



Curriculum and Credit Framework
(Based on National Education Policy 2020)
for
Four Year Undergraduate Programme in Geography
and
Three Year Undergraduate Programme in Geography

TO BE EFFECTIVE FROM THE ACADEMIC SESSION 2023-24

West Bengal State University
July, 2023

Curriculum & Credit Framework for Undergraduate Courses in Geography under National Education Policy of 2020

INTRODUCTION: In compliance with directives on the Curriculum & Credit Framework from the University Grants Commission, the undergraduate syllabus for Geography is reframed under the National Education Policy of 2020. In a major deviation from its previous versions, the current syllabus uniquely caters to the students' requirement of education levels that would help them to balance between their professional and educational aspirations.

The four-year curriculum has four exit options that are hierarchically related to the level of education at the end of second, fourth, sixth, and eighth semesters — i.e., at the completion of the first, second, third, and fourth years of the course. These would relate to the award of • certificates, • diplomas, • BSc Major in Geography, and • BSc Honours in Geography, respectively. The course would also provide an opportunity to do research in the final Semester-8 for the meritorious students.

The present curriculum of Geography is designed to give the students a holistic understanding of the subject at every year of exit from the second year onwards, putting equal weightage to the core content and techniques used in Geography. The syllabus also tried to give similar importance to the two main branches of Geography: Physical and Human. Its principal goal of is to enable the students to secure a job at the end of the undergraduate programme. Keeping this in mind and in tune with the changing nature of Geography, adequate emphasis is rendered on applied aspects of the subject such as emerging techniques of mapping and field-based data generation, especially in the Honours course.

LEARNING OUTCOMES: The syllabus is designed to impart basic knowledge on geography as a spatial