, causes and effects	5
4	Coastal Sediments: Sediment Dynamics, Types, Sediments in different coastal Environment.	4
5	Coastal Landforms of Erosion and their importance- Sea Cliff, Caves, Stacks, Shore platform	6
6	Coastal Landforms of Deposition and their importance- Beaches, Sandbars, Salt marshes, Tidal flats, Coastal dunes and Deltas	8
7	Classification of Coasts—Primary and Secondary	6
7	Coastal Geomorphology Modelling: Numerical and Conceptual models	6
8	Coastal Hazards and Mitigation Strategies: Storm surges and Flooding, Erosion of Coast, Tsunamis, Sea level rise	4
9	Human Impacts on Coastal Geomorphology: Coastal Development, Engineering projects, Residential and Recreational Activities.	4
10	Coastal Management and Conservation: Coastal zone management plans, policies and Practices, Integrated Coastal Zone Management (ICZM), CRZ Policy	5

Course Outcomes:

By the end of the course, the student will:

1. be acquainted with concepts related to coast, shore and shore zones, coastline, coastal zones and coastal environment.
2. understand the cause and characteristics of waves, tides and currents and their importance in a coastal environment.

3. know the characteristics of coastal sediments and related environmental conditions.
4. understand coastal processes like erosion, deposition and construction and landforms.
5. understand the coastal environment for hazard management and coastal zone management.

Suggested Readings:

1. Bird, E. C. F. (2020). Coastal geomorphology: An introduction (2nd ed.). John Wiley & Sons.
2. Cowell, P. J., & Thom, B. G. (2021). Introduction to coastal processes and geomorphology (3rd ed.). Cambridge University Press.
3. Hesp, P. (2019). Coastal dunes: Ecology and conservation. Cambridge University Press.
4. Leatherman, S. P., & Booth, D. B. (Eds.). (2020). Coastal erosion and wetland change in Louisiana: A digital atlas illustrating land loss and wetland change in coastal Louisiana. Springer.
5. Masselink, G., & Hughes, M. (Eds.). (2020). Coastal geomorphology: An introduction. Oxford University Press.
6. Schwartz, M. L. (2019). Coastal geomorphology: An introduction (2nd ed.). Rowman & Littlefield Publishers.

GEO 532: Synoptic Climatology
(Credits-4)

Course Objectives:

1. The prime objective of the course is to train students in various key concepts of synoptic climatology.
2. To learn about atmospheric motion, its stability and the role played by different lapse rates in atmospheric stability.
3. To acquire knowledge of air masses and fronts, their classification and weather associated.
4. To gain an understanding of how cyclones form, how precipitation occurs and about weather patterns.
5. To comprehend forecasting techniques and application of climatology knowledge in different fields.

Topic No.	Topic Name	Number of Lectures
1	Introduction, Definition, Scope of Synoptic Climatology, Weather Observations and Analysis, Synoptic Charts	4
2	Synoptic Scale Motions – Global Scale, Synoptic Scale, Meso Scale, Laws of Motion, Atmospheric Forces	4
3	Synoptic Charts and Maps, Atmospheric Stability: Dry Adiabatic Lapse Rate and Saturated Adiabatic Lapse Rate, Changes in Stability, Factors Affecting Stability	8
4	Air Masses: Characteristics, Source Regions, Identification and Modification, Major Air Masses of World and the Associated Weather	6
5	Fronts: Frontogenesis, Frontolysis, Characteristics of Fronts, Polar Front Theory, Frontal Types: Cold, Warm, Stationary and Occluded Fronts, Frontal Weather	7
6	Cyclones and Anticyclones: Wave Cyclone, Tropical Cyclone – Origin, Structure, Life Cycle, Rossby Waves and Western Disturbances, Anticyclones: Cold and Warm Core Systems, Anticyclonic Weather	10
7	Weather Patterns: Precipitation Processes: Ice Crystal Theory, Collision Coalescence Theory, Heat and Cold Waves- Classification, Occurrence in India, Thunderstorms- Origin, Stages of Development and Structure, Tornadoes - Development	9
8	Synoptic Scale Forecasting: Types – Short, Medium and Long Range, Methods – Climatological, Synoptic, Trend, Persistence, Analog, Numerical Weather Prediction	5
9	Application of Synoptic Climatology in Pollution Studies, Aviation and Navigation, Meteorological Factors Affecting Air Pollution	7

Course Outcomes:

By the end of the course, the student will:

1. understand the nature of synoptic climatology, synoptic scale motions, synoptic charts.
2. develop understanding of atmospheric stability, different lapse rates.
3. possess advanced knowledge about air masses and their classification and modification.
4. comprehend frontogenesis, frontolysis, different types of fronts and frontal weather.
5. gain knowledge about cyclones anticyclones, their formation, structure and associated weather
6. will learn about precipitation processes, heat waves, forecasting and applications of synoptic climatology in various fields.

Suggested Readings:

1. Barry, R. G., & Perry, A. H. (1973). Synoptic Climatology: Methods and Applications. London: Methuen and Co. Ltd.
2. Navarra, J. G. (1979). Atmosphere, Weather and Climate. Philadelphia: W. B. Saunders Company.
3. Petterson, S. (1969). Introduction to Meteorology. New York: McGraw Hill.
4. Rama Sastry, A. A. (1984). Weather and Weather Forecasting. Publications Division, Ministry of Information and Broadcasting, Government of India, New Delhi
5. Stringer, E. T. (1972). Foundations of Climatology. New York: W. H. Freeman and Company.

GEO 533: Agriculture Geography
(Credits-4)

Course Objectives

1. To make students aware of the nature scope and origin of the discipline
2. To cover the history present status and future prospects of the agriculture in India and world
3. To analyze the effects of economic physical and social factors on agriculture
4. To learn about the classification perspectives on types of agriculture
5. To explorer the relationship between agriculture hunger in food security
6. To study the prospects of globalization and agriculture

Topic No.	Topic Name	Number of Lectures
1	Nature, Scope and Significance of Agricultural Geography, Various Approaches to Study of Agricultural Geography	6
2	Origin and Dispersal of Agriculture	4
3	Physical and Economic Factors Affecting Agriculture, Land Classification	6
4	Basis of Agricultural Classification, Agricultural Types: Intensive, Subsistence, Extensive, Commercial and Plantation Agriculture	8
5	New Perspectives on Types of Agriculture	4
6	Agricultural Regionalization	8
7	Measures of Agricultural Productivity	6
8	Agricultural Land Use Models: Critical Review, Contemporary Perspective	8
9	Crisis of Agriculture, Aspects of Food Security and World Patterns of Hunger	6
10	Globalization and Agriculture	4

Course Outcomes:

By the end of the course, the student will:

1. learn about the evolution, nature and scope of the discipline in its entirety.
2. learn about the contemporary status add relevance of agriculture as an economic activity
3. learn about the types, both, conventional and modern, of Agriculture and their importance.
4. realize the importance of sustainable agriculture and its positive impact on reducing food insecurity.

Suggested Readings:

1. Grigg, D. (1995). An Introduction to Agricultural Geography. London: Routledge.
2. Hussain, M. (1978). Agricultural Geography. Jaipur: Rawat Publication.

3. Singh, J., & Dhillon, S. S. (1994). Agricultural Geography. New Delhi: Tata McGraw Hill Publishing Co. Ltd.
4. Symons, L. (1970). Agricultural Geography. London: G. Bell and Sons Ltd.
5. Vaidya, B. C. (1997). Agricultural Land use in India. New Delhi: Manak Publications.

GEO 534: Population Geography
(Credits-4)

Course Objectives:

1. To provide in-depth understanding of population geography.
2. To understand levels, trends and differentials of population dynamics.
3. To learn advanced models and theories and its applications, role of geospatial technology in policy and planning.

Topic No.	Topic Name	Number of Lectures
1	Introduction: Definitions, Nature and Scope, Historical Development, Approaches to Study of Population Geography	5
2	Population Structure and Characteristics	6
3	Theories of Population Growth: Malthus, Optimum Population Theory, Density Principle, Logistic Law, Diet Principle	6
4	Concepts of Mortality, Fertility and Nuptiality, Theories of Fertility: Social capillarity, Cultural Lag, Theory of change and response, Theory of inter-generational wealth flow	8
5	Concepts, Theories of Migration: Ravenstien's Law, Lee's Migration Framework	6
6	Contemporary Population trends: Transitions of Fertility, Mortality and Migration.	6
7	Contemporary Population Issues: Aging, Educational, Population Growth, Displacement	6
8	Climate Change and Population Dynamics	6
9	Population as Recourse: Dose Population hinders Development?	5
10	Population and Health Policies in India and Initiatives at Global Level, Role of Population in Public Health	6

Course Outcomes:

By the end of the course, the student will:

1. get acquainted with the approaches to study population geography, various key concept along with dynamic nature and scope, evolution of Population Geography.
2. comprehend about levels, trends and differentials of population dynamics.
3. be able to criticize and evaluate the implications of key changes in the world's population and associated theories and practice through time.
4. recognize various population issues and evaluate population polices with implication.

Suggested Readings:

1. Aggarwal, S. M. (1974): India's Population Problems, McGraw Hill Publishing Co. Ltd., New

Delhi

2. Berelson, B. (1974): Population Policy in Developed Countries, MacMillan, London
3. Bhende, A. A. and Kanitkar, T. (2011): Principles of Population Studies, Himalaya Publishing House, Mumbai
4. Chandana, R. C. (2013): Population Geography, Kalyani Publications, Delhi
5. Coale, A. J. and Hoover, E. M. (1958): Population Growth and Economic Development in Low Income Countries, Amit Publishers, New Delhi
6. Desoza, A. A. (1983): Indian Population Problem in Perspective and Social Action, Concept Publications, New Delhi
7. Hazel, B. R. (1994): Population Geography, Singapore Publishers Pvt. Ltd., Singapore
8. Rao, V. K. R. V. (1966): Education and Human Resource Development, Allied Publishers, Bombay
9. Stockwell, E. G. (1968): Population and People, Quadrangle Books, Chicago
10. UN (1962): Demographic Aspects of Manpower, Report 1, Sex and Age Patterns of Participation in Economic Activities, Population Studies No. 33, New York

GEO 535: Environmental Geomorphology
(Credits-4)

Course Objectives:

1. To understand the role of Geomorphology in the assessment of Environment.
2. To study the characteristics of landforms and Process in the Resources Management.
3. To Understand the Geomorphological Impact due to Natural processes and human activities.

Topic No.	Topic Name	Number of Lectures
1	Introduction to Environmental Geomorphology, Anthropocene: Man as a Geomorphological Agent	5
2	Geomorphological Resources: Geomorphological raw material in construction, Geomorphology and Natural Resources-Soil, Landforms as assets, Geomorphological Impact Assessment (GIA)	8
3	Geomorphology in Land Capability Classification Physiographic Zonation of Land Surface	7
4	Geomorphology in Watershed Management	6
5	Geomorphological Hazards and Environmental Damages: Soil Erosion, Water erosion, Degradation of Land surface, Models of Soil Erosion, Damages caused by Landslides	8
6	Slope Instability: Causes and Effects, Mitigation measures	6
7	Geomorphology and Forest Resources: Distribution, Forest fire	4
7	Geomorphological Impacts- Agriculture, Recreation, Engineering projects.	6
8	Geodiversity, Geomorphosites: Importance and Human Impact	4
9	Geoconservation: Need and Techniques	6

Course Outcomes:

By the end of the course, the student will:

1. be able to understand the role of Geomorphology in Environmental assessment.
2. acquire the skill of assessment of Geomorphological parameters and their role in Environmental analysis.
3. get knowledge of 'How to apply knowledge of Geomorphology?' to address the environmental problems.

Suggested Readings:

1. Anderson, R. S. (2010). Geomorphology: The Mechanics and Chemistry of Landscapes. Cambridge University Press.
2. Goudie, A. (2001). Nature of the Environment (4th Edition), Blackwell Publishers Ltd. Oxford, UK.

3. Goudie, A. (2013). Human Impact on Natural Environment (7th Edition), Wiley-Blackwell Publishers, West Sussex, UK.
4. Knighton, D. (2014). Fluvial Forms and Processes: A New Perspective. Routledge.
5. Montgomery, D. R. (2003). Soil Erosion and Agricultural Sustainability. Proceedings of the National Academy of Sciences, 100(20), 11157-11161.
6. Panizza M. (2001) − Geomorphosites: concepts, methods and example of geomorphological survey. Chinese Science Bulletin, 46, Suppl. Bd, 4-6.
7. Richards, K. S. (2013). Rivers: Physical, Fluvial, and Environmental Processes. John Wiley & Sons.

GEO 536: Regional Climatology
(Credits-4)

Course Objectives:

1. To explore the climatic characteristics, patterns, and variability of various climatic regions of the world.
2. To understand the factors influencing regional climate, analyzing climate data, and interpreting climatic phenomena within a geographical context.
3. To emphasize the application of climatological principles in regional and environmental planning.

Topic No.	Topic Name	Number of Lectures
1	Introduction to Regional Climatology, Historical Development and Significance	4
2	Climate Classification Systems: Climates of the World	6
3	Climatic Features of Tropical Regions: Atmospheric Circulation, Tropical Cyclones (origin, structure and life cycle) Climatic Features of Temperate Regions: Atmospheric Circulation, Air masses and fronts, Frontal Weather, Extratropical Cyclones (origin and life cycle)	6
4	Regional Temperature patterns and Variability, Temperature anomalies, heat wave and cold wave, drivers influencing regional temperature variability	6
5	Regional Precipitation patterns and Variability: Precipitation Processes, Precipitation extremes, droughts and monsoon patterns	5
6	Daily Weather and Atmospheric Stability: Temperate and Tropical Regions	4
7	Regional Climatology of India, Agro-climatic classification	5
8	Urbanization and Regional Climate: Urban heat island effect, LULC change and climate	5
9	Regional Climate change and variability, Impacts of Regional Climate changes: Ecosystem and Biodiversity impacts, Socio-economic impacts (agriculture, water resources, human health and communities) Vulnerability and Risk Assessment, Climate Adaptation and Mitigation Strategies Assessment of Climate Change over the Indian Region (Temperature and Precipitation Changes in India, Droughts and Floods, Extreme Storms and Sea Level Rise, Indian Ocean Warming, Climate Change over Himalayas)	10
10	Application of Regional Climatology in regional planning and environmental planning, Tourism Climate Index, Holiday Climate Index	9

Course Outcomes:

By the end of the course, the student will:

1. understand the principles and concepts of regional climatology.
2. gain knowledge of the major climatic systems, regional climatic classification and the impacts of climate change on different regions.
3. identify the drivers affecting regional climate.
4. apply climatological knowledge in regional planning and environmental management.

Suggested Readings:

1. Awasthi, A. (1995). Indian climatology. APH Publishing Corporation.
2. Blair, T. A. (1942). Climatology: general and regional. Prentice Hall, New York.
3. Chatterjee, S. B. (1953). Indian climatology: Climostatics: climatic classification of India, with special reference to the monsoons.
4. Lutgens, Frederic K. & Tarbuck, Edward J. (2010). The Atmosphere: An Introduction to Meteorology. New Jersey: Pearson Prentice Hall.

GEO 538: Population Resources and Planning
(Credits-4)

Course Objectives:

1. To familiarize the students with the geographical importance of population resources and planning with definition, concepts and role of population resource.
2. To impart the knowledge on scarcity and unemployment, poverty and its effect on population development.
3. To use information, theories, concepts and skills to solve problems of Manpower planning by understanding population potential.
4. To gives opportunity to students to develop an opinion and back it up with reasoning and evidence with the help of Policies and SDGs.

Topic No.	Topic Name	Number of Lectures
1	Introduction: definition, nature and scope, concepts, Role of population resource	4
2	Scarcity of skilled labour and unemployment in India	6
3	Poverty and its effects on Population Development	6
4	Technological advancement and population development	5
5	Population Potential for population resource planning	6
6	Manpower management in India: Training and Development	5
7	Models for Population development: Lewis, Rosenstein Rodan	5
8	Manpower planning: sector wise, multi-level	6
9	Transformation of status and roles of women and men in labours, Demographic implications of recent changes in gender roles, families and household	6
10	Case studies of manpower development in developed and developing nations	5
11	Sustainable development goals and its implications for population Development: Ageing, Migration, Poverty Eradication	6

Course Outcomes:

By the end of the course, the student will:

1. learn various key concept along with dynamic role of population resource planning.
2. be able to discover and understand scarcity of skilled manpower, poverty like issues along with understanding of population potential.
3. be able to do the critical appraisal of theories and models for manpower planning.
4. apprehend with various regional and global issues of population resources.

5. be able to critically examine the policy and programmes related to manpower planning.

Suggested Readings:

1. Rao, V. K. R. V. (1966): Education and Human Resource Development, Allied Publishers, Bombay
2. Shivkumar, A. K., Panda, P. and Ved, R.R. (2013): Handbook of Population and Development in India, Oxford University Press, Oxford
3. Stockwell, E. G. (1968): Population and People, Quadrangle Books, Chicago
4. UN (1962): Demographic Aspects of Manpower, Report 1, Sex and Age Patterns of Participation in Economic Activities, Population Studies No. 33, New York
5. UN (1973): The Determinants and Consequences of Population Trends, Vol. I, ST/SOA/SER.A/50, Population Studies No. 50, New York

GEO 541: Coastal Geomorphology: Practicals
(Credits-2)

Course Objectives:

1. To understand the coastal landforms and the landscape.
2. To study the characteristics of waves and tides in the field and through laboratory analysis.
3. To assess the coastal landforms and their characteristics, and human activities in the coastal environment.

Topic No.	Topic Name	Number of Practicals
1	Study of Coastal Landforms Using Topographic Maps and Satellite Images	2
2	Wave Analysis, Recording of Waves in the Surf Zone	3
3	Tide Data Analysis and Classification	3
4	Beach/ Dune/ Sand Bar Profiles	3
5	Coastal Sediments: Sample Collection and Analysis	2
6	Observations and Recording of Human Activities in Coastal Areas	2

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Course Outcomes:

By the end of the course, the student will:

1. be able to interpret and understand the coastal landforms and their setup in the coastal regions.
2. learn to collect, analyse and interpret the wave and tide data.
3. be able to relate different human activities and their impact on coastal environment.

Suggested Readings:

1. Bloom, A. L. (2002). Geomorphology: A Systematic Analysis of Late Cenozoic, Landforms, New Delhi: Prentice- Hall of India.
2. Carter, R. W. G. (1988). Coastal Environments, London: Academic press ltd.
3. Dackombe, R. V., & Gardiner, V. (1983). Geomorphological Field Manual, London: George Allen and Unwin.
4. Goudie, A. (1990). Geomorphological Techniques. London: Routledge.
5. King, C. A. M. (1972). Beaches and Coasts, London: Edward Arnold.
6. Pethick, J. (1984). An Introduction to Coastal Geomorphology. London: Arnold-Heinemann.
7. Smith, M. J., Paron, P., & Griffiths, J. (2011). Geomorphological Mapping. Amsterdam: Elsevier.

GEO 542: Synoptic Climatology: Practicals
(Credits-2)

Course Objectives:

1. To make students understand working of different weather instruments.
2. To train students in mapping weather data and train them in field measurements of weather parameters.

Topic No.	Topic Name	Number of Practicals
1	Scientific Notation and Conversion in Different Units, Temperature Profile, Atmospheric Stability and Humidity	3
2	Instrumentation and Measurement Techniques of Weather Elements and Processing of Weather Data:	5
3	Station Model: Coding, Decoding and Plotting of Synoptic Data	3
4	Climatic Map Analysis: Daily Weather Reports, Preparation of Temperature and Pressure Distribution Maps	2
5	Field Work: Measurements with whirling psychrometer	2

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Course Outcomes:

By the end of the course, the student will:

1. understand the observation and measurement of weather parameters using various instruments.
2. be trained in field measurements and analysis of weather maps.

Suggested Readings:

1. Navarra, J. G. (1979). Atmosphere, Weather and Climate, Philadelphia: W. B. Saunders Company.
2. Jarraud, M. (2008). Guide to meteorological instruments and methods of observation (WMO-No. 8). World Meteorological Organisation: Geneva, Switzerland, 29.

GEO 543: Agriculture Geography: Practicals
(Credits-2)

Course Objectives:

1. To introduce students with the concept and practice of agricultural regionalization.
2. To teach them various agricultural regionalization techniques.
3. To make them aware about the importance of such techniques for sustainable agricultural development.
4. To make them aware of applications of such techniques in Indian agricultural context.

Topic No.	Topic Name	Number of Practicals
1	Methods of Crop Concentration and Diversification: Bhatia, Jasbir Singh, Gibbs and Martin	5
2	Crop Combination Techniques: Weaver, Thomas, Rafiullah	5
3	Measurement of Agricultural Efficiency: Bhatia and Kendell	5

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Course Outcomes:

By the end of the course, the student will:

1. learn about the concepts of agricultural regionalisation and methods of performing them.
2. learn about the concept of crop combination, concentration and diversification along with intensity and efficiency of cropping.
3. learn How physical and economic factors shape agricultural land use and derive profit or losses.

Suggested Readings:

1. Ali, M. (1979). Dynamics of Agricultural Development in India. New Delhi: Concept Publication.
2. Hussain, M. (1978). Agricultural Geography, Jaipur: Rawat Publication.
3. Singh, J., & Dhillon, S. S. (1994). Agricultural Geography. New Delhi: Tata-McGraw Hill Publication.
4. Yeats, M. H. (1978). An Introduction to Quantitative Analysis in Human Geography, Chicago: John and John Company.

GEO 544: Population Geography: Practicals
(Credits-2)

Course Objectives:

1. To enable students to describe and analyze the framework of population dynamics.
2. To acquire to calculate and interpret different indicators affecting spatially population dynamics.

Topic No.	Topics	Number of Practicals
1	Rate of Population Change, Population Projection	4
2	Basic Measures of Fertility and Mortality	4
3	Construction of Life Table	3
4	Singulate Mean Age at Marriage	2
5	Collection of Data on a Given Problem and Report Writing	2

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Course Outcomes:

By the end of the course, the student will:

1. get acquainted with the various techniques of population estimates.
2. utilize different measures related to population dynamics, singulate mean age at marriage and life table with relevance.
3. learn to collect, analyse and interpret the data and report writing.

Suggested Readings:

1. Agarwala, S. N. (1962). Age at Marriage in India, Allahabad: Kitab Mahal Pvt. Ltd.
2. Barclay, G. W. (1958). Techniques of Population Analysis, New York: John Wiley and Sons.
3. Mandal, R. B., Uyanga, J., & Prasad, H. (2007), Introductory Methods in Population Analysis, New Delhi: Concept Publishing Company.
4. Pathak, K. B., & Ram, F. (2013). Techniques of Demographic Analysis, Mumbai: Himalaya Publishing House.
5. Shryock, H. S. (1970). The Methods and Materials of Demography, New York: Academic Press.
6. Siegel, J. S., & Swanson, D. A. (2004). The Methods and Materials of Demography. Boston: Academic Press.
7. Taylor, P. J. (1977). Quantitative Methods in Geography. Boston: Hughton Miffin Co.
8. Wilkinson, F. J., & Monkhouse, H. R. (1966). Maps and Diagrams: Their Compilation and Construction. London: Metheun and Co.

GEO 545: Environmental Geomorphology: Practicals (Credits-2)

Course Objectives:

1. To understand the Practical application of Geomorphology in the Environment Management.
2. To understand and assess relief, slope and other characteristics of land surface and processes in the resources and watershed management.
3. To apply Geomorphology knowledge in impact assessment studies.

Topic No.	Topics	Number of Practicals
1	Geomorphic mapping for landforms, processes and material	2
2	Relief and slope mapping for land capability classification	2
3	Geomorphic techniques in watershed management	2
4	Soil and water erosion analysis: basin-scale erosion assessment	2
5	Slope stability assessment: slope angle, length, curvature and material analysis. Geomorphic impact analysis of slopes	2
6	Assessment of slope and relief for forest fire events	1
7	Geomorphological impact assessment: related to tourism, dam reservoirs and other engineering projects.	2
8	Geodiversity assessment, identification of geomorphosites and their mapping	2

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Course Outcomes:

By the end of the course, the student will:

1. help the students to understand techniques of landscape and environment assessment.
2. develop skill to do impact assessment of different natural process and human induced effects.
3. learn geomorphological techniques and will be able to apply suitable land and water conservation method
4. be trained to carry out Geomorphic Impact Assessment.

Suggested Readings:

1. Anderson, R. S. (2010). Geomorphology: The Mechanics and Chemistry of Landscapes. Cambridge University Press.
2. Goudie, A. (2001). Nature of the Environment (4th Edition), Blackwell Publishers Ltd. Oxford, UK.
3. Goudie, A. (2013). Human Impact on Natural Environment (7th Edition), Wiley-Blackwell Publishers, West Sussex, UK.

4. Knighton, D. (2014). Fluvial Forms and Processes: A New Perspective. Routledge.
5. Montgomery, D. R. (2003). Soil Erosion and Agricultural Sustainability. Proceedings of the National Academy of Sciences, 100(20), 11157-11161.
6. Panizza M. (2001) − Geomorphosites: concepts, methods and example of geomorphological survey. Chinese Science Bulletin, 46, Suppl. Bd, 4-6.
7. Richards, K. S. (2013). Rivers: Physical, Fluvial, and Environmental Processes. John Wiley & Sons.

GEO 546: Regional Climatology: Practicals
(Credits-2)

Course Objectives:

1. To provide students with a comprehensive understanding of climate classification schemes.
2. To identify various climatic patterns, such as heat waves, cold waves, and rainfall patterns.
3. To develop skills among students in applying statistical methods to analyze climate data.

Topic No.	Topics	Number of Practicals
1	Climate Classification Schemes: Modified Köppen-Geiger and Thornthwaites's classification scheme	5
2	Identification of Heat Waves and Cold Waves	2
3	Temperature Indices: Mean Temperature (Daily, monthly and annual), Temperature Range (Daily and annual) Rainfall Indices: Consecutive Dry Days, Consecutive Wet Days, Effective Rainfall	3
4	Trend Analysis: Linear Regression, Mann-Kendall (Manual and Excel)	3
5	Field Work	2

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Course Outcomes:

By the end of the course, the student will:

1. identify climatic regions of the world using different climatic classification schemes.
2. identify and analyze heat and cold waves based on temperature data and specific threshold criteria.
3. compute various temperature and precipitation indices and interpret their implications for climate analysis.
4. apply trend analysis techniques to assess long-term trends in temperature and precipitation data.

Suggested Readings:

1. Blair, T. A. (1942). Climatology: general and regional. Prentice Hall, New York.
2. Chatterjee, S. B. (1953). Indian climatology: Climostatics: climatic classification of India, with special reference to the monsoons.
3. Lutgens, Frederic K. & Tarbuck, Edward J. (2010). The Atmosphere: An Introduction to Meteorology. New Jersey: Pearson Prentice Hall.
4. Oliver, J. E. (1981): Climatology: Selected Applications, V. H. Winston and Sons, London
5. Thornthwaite, C. W., & Mather, J. R. (1957). Instructions and tables for computing potential evapotranspiration and the water balance, Drexel Institute of Technology, Laboratory of Climatology.

GEO 548: Population Resources and Planning: Practicals (Credits-2)

Course Objectives:

1. To impart adequate skills so as to enable the students to take up career in the field of population resource planning.
2. To developed the ability of estimating population potential for population resources using different methods.
3. To developed the analysing skill of the students to measure the scope of population resource planning.

Topic No.	Topics	Number of Practicals
1	Human development index	3
2	Multi-dimensional Poverty Index	3
3	Gender related development index, Physical Quality of Life Index	4
4	Application of Models for population resource development	3
5	Collection of data on a given problem and report writing	2

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Course Outcomes:

By the end of the course, the student will:

1. gain the knowledge basic measures of population resource planning.
2. possess knowledge about estimation on scarcity and population potential.
3. be acquainted with skill of analysing various planning strategies and framing policies.

Suggested Readings:

1. Mandal, R. B., Uyanga, J. and Prasad, H. (2007): Introductory Methods in Population Analysis, Concept Publishing Company, New Delhi
2. Taylor, P. J. (1977): Quantitative Methods in Geography, Hughton Miffin Co., Boston
3. Shryock, H. S. (1970): The Methods and Materials of Demography, Academic Press, New York
4. Wilkinson, F. J. and Monkhouse, H. R. (1966): Maps and Diagrams – Their Compilation and Construction, Metheun and Co., London

GEO 551: Geographical Thought
(Credits-2)

Course Objectives:

1. To develop the philosophical and historical aptitude among students in the context of evolution and development of geographical ideas, theme, dichotomies, approaches and knowledge.
2. To aware the students about recent trends and explanations in geography.
3. To critically evaluate the nature of geography as spatial science with changing space and time.

Topic No.	Topic Name	Number of Lectures
1	Geographical Knowledge of the Ancient and Medieval Period: Greek, Roman, Arab and Indian Contribution	7
2	Contribution of Modern Geographers: Major Schools and Scholars	5
3	Regional Vs Systematic; Environmentalism Vs Possibilism	3
4	Conceptual Development: Areal Differentiation, Regional Synthesis, Locational and Spatial Analysis	3
5	Quantitative Revolution; Behaviouralism	3
6	Marxism, Radicalism, Positivism, Humanism, Feminism and Welfare Approach,	6
7	Political Economy Perspective; Geography and Public Policy	3

Course Outcomes:

By the end of the course, the student will:

1. be able to visualize the basic theme, ideas, dichotomies and approaches of geographic knowledge with relation to historical juncture, varying schools and era of their emergence.
2. critically evaluate the nature of geography as spatial science with changing space and time and comprehend, correlate and connect geographical ideas and concepts with historical as well as contemporary context.

Suggested Readings:

1. Arild, H. J. (1999). Geography: History and Concepts. London: SAGE Publications.
2. Chorley, R. J. (Ed). Directions in Geography, London: Matheun and Co.
3. Dikshit, R. D. (1997). Geographical Thought: Contextual History of Ideas. New Delhi: Prentice Halls.
4. Goudie, A. (Ed) (2004). Encyclopedia of Geomorphology. London: Routledge.
5. Hussain, M. (1984). Evolution of Geographical Thought. Jaipur: Rawat Publications.
6. Richard, P. (1998). Modern Geographical Thought, Singapore: Blackwell.
7. Warf, B. (Ed) (2006). Encyclopedia of Human Geography. New Delhi: SAGE Publications.

GEO 561: Fluvial Geomorphology
(Credits-4)

Course Objectives:

1. To introduce basic concepts of Fluvial Geomorphology.
2. To make the students aware of the forms and processes of streams and rivers.
3. To introduce the student mechanics and process of Fluvial erosion, transportation and deposition.
4. To acquire the knowledge about the concept of river Metamorphosis and Quaternary Fluvial systems.
5. To acquaint the students with the applications of Fluvial Geomorphology in different areas and environment.

Topic No.	Topic Name	Number of Lectures
1	Drainage Basin and Network: Laws of Drainage Composition, Basin Morphometry	6
2	Mechanics of Fluvial Erosion: Overland Flow, Throughflow and Groundwater Flow; Hydrographs	6
3	Open Channel Hydraulics: Classification of open channel flows, Hydraulic geometry (at-a-station and downstream), Stream Energy,	8
4	Channel Geometry: Bedrock and Alluvial Rivers; Channel Classification Schemes	6
5	Concept of Grade: Graded Profile, Dynamic Equilibrium, rejuvenation	6
6	Fluvial erosional processes and Forms: Geomorphic implications of knickpoints and potholes, Riverbank failure, Bank erosion measurement and hazard assessment	6
7	Sediment Transport: Suspended and Bedload	4
8	Fluvial deposition processes and Forms: Flood plains, River terraces; Anabranching Channels: factors, types and mechanisms of braiding and anabranching stream development; Channel avulsion: Causes, processes, stages and case studies	8
9	River Metamorphosis: Concept and parameters; Quaternary fluvial systems; Climate change and Fluvial geomorphology	8
10	River Channel Management and restoration	2

Course Outcomes:

By the end of the course, the student will:

1. understand with the various basic concepts in Fluvial Geomorphology.
2. understand various basic concepts of Fluvial Geomorphology like laws of drainage composition, channel geometry, mechanics of fluvial erosion-transportation-deposition, open channel hydraulics etc.

3. acquire the knowledge of Fluvial erosional and depositional processes with special reference to Flood plains and River terraces.
4. understand the significance of the river channel management.

Suggested Readings:

1. Charlton, R. (2008). Fundamentals of Fluvial Geomorphology, Routledge, Oxon.
2. Chow, V. T. (1964). Handbook of Applied Hydrology, McGraw Hill Book Co. New York.
3. Downs P. W. and Gregory K. J. (2004). River Channel Management, Arnold, London.
4. Fryirs, K. A. and Brierley, G. J. (2013). Geomorphologic Analysis of River Systems, Wiley-Blackwell, Chichester.
5. Kale, V. S. and Gupta, A. (2010). Introduction to Geomorphology, Universities Press, Hyderabad.
6. Kondolf, G. M. and Piegay, H. (2003). Tools in Fluvial Geomorphology, Wiley, Chichester.
7. Leopold, L. B., Wolman, M. G. and Miller, J. P. (1964). Fluvial Processes in Geomorphology, W. H. Freman, San Franscisco.
8. Robert, A. (2003). River Processes- An Introduction to Fluvial Dynamics, Arnold, London.
9. Schumm, S. A. (1977). Fluvial Systems, Wiley, New York.
10. Small, R. J. (1978): The Study of Landforms: A Textbook of Geomorphology, Cambridge University Press, Cambridge

GEO 562: Applied Climatology
(Credits-4)

Course Objectives:

1. To understand the Nature and scope of Applied Climatology as well as Atmospheric concern and awareness.
2. To study the relationship between Climate and Physical and Biological Environment.
3. To realize the impact of climate on societal systems like agriculture, transport sector, recreational activities, energy or power requirement and insurance sector Industrial and commercial activities as well as human health which are affected directly and indirectly by climatic parameters.
4. To acquire knowledge about Climate Change, Urban Climate, GEC, and its Adaptation and Mitigation.

Topic No.	Topic Name	Number of Lectures
1	Nature and Scope of Applied Climatology: Sources of Climatological Data, Atmospheric Concern, Climate Impact Assessment and Awareness	4
2	Climate and Natural Systems: Lithosphere, Hydrosphere, Biosphere, Cryosphere	10
3	Climate and Agriculture: Using Climate Information to Improve Agricultural System- Making Efficient Use of Rainfall, Developing Resilience, Managing the Extremes—Droughts and Floods, The Decision-Making Process—Dealing with Risk and Complexity, Providing Climate Technology to Farmers, Communicating New Ideas and Practices	4
4	Climate and Industrial and Commercial Activities	4
5	Climate and Transportation: Air transport, water transport, and land transport (roads and railways)	4
6	Climate and Health (Mountain sickness, Hypothermia, Hyperthermia, Human comfort, V.B.D. Air pollution-related health effects, Extreme weather-related health effects, Water and food-borne diseases, Allergies	5
7	Climate and Recreational Activities and Tourism: weather-dependent sports, Weather – interference sports. Climate–dependent tourism and attractiveness-dependent tourism, Religious tourism	5
8	Climate and the Energy Requirement	3
	Climate and Insurance Sector	3
9	Urban Climate and Global Environment Change: Adaptation and Mitigation	5
10	Climate Change: Theories, Methods to Reconstruct the past climate - (Dendrochronology, Pollen grain analysis, Isotope analysis – Ice core investigation, and ocean floor sediment analysis); Past, Present, and Future Scenarios, Impacts, Future Strategies, and Adaptations. (IPCC Reports-different climate change models), Climate services to achieve SDGs-Climate Action (SDG No. 13)	10

Course Outcomes:

By the end of the course, the student will:

1. be educated about Climate has a huge impact on our societal systems like agriculture, transportation, tourism, energy requirement, insurance sector, etc.
2. synthesize the effects of climatic variability on human health as the human body can survive well only in certain suites of climatic conditions.
3. Learn about Climate Change: Data Sources, Methods, and Theories. Past, Present, and Future Scenarios, Impacts, Future Strategies, and Adaptations

Suggested Readings:

1. Doorenbos, J. (1977). Guidelines for predicting crop water requirements. FAO (United Nations)
2. Oliver, J. E. (1973). Climate and Man's Environment: An Introduction to Applied Climatology, New York: John Wiley and Sons.
3. Thompson, R.D., & Allen, P. (1997). Applied Climatology: Principles and Practice. London: Routledge

GEO 563: Geography of Tourism
(Credits-4)

Course Objective:

1. To equip the students with the Knowledge of tourism Geography and to lay emphasis on the importance of geography in travel and tourism.
2. This course will give an overview of concept of tourism and the basics of tourism industry.
3. The course aims to impart the fundamental knowledge of Geography and its linkages and anthropological aspects of tourism.
4. To understand the impact of tourism on physical and human environments

Topic No.	Topic Name	Number of Lectures
1	Definition, Nature and Scope of Geography of Tourism, Relation between Geography and Tourism	4
2	Factors Affecting Tourism: Physical, Economic and Socio-cultural, Technology	6
3	Tourism Products and Types of Tourism: Natural, Cultural, Heritage and Emerging tourist destination	8
4	Infrastructure and Support System for Tourism: Accommodation, Transport and Tour operator, Tourism services	8
5	Development and Planning for Tourism: Planning approaches, Types of Planning, Scale of Planning	8
6	Economic, Social, Physical and Cultural Impacts of Tourism	8
7	Theories in Tourism Studies: Butler's Model of Tourism Development, Doxy's Index	8
8	Tourism Development in India	6
9	Globalization and Tourism	4

Course Outcomes:

By the end of the course, the student will:

1. be able to describe about the importance of geography in tourism and tourism potential hotspot in the various tourism generating regions in India.
2. be well-equipped to explain the nature and unique characteristics of the tourism.
3. understand the numerous dimensions of the tourism.

Suggested Readings:

1. Bhatia, A. K. (1991). International Tourism - Fundamentals and Practices. New Delhi: Sterling Publisher.

2. Bhatia, A. K. (1996). Tourism Development: Principles and Practices. New Delhi: Sterling Publisher Ltd.
3. Das, M. (1999). India: A Tourist Paradise. New Delhi: Sterling Publishers.
4. Lew, A. A., Hall, C. M., & Williams, A. M. (ed) (2014). Tourism. Hoboken: Wiley-Blackwell.
5. Pearce, D. G. (1987). Tourism Today: A Geographical Analysis. Harlow: Longman.
6. Robinson, H. (1996). A Geography of Tourism. London: Macdonald and Evans.
7. Smith, L. J. S. (2010). Tourism Analysis: A Handbook. Sydney: Halstead Press.

GEO 564: Geography of Rural Settlement
(Credits-4)

Course Objectives:

1. To impart the knowledge related definition, concepts, development and paradigm shift.
2. To developed the ability of classifying rural settlement on different basis along with types, patterns.
3. To comprehend the knowledge of spatial distribution, changing morphology and segregation, rural dwellings and house types.
4. To enable the students to critically understand the development of amenities and infrastructure of rural settlement geography.

Topic No.	Topic Name	Number of Lectures
1	Introduction: definition, nature, scope and paradigm shift	4
2	Evolution and development of rural settlement from ancient to 21st Century	6
3	Size and Spacing of Rural Settlements: Factors with examples	5
4	Types, Pattern of Rural Settlements: Based on Size and Shape, Factors responsible for development	5
5	Changing morphology and segregation of rural settlements	5
6	Spatial distribution of rural settlements: World and India	5
7	Rural dwelling and house types in India: Factors, Regional patterns	5
8	Ruralization in Indian scenario	6
9	Development of amenities and infrastructure in rural India	6
10	World scenario of development of rural settlements	4
11	Role of GIS and RS in rural Settlements	4

Course Outcomes:

By the end of the course, the student will:

1. learnt various key concept, development along and paradigm shift in geography of rural settlement.
2. be able to discover and understand spatial distribution and changing forms with the help of critical appraisal of segregation, rural dwellings and house types.
3. apprehend with various issues of rural settlement development.

Suggested Readings:

1. Alam, M. and Gopi, K. N. (1982): Settlement System of India, Oxford and IBH Publication, New Delhi

2. Haggett, P. (1965): Locational Analysis in Geography, Edward Arnold, London
3. Mandal, R. B. (2001): Introduction to Rural Settlement, Concept Publishing Company, New Delhi
4. Singh, R.Y. (1994): Geography of Settlements, Rawat Publications, Jaipur
5. Woods, M. (2005): Rural Geography, Sage Publication, London

GEO 565: Regional Geomorphology of India
(Credits-4)

Course Objectives:

1. To know the geomorphological set up of India
2. To understand the landscape diversity in India
3. To understand and interpret different landform assemblage of Geomorphic region of India.

Topic No.	Topic Name	Number of Lectures
1	Introduction to Regional Geomorphology with reference to Elevation and Landforms	4
2	Introduction to Major Geomorphological Divisions of India	4
3	Significance of the Two Mega Features of India: Western Ghats and Himalayas	5
4	Variation in Relief in Geomorphological Divisions, Relief Variation in Mountains, Plateaus and Plains of India, Mountain Systems in India.	5
5	Plateau Regions: Formation of the Deccan Traps and Geology; Physiographic Divisions and Geology, Chhota Nagpur, Hadauti and Shillong Plateaux	6
6	Geomorphology of Himalayas with special reference to Tectonics, Glacial features and landslides	4
7	Geomorphology of Western Ghats, Tectonics, with special reference to Deccan Trap.	4
8	Geomorphology of Great Indian (Thar) Desert	4
9	Form, process and evolution of Ganga-Brahmaputra and Godavari Plains	4
10	Geomorphology of the Andaman and Nicobar, Rameswaram and Lakshadweep Islands	4
11	Major Drainage Systems of India: Rivers draining in Bay Bengal and Arabian Sea	4
12	Ganga, Brahmaputra, Mahanadi, Subarnarekha Drainage system	4
13	Indus, Narmada, Tapi System and West-flowing Rivers	4
14	Peninsular Rivers: Godavari, Krishna, Cauvery, Pennar, Palar and Vaigai Systems	4

Course Outcomes:

By the end of the course, the student will:

1. understand landform diversity of India
2. help the students in better understanding of the impact of landscape on human activities throughout India.
3. gain thorough knowledge of the geomorphic regions of the country.

Suggested Readings:

1. Kale, V. S. (2002). Fluvial geomorphology of Indian rivers: an overview. Progress in physical geography, 26(3), 400-433.
2. Kale, V. S. (Ed.). (2014). Landscapes and landforms of India. Springer.
3. Kale, V.S.(ED.) (2017): Atlas of Geomorphosites in India, Indian Institute of Geomorphologists, Allahabad, India.
4. Owen, L. A. (2014). Himalayan landscapes of India. Landscapes and landforms of India, 41-52.
5. Sharma H.S. and Kale V.S. (Eds.) (2009): Geomorphology in India, Prayag Pustak Bhavan, Allahabad, India
6. Singh, L. P., Parkash, B., & Singhvi, A. K. (1998). Evolution of the lower Gangetic Plain landforms and soils in West Bengal, India. Catena, 33(2), 75-104.

GEO 566: Urban Climatology
(Credits-4)

Course Objectives:

1. To explore the interactions between urban environments and climate systems.
2. To make students aware of problems of urban climates related to urban heat island and urban air quality.
3. To acquaint students with concepts related to urban hydrology, urban planning and design.
4. To provide students with an in-depth understanding of interactions of urban climates with global climate change.

Topic No.	Topic Name	Number of Lectures
1	Introduction and Development of Urban Climatology, Concept and properties of 'Urban Surface'	4
2	Air flow, Radiation and Energy Balance in cities, Microclimates, Local Climate Zones (LCZ's), Difference in Urban-Rural Climate	5
3	Urban Heat Island: Concept and types (Surface, Canopy Layer, Boundary Layer and Subsurface Heat Island)	6
4	Urban Hydrology: Water Balance of Urban Hydrologic Units, Urban Effects on components of Water Balance	6
5	Urban Air Quality: Air Pollution, Smog, Temperature Inversion, Modelling Urban Air Pollution, Regional and Global effects of urban air pollution	6
6	Urban Climate and Human Health: Human Energy Balance, Thermal Stress, Thermal Comfort, Effects of air pollution on human health	6
7	Urban Planning and Design: Concept of Climate-Sensitive Design, Green spaces and land use planning, Climate controls on individual buildings, streets and urban blocks	6
8	Cities and Global Climate Change: Land cover change, Greenhouse gases, Monitoring Climate change in Urban environments, Projecting Future Climates in Cities, Urban Climate Modelling	8
9	Urban Climate Change Adaptation and Mitigation: Vulnerability and Risk Assessment of Cities, Climate-resilient urban planning, Urban growth Management, Sustainable Cities and Communities (SDG-11)	7
10	Cities of India, Heat Wave and Action Plan Implementation in Indian Cities	6

Course Outcomes:

By the end of the course, the student will:

1. understand the fundamentals of urban climatology and its relevance to urban areas.
2. analyze and interpret urban climate data, including temperature, humidity, and air quality.
3. identify the drivers of urban climate change and their impacts on cities.

4. apply knowledge of urban climatology to assess and plan for sustainable urban development.

Suggested Readings:

1. Oke, T. R., Mills, G., Christen, A., & Voogt, J. A. (2017). *Urban climates*. Cambridge University Press.
2. Landsberg, H. E. (1981). *The urban climate*. Academic press.
3. Pearlmutter, D., Calfapietra, C., Samson, R., O'Brien, L., Ostoić, S. K., Sanesi, G., & del Amo, R. A. (2017). The urban forest. *Cultivating green infrastructure for people and the environment*, *7*.
4. Thompson, R. D., & Perry, A. H. (Eds.). (1997). *Applied climatology: principles and practice*. Psychology Press.

GEO 568: Settlement Planning and Management
(Credits-4)

Course Objectives:

1. To provide in-depth understanding of settlement planning and management with planning principles and processes.
2. To comprehend information and grasp meaning and linkages of settlement planning and management.
3. To use information, theories, concepts to solve problems of land use, land reforms and governance.
4. To make connections to recognize patterns and deeper meanings with application knowledge of settlement planning.
5. To make and justify a judgement on existing policies and role of regional authorities which will help for better settlement planning.

Topic No.	Topic Name	Number of Lectures
1	Planning Principles: Scope and Content; Origin and Evolution of Planning	4
2	Planning Process: Facets of Rural Societies; Planning for Rural Development Multi-Level Planning; PURA Initiative	6
3	Land Reforms and Rural Development: Land Reforms and Agrarian Class Structure in India; Globalization and Indian Peasantry	6
4	Rural Infrastructure Management: Importance; Economy and Rural Development; Linkages with Livelihood; Impact of Infrastructure upon Rural Development; Rural Development Programmes	8
5	Urban Planning: Impacts of Industrial Revolution; Contributions of Ebenezer Howard, Patrick Geddes, Tony Garnier, Lewis Mumford, Le-Corbusier and Others in Planning	6
6	Urban Policy and Planning: Goals of Urban Planning; Nature of Urban Policy; Neighbourhoods in Planning; Urban Renewal (JNNURM) and Its Aftermath; Role of NGOs in Planning; Urban Social Movements; Urban Architecture; Social Construction of Urban Landscape	8
7	Urban Land Use: Urban Morphogenesis; Critics of Classical Models and Recent Developments; Central Business District; Urban Landscape; Land Use Transformation; Ecological Models	6
8	Urban Governance and Management: Concept, Role of Urban Development Bodies and Local Bodies, Urban Governance and Indicators; Smart Cities, Liveable Cities	6
9	Settlement Policies and Planning: Policies and programmes for Rural and Urban Development, Role of Regional Developmental authority	5

Course Outcomes:

By the end of the course, the student will:

1. learn various key concept, principals and process of settlement planning.
2. be able to discover and understand various linkages of planning with the help of information, theories and models to deal with various issues of settlement planning.
3. be able to critically evaluating the existing policy and programmes, role of regional authority related to settlement planning.

Suggested Readings:

1. Bourne, L. (Ed.) (1982). Internal structure of the city.New York:Oxford University Press.
2. Chitambar, J.B. (1993). Introductory rural sociology. New Delhi: Wiley Eastern.
3. Gallent, N. and Scott, N.(2017).Rural planning and development. Routledge.
4. Gallion, A.B., Eisner, S., and Stoner, A. (1963). The urban pattern: city planning and design. New York: Van Nostrand.
5. Hall, P.G. (1997). Cities of tomorrow: an intellectual history of urban planning and design in the twentieth century. New Jersey: Wiley Blackwell.
6. Hudson, F.S. (1976). A geography of settlements. New York: Macdonald and Evans.
7. Kaiser, E.J., Godschalk, D.R., and Chapin, F.S. (1995). Urban land use planning. Urbana: University of Illinois Press.
8. Macionis,J. and Parrillo,V.(2010) Cities and urban life. PHI
9. Mandal, R.B. (1988). Systems of rural settlements in developing counties. New Delhi: Concept Publishing Company.
10. Ramchandran, R. (1997). Urbanization and urban systems in India. Oxford: Oxford University Press.
11. Rao, R.N. (1986). Strategy for integrated rural development. New Delhi: B.R. Publication.
12. Singh, K.(2009).Rural development: principles, policies and management. Sage Publications
13. Sundaram, K.V. (1977). Urban and regional planning in India. New Delhi: South Asia Books.

GEO 571: Fluvial Geomorphology: Practicals
(Credits-2)

Course Objectives:

1. To acquaint the students with various practical techniques in Fluvial Geomorphology.
2. To learn the practical computation of drainage morphometric analysis, Hack's stream gradient index.
3. To familiarize the students about the computation of Hydraulic Geometry Equations.
4. To acquaint the students about the estimation of with Runoff, Sediment load, Sediment yield, Velocity, discharge, stream power, shear stress and shape analysis.
5. To acquire the field knowledge about the channel cross section, sedimentary sequences and facies.

Topic No.	Topics	Number of Practicals
1	Drainage Basin and Network morphometry. Longitudinal Profile of rivers and Hack's Stream Gradient Index	3
2	Calculation of Hydraulic Geometry Equations, Planform Analysis	3
3	Calculation of Runoff, Sediment Load and Sediment Yield	1
4	Estimation of Velocity and Discharge using Chezy and Manning Equation. Estimation of Unit Stream Power and Shear Stress	3
5	Hypsometric Curve and Integral of basin; Mapping of Channel bed materials using Zingg's shape analysis in the field	3
6	Measurement of Channel Cross-Section in the Field, Identification of fluvial erosional and deposition landforms in the field and also with special reference to India using toposheets and Satellite Imagery	2

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Course Outcomes:

By the end of the course, the student will:

1. understand the various applications and techniques of Fluvial Geomorphology.
2. be acquainted with the computation and estimation various Fluvial Geomorphology parameters.
3. acquire the practical knowledge of Fluvial Geomorphology.
4. utilize the acquired knowledge for identification of landforms using toposheets and satellite images.

Suggested Readings:

1. Charlton, R. (2008). Fundamentals of Fluvial Geomorphology, Routledge, Oxon.
2. Chow, V. T. (1964). Handbook of Applied Hydrology, McGraw Hill Book Co. New York.
3. Kale, V. S. and Gupta, A. (2010). Introduction to Geomorphology, Universities Press, Hyderabad.
4. Kondolf, G. M. and Piegay, H. (2003). Tools in Fluvial Geomorphology, Wiley, Chichester.
5. Leopold, L. B., Wolman, M. G. and Miller, J. P. (1964). Fluvial Processes in Geomorphology, W. H. Freman, San Franscisco.
6. Robert, A. (2003). River Processes- An Introduction to Fluvial Dynamics, Arnold, London.
7. Schumm, S. A. (1977). Fluvial Systems, Wiley, New York.
8. Vaidyanadhan, R., & Subbarao, K. V. (2020). Landforms of India from Topomaps and Images-Revised Second Edition (Digital Edition) 2016. GSI Publications, 7(1).

GEO 572: Applied Climatology: Practicals
(Credits-2)

Course Objectives:

1. To equip students with the knowledge and skills to analyze climate data and understand its implications for architectural design and human comfort.
2. To acquaint students with various statistical methods for analyzing climate data, and techniquesfor retrieving land surface temperature from satellite imagery.

Topic No.	Topics	Number of Practicals
1	Climate and Architectural Analysis	2
2	Comfort Indices: Effective Temperature, Heat Index, Temperature-Humidity Index	2
3	Statistical Analysis of Climatic Data: Climatological Series, Frequency Distribution, Cumulative Distribution, Homogeneity of Data Series (Run's Test), Trend analysis (Linear Regression and Mann-Kendall)	6
4	Retrieval of Land Surface Temperature from Satellite Imageries, Relationship between NDVI and LST to study vegetation and thermal characteristics	3
5	Field Work	2

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Course Outcomes:

By the end of the course, the student will:

1. be able to perform statistical analysis of climate data, including the calculation of climatological series and cumulative distribution.
2. evaluate the homogeneity of climate data series.
3. apply trend analysis to identify long-term climate trends and variability.
4. analyse the relationship between ndvi and lst to study the thermal characteristics of different land cover types.

Suggested Readings:

1. Oliver, J. E. (1981): Climatology: Selected Applications, V. H. Winston and Sons, London
2. Keith, S. (1975): Principles of Applied Climatology, Wiley the University of Michigan
3. Griffiths, J. F. (1966): Applied Climatology: An introduction, Oxford University Press, London
4. Hobbs, J. E. (1980): Applied Climatology: A Study of Atmospheric Resources, W. Dawson, University of California, California
5. Fitzroy, R. (2012): The Weather book, A manual of Practical Meteorology, Green, Longman, Cambridge

GEO 573: Geography of Tourism: Practicals
(Credits-2)

Course Objective:

1. To provide comprehensive understanding of data interpretation and analysis regarding tourism.
2. To enable the students to prepare for the report writing based on observations.

Topic No.	Topics	Number of Practicals
1	Source of Data: Types of tourism data, National and International Sources	2
2	Perception Studies: Ranking, Satisfaction Index, Garet's Method	3
3	Evaluation of Tourism Potential / Carrying Capacity Analysis	4
4	Analysis of Tourism Impacts and Report Writing	6

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Course Outcomes:

By the end of the course, the student will:

1. enhance the analytical skills of data interpretation regarding tourism.
2. be acquainted with the report writing and analysis of various components of tourism geography.

Suggested Readings:

1. Kaul, R. K. (1985). Dynamics of Tourism and Recreation, New Delhi: Inter India.
2. Pearce, D. (1987). Tourism Today: A Geographical Analysis, New York: Longman Scientific and Technical.
3. Smith, L. J. S. (2010). Practical Tourism Research, CABI, Wallinford
4. Smith, L. J. S. (2010). Tourism Analysis: A Handbook, Sydney: Halstead Press.

GEO 574: Geography of Rural Settlement: Practicals (Credits-2)

Course Objectives:

1. To inculcate the skill of measuring basic indices of rural settlement.
2. To developed the ability of classifying rural settlement using different methods.
3. To developed the analysing skill of the students to measure the rural spacing.

Topic No.	Topics	Number of Practicals
1	Methods of concentration of rural settlements	3
2	Chi-square test for environmental factors responsible for pattern variation of settlements	3
3	Measurement of shape (pattern) of rural settlements	3
4	Methods for measuring spacing of settlements	3
5	Collection of data on given problem and report writing	3

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Course Outcomes:

By the end of the course, the student will:

1. gain the knowledge basic measures of rural settlement.
2. possess knowledge about classification methods based on various factors.
3. be acquainted with skill of analysing various factor affecting settlement.

Suggested Readings:

1. Haggett, P. (1965): Locational Analysis in Geography, Edward Arnold, London
2. Mandal, R. B. (2001): Introduction to Rural Settlement, Concept Publishing Company, New Delhi
3. Wilkinson, F. J. and Monkhouse, H. R. (1966): Maps and Diagrams: Their Compilation and Construction, Metheun and Co., London

GEO 575: Regional Geomorphology of India: Practicals (Credits-2)

Course Objectives:

1. To develop the skill of understanding the setup of geomorphic regions.
2. To interpret and appraise the landscape at regional level.
3. To understand the role of impact of human activities on geomorphic landforms and environment.

Topic No.	Topics	Number of Practicals
1	Identification of Geomorphic regions using Satellite images and /or Maps	2
2	Interpretation of Himalayan Region with Respect to Glacial Features	2
3	Interpretation of Plateau regions with reference to relief and drainage	2
4	Identification of different coastal features and regional variation	2
5	Regional elevation profiles: Preparation and Interpretation	2
6	Demarcation of Great Thar Desert and Interpretation of Desert Landscape	1
7	Drainage basin analysis of River systems of different geomorphic regions	2
8	Demarcation and Interpretation of Geomorphology of Islands	2

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Course Outcomes:

By the end of the course, the student will:

1. understand the assemblage of landforms and the landscape.
2. be able to visualize the regional geomorphology.
3. understand the importance of landforms and regional geomorphology.
4. be able to understand and interpret river drainage basins of India.

Suggested Readings:

1. Chorley, R. J. (Ed.). (2019). Spatial analysis in geomorphology. Routledge.
2. Goudie, A. (Ed.). (2003). Geomorphological techniques. Routledge.
3. Prasad, G. (2007). Trends and techniques of geomorphology. Discovery Publishing House.

GEO 576: Urban Climatology: Practicals
(Credits-2)

Course Objectives:

1. To provide students with a comprehensive understanding of climate analysis.
2. To understand principles and calculations of comfort indices to assess thermal comfort in buildings and urban spaces.
3. To apply remote sensing techniques to map Local Climate Zones and understand urban microclimates.

Topic No.	Topics	Number of Practicals
1	Climate and Architectural Analysis	2
2	Comfort Indices, Heat and Cold Wave Analysis	3
3	Mapping of Local Climate Zones using Satellite Imageries	2
4	Retrieval of Land Surface Temperature from Satellite Imageries Relationship between NDVI and LST to study urban vegetation and thermal characteristics	3
5	Impervious Surface Estimation Techniques, Urban Land Use Land Cover Mapping	3
6	Field Work	2

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Course Outcomes:

By the end of the course, the student will:

1. To explain the significance of climate analysis in architectural designs and human comfort.
2. To analyze heat and cold wave events and their implications in urban areas.
3. To retrieve land surface temperatures from satellite imagery and interpret its variations across urban areas.

Suggested Readings:

1. Oke, T. R., Mills, G., Christen, A., & Voogt, J. A. (2017). *Urban climates*. Cambridge University Press.
2. Landsberg, H. E. (1981). *The urban climate*. Academic press.
3. Pearlmutter, D., Calfapietra, C., Samson, R., O'Brien, L., Ostoić, S. K., Sanesi, G., & del Amo, R. A. (2017). The urban forest. *Cultivating green infrastructure for people and the environment*, *7*.
4. Thompson, R. D., & Perry, A. H. (Eds.). (1997). *Applied climatology: principles and practice*. Psychology Press.

GEO 578: Settlement Planning and Management: Practicals (Credits-2)

Course Objectives:

1. To impart adequate skills so as to enable the students to take up career in the field of Settlement planning and management.
2. To developed the skills of settlement planning using different methods and technology.
3. To developed the evaluating skill of exiting planning policies.

Topic No.	Topics	Number of Practicals
1	Participatory Methods of Data Collection: Rapid Rural Appraisal; PRA and PLA; Focus Group Discussion; Buzz Group Analysis Method, GPS and Mapping of Primary Data: Social and Resource Mapping, Village Information Map Using GPS	**2**
2	Remote Sensing and GIS in Rural Planning: Preparation of Thematic Maps at Village Level, Administrative Map, Land Use/ Land Cover	**3**
3	Techniques of Urban Planning: Dominant and Distinctive (Nelson's Ternary); Quality of Life Index for Urban Residential Areas; Sopher's Index of Disparity	**3**
4	Qualitative Methods in Urban Research: Urban Ethnography – Interview, FGDs, Satisfaction Index, Content Analysis: Policy/Planning Reports and Documents	**2**
5	Mapping the Built Environment (Using RS & GIS Techniques): Mapping of Urban Land Cover and Land Use; NDVI, Urban Expansion; Attribute Data Interfaces, Mapping of Services: Network Analysis	**3**
6	Case Study and Report Writing	**2**

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Course Outcomes:

By the end of the course, the student will:

1. gain the skill of collecting data for settlement planning and management.
2. gain the skill of computing basic indices of settlement planning and management.
3. be sophisticated with handling the data using appropriate methods and software's.
4. be able to perform advance level planning and management techniques using various software.

Suggested Readings:

1. Chisholm, M. (1967). Rural settlement and land use. New York: John Wiley.
2. Gallion, A.B., Eisner, S., and Stoner, A. (1963). The urban pattern: city planning and design. New York: Van Nostrand.

3. Hall, P.G. (1997). Cities of tomorrow: an intellectual history of urban planning and design in the twentieth century. New Jersey: Wiley Blackwell.
4. Kaiser, E.J., Godschalk, D.R., and Chapin, F.S. (1995). Urban land use planning. Urbana: University of Illinois Press.
5. Narayanasamy,N. (2009). Participatory rural appraisal: principles, methods and application. Sage Publications.
6. Ramchandran, R. (1997). Urbanization and urban systems in India. Oxford: Oxford University Press.
7. Rao, R.N. (1986). Strategy for integrated rural development. New Delhi: B.R. Publication.
8. Sundaram, K.V. (1977). Urban and regional planning in India. New Delhi: South Asia Books.

GEO 581: Geography of Health
(Credits-2)

Course Objectives:

1. To familiarize the students with the geographical importance of Health.
2. To impart the knowledge on human ecology of diseases, spread and origin of different disease, major public health issues raising due to geographical factors.
3. To make and justify a judgement on policies and planning with special reference to Indian Health Care Delivery System.

Topic No.	Topics	Number of Lectures
1	Introduction, Definition, Development and Significance, Dualism between Medical and Health Geography	4
2	Human Ecology of Disease, Landscape Epidemiological Approaches, Social and Spatial Epidemiological Perspectives on Health Transition	4
3	Developmental Changes and Human Health: Context of Population Change, Mobility and Exposure, Urbanization and Health, Emerging Diseases	3
4	Geographical Perspective on Health Care Provisions in Developed and Developing Countries, Spatial Aspects of Health Care Planning	3
5	Climate Change and Pollution Syndrome: Toxic Hazards of Natural and Economic Origins, Globalization and Perception of Health Hazard	4
6	Poverty, Hunger, Morbidity and Health	4
7	Health Policies in India, Reproductive and Child Health, Millennium Development Goals and SDGs	4
8	Indian Health Care Delivery System: Public and Private Sectors, Accessibility, Utilization and Health Service Planning	4

Course Outcomes:

By the end of the course, the student will:

1. learn various key concept with spatial perspectives on health importance.
2. be able to explore and understand Human ecology of diseases, spread and origin of disease, Developmental Changes and Human Health.
3. get acquainted with the health care provisions, major public health issues raising due to geographical factors globally.
4. be able to critically examine the health policy and programmes with health care delivery system.

Suggested Readings:

1. Brown, T., McLafferty, S., Moon, G. (2010). A Companion to Health and Medical Geography, UK: Wiley Blackwell.

2. Curtis, S. (2004). Health and Inequality: Geographical Perspectives. London: Sage Publications.
3. Hazra, J. (Ed.) (1997). Health Care Planning in Developing Countries. Calcutta: University of Calcutta.
4. May, J. M. (1959). Ecology of Human Diseases. New York: M.D. Publications.
5. Meade M., & Earickson R. (2006). Medical Geography. Jaipur: Rawat Publications.
6. Misra R. P. (2007). Geography of Health: a treatise on geography of life and death in India, New Delhi : Concept Publishing company.
7. Pati, B. and Harrison, M. (2009). The Social History of Health and Medicine in Colonial India, London : Routledge.
8. Philips, D. R. (1990). Health and Health Care in Third world, London: Longman.
9. Stamp, L. D. (1964). Geography of Life and Death, Ithaca: Cornell University.

GEO 582: Surveying: Practicals
(Credits-2)

Course Objectives:

1. To provide students with a strong foundation in surveying principles, methodologies and equipment.
2. To relate theoretical knowledge of surveying to resolve real problems.
3. To establish horizontal and vertical control by traversing and triangulation.

Topic No.	Topics	Number of Practicals
1	Introduction to Surveying and Leveling	1
2	Dumpy Level Survey: Rise and Fall Method, Collimation Level Method, Profile Drawing and Contouring	6
3	Theodolite Survey: Intersection Method, Tacheometric Method, Contouring	6
4	GPS: Road Mapping	2

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Course Outcomes:

By the end of the course, the student will:

1. develop skills necessary for accurate and efficient surveying in field.
2. be able to handle dumpy level and theodolite instruments.
3. acquire skills to handle GPS for mapping roads.

Suggested Readings:

1. Basak, N. N. (1994). Surveying and Levelling. Delhi: Tata McGraw-Hill Education.
2. Bhavikatt, S. S. (2009). Surveying and Levelling. New Delhi: I. K. International.
3. Kanetkar, T. P., & Kulkarni, S.V. (I960). Surveying and Leveling- Part I and II. Pune: A. V. Ghriha Prakashan.
4. Pugh, J. C. (1975). Surveying for Field Scientists. London: Methuen and Co.
5. Roy, S. K. (2004). Fundamentals of Surveying. New Delhi: PHI Learning.

GEO 583: Geography of South Asia
(Credits-2)

Course Objectives:

1. To understand the complex relationship between the countries which have been counted in South Asia.
2. To study the Physiographic aspects of the region as well as the contemporary issues related to the various natural resources and also boundary disputes.
3. To examine the social, cultural, economic, and political system of the region and its contemporary status.

Topic No.	Topics	Number of Lectures
1	South Asia as a Region, Strategic Importance	2
2	Physical Aspects: Physiographic Divisions, Climate, Soil, Major River System, Natural Vegetation	6
3	Cultural Framework: Language, Religion, Ethnicity and issues	6
4	Urbanization, Population, Poverty and Development	6
5	Border Related Issues: Territorial Disputes and Trans-Boundary River Water Issues.	5
6	South Asia in Global Economy	3
7	SAARC: Role, Challenges and Potentialities in Regional Integration	2

Course Outcomes:

By the end of the course, the student will:

1. understand the strategic importance of the South Asia.
2. know about the socio-economic and political status of the South Asia among the students.
3. be aware about the various social, cultural, and political issues and within the country and with the countries in South Asia.

Suggested Readings:

1. Bradnock, R. W. (2016). The Routledge Atlas of South Asian affairs. London: Routledge Publication.
2. Farmer, B. H. (1993). An Introduction to South Asia. London: Routledge Publications.
3. Gonsalves, F., & Jetly, N. (1999). The Dynamics of South Asia: A Regional Co-operation and SAARC. New Delhi: Sage.
4. Johnson, B. L. C (1981). South Asia. Exeter: Heinemann Educational Books Ltd.
5. Mollinga, P. A. (2000). Water for Food and Rural Development Approaches and Initiatives in

South Asia, New Delhi: Sage.

6. Shafi, M. (2000). Agriculture Geography of South Asia. New Delhi: McMillan India.

GEO 584: Digital Cartography: Practicals
(Credits-2)

Course Objectives:

1. To impart adequate professional knowledge and computer skills so as to enable the students to take up career in the field of Geospatial Technology.
2. To introduce to the students a new Geospatial Technology of Digital Cartography.
3. To gain an understanding of cartographic software to produce accurate appropriate convincing and creative cartographic and graphic images.

Topic No.	Topics	Number of Practicals
1	Introduction to Cartography, Elements of Cartography	1
2	Basics of Digital Cartography	2
3	Application of Digital Cartography: Hardware and software for Digital cartography; Representation of geospatial data: histogram, bar graphs, line graphs, scatter diagram, pie diagram and trend line in MS Excel; Preparation of located diagrams & thematic maps in QGIS	6
4	Application of computer assisted cartography in the various fields e.g. earth sciences, environmental sciences, natural resources, regional development and planning, management, agriculture, forestry, disaster management, water resources, urban planning etc.	4
5	Data Collection, Application of digital cartography and Report Writing	2

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Course Outcomes:

By the end of the course, the student will:

1. gain the knowledge about basic knowledge and computer skills of digital cartography.
2. possess knowledge about new geospatial technology of digital cartography.
3. be acquainted with skill of data management and graphical representation digitally.

Suggested Readings:

7. Cromley, R.G.(1992): Digital Cartography, Prentice-Hall, New York.
8. Dent, B.D.(1999): Cartography- Thematic Map Design, 5th Edition, WCB McGrew Hill, Boston.
9. Kraak M. J.and Ormeling. F (2004): Cartography: Visualization of Spatial Data, Pearson Edu. pvt Ltd. (Singapore) Inelian Branch, New Delhi.

10. Mishra, R.P. (1973): Fundamentals of Cartography, Prasaranga, University of Mysore.
11. Monkhouse, F.J.R. & Wilkinson H.R.(2000):Maps and Diagrams, Methuen &Co. London.
12. Monmonier, M.S. (1982): Computer Assisted Cartography: Principles and Prospects, Prentice Hall.
13. Raise, Erwin (1962): Principles of Cartography, McGraw-Hill, New York.
14. Rampal, K.K.(1993): Mapping and Compilation, Concept Publishing Co. New Delhi.
15. Robinson, H. et al (1995): Elements of Cartography, 6th Edition, John Wiley & Sons, New York.
16. Sarkar, A (2009): Practical Geography: A Systematic Approach, Orient Longman, Kolkatta.
17. Slocum, T.A.et al.(2008): Thematic Cartography and Geovisualization , 3rd Edition, Prentice Hall.

GEO 585: Environmental Geography
(Credits-2)

Course Objectives:

1. To learn about the earth system and its components.
2. To learn about the ecosystem concept and its structure.
3. To study Ecosystem Management at the national and international level
4. To study Pollution and various legal provisions, laws, rules, and Acts for Air, Water, and noise pollution.
5. To understand National and International Efforts for the Conservation and Protection of the Environment

Topic No.	Topics	Number of Lectures
1	Environmental Geography: Introduction, Scope, Concepts, Principles and Approaches	5
2	Structure and Function of Ecosystem	4
3	Air, Water, Soil and Noise Pollution: Sources, Effects, and Remedies	8
4	Human-Environment Relationships: Historical Progression, Adaptation; Environment and Development; Human Rights	8
5	National and International Efforts for Conservation and Protection of Environment	5

Course Outcomes:

By the end of the course, the student will:

1. understand different types of ecosystems, food chains, and food webs in an ecosystem and energy flow in the ecosystem.
2. learn about the status of biodiversity in India.

Suggested Readings:

1. Chandna, R. C. (2002). Environmental Geography. Ludhiana: Kalyani.
2. Cunninghum, W. P. & Cunninghum, M. A. (2004). Principles of Environmental Science: Inquiry and Applications, New Delhi: Tata McGraw Hill.
3. Goudie, A. (2001). The Nature of the Environment, Oxford: Blackwell.
4. Miller, G. T. (2004). Environmental Science: Working with the Earth, Singapore: Thomson Brooks Cole.
5. Singh, S. (1997). Environmental Geography, Allahabad: Prayag Pustak Bhawan.
6. UNEP (2007). Global Environment Outlook: GEO4: Environment for Development, United Nations Environment Programme.

GEO 586: Bivariate Statistical Methods
(Credits-2)

Course Objectives:

1. To provide students with a strong foundation in statistical methods for bivariate data analysis.
2. To acquaint the students with the concepts of covariance, correlation and regression.
3. To analyze residuals to assess the adequacy of regression models and identify potential patterns and outliers.
4. To train the students in various techniques of Inferential Statistics.

Topic No.	Topics	Number of Practicals
2	Bivariate Analysis: Covariance, Correlation and Regression (Linear, Exponential, Power- Law, Logarithmic), Explained Variance, Residuals, Mapping of Residuals	5
3	Probability: Normal, Binomial and Poisson Distributions	3
4	Inferential Statistics: Sample and Population, Sampling Distribution, Hypothesis Testing: Formulation, Rejection Rule, One and Two-Tailed Tests, Significance Level, Degrees of Freedom, Type I and Type II Errors	2
5	Student's T-Test, ANOVA: One-Way, Two-Way (Single and Multiple Entry), Chi-Square Test: One-Way and Two-Way	5

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Course Outcomes:

By the end of the course, the student will:

1. Apply bivariate statistical methods in geographical analysis by interpreting relationships between two variables.
2. Calculate and interpret explained variance and residuals to evaluate the goodness of fit in regression models.
3. Differentiate between sample and population data, and understand the concept of sampling distribution in inferential statistics.
4. Formulate and conduct hypothesis testing using different statistical tests.

Suggested Readings:

1. Frank, H.,&Althoen, S. C. (1994).Statistics: Concepts and Applications. Cambridge: Cambridge University Press.
2. Hammond, R.,& McCullagh, P. (1991).Quantitative Techniques in Geography. Oxford: Clarendon Press.
3. Mann, P. S. (2007).Introductory Statistics. New Delhi: John Wiley and Sons.
4. Rogerson, P. A. (2010): Statistical Methods for Geography, Sage Publications, London

GEO 587: Introduction to Geographical Information System (Credits-2)

Course Objectives:

1. To introduce students to geographic information system (GIS).
2. To learn databases, data models and map projections.
3. To acquire knowledge about data models and database management systems.

Topic No.	Topics	Number of Lectures
1	GIS: Definition, History and Development, Advantages of GIS, Applications	4
2	Components of GIS, Tasks/Functions of GIS	3
3	Geographical Data Models: Raster and Vector, Spatial and Non-Spatial, Types of Attribute Data, Topology	6
4	Coordinate Systems, Map Projections – properties, Classification, Aspects. Shape of Earth – Ellipsoid, Geoid. Datum,	6
5	Database Management System: Database Modelling, Models – Hierarchical, Network, Relational	6
6	Digital Elevation Model (DTM), Digital Terrain Model (DTM), Digital Surface Model (DSM)	3
7	Decision Support System (DSS)	2

Course Outcomes:

By the end of the course, the student will:

1. become familiar with fundamentals of GIS, its elements, spatial and non-spatial data.
2. acquire basic understanding of coordinate system, map projections, GIS data models.

Suggested Readings:

1. Burrough, P. A., & McDonnell, R. A. (1998). Principles of Geographical Information Systems. New York: Oxford University press Inc.
2. Chang, K. T. (2008). Introduction to Geographic Information Systems. Avenue of the Americas, McGraw-Hill,
3. Environmental Systems Research Institute, Inc. (1998). Understanding GIS: The ARC/INFO Method. Redlands: ESRI Press.
4. Goodchild, M. F. (2003). Geographic Information Science and System for Environmental Management. Annual Review of Environment and Resource 28: 493-519

GEO 588: Practicals in Geographical Information System (Credits-2)

Course Objectives:

1. To train students in handling QGIS software and using it for creating different raster and vector based thematic maps.
2. To train students in analysis of digital elevation model (DEM), building topology, buffer analysis.

Topic No.	Topics	Number of Practicals
1	Introduction to Digitizing in QGIS: Georeferencing, Making a Base Map, Creating Shapefile with Point, Line and Polygon Feature,	3
2	Adding Attribute Data, Making Classes for Different Attribute Data (Classified Map), Generating Layout with Legend, Saving and Editing Shapefiles, Projects	3
3	Digital Elevation Model: Generating Maps of Slope, Aspect, Contour, Relief, Hillshade	3
4	Buffer Analysis	2
5	Building Topology, Data Query	2
6	Using different tools in QGIS: Raster Calculator, Reproject, Spatial Analyst	2

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Course Outcomes:

By the end of the course, the student will:

1. become familiar generation of maps by creating shapefiles.
2. acquire different skills such as building topology, query analysis, raster and vector-based tools.

Suggested Readings:

1. Burrough, P. A., & McDonnell, R. A. (1998). Principles of Geographical Information Systems. New York: Oxford University press Inc.
2. Chang, K. T. (2008). Introduction to Geographic Information Systems. Avenue of the Americas, McGraw-Hill,
3. Environmental Systems Research Institute, Inc. (1998). Understanding GIS: The ARC/INFO Method. Redlands: ESRI Press.
4. Goodchild, M. F. (2003). Geographic Information Science and System for Environmental Management. Annual Review of Environment and Resource 28: 493-519

GEO 591: On Job Training
(Credits-4)

Course Objectives:

1. To give hands-on experience and practical training to students in different sectors related to geography
2. To develop marketable skills among students
3. To expose students to different industrial, educational and research institutes and future employers
4. To apply their knowledge in real situations
5. To gain experience in writing technical reports

Guidelines
• For on-job training, the students will be attached with the local institutions and employing establishments, which have laboratory/workshop, other related facilities and where adequate supervision by qualified personnel will be available. • A student is expected to spend not less than 60 working hours on On-job training and related activities. • On-job training will be carried in the summer vacation after the students complete their second semester examinations. • Students need to provide the confirmation letter from the organization or the institute where they have joined for on-job training. • The continuous evaluation of the students' performance in the on job-Training will be carried out with the assistance of the personnel of training institutions/employing establishments where this training will be imparted. • The proof of completion of on-job training (work experience certificate and field report) should be submitted during examination to the parent institution, duly issued and signed by the concerned training authority.

Course Outcomes:

By the end of the course, the student will:

1. embrace different pathways of learning, including experiential learning
2. understand the social, economic and administrative considerations that influence the working environment of different organizations
3. learn new strategies like time management, multi-tasking and new skills
4. get an opportunity to meet new people and learn networking skills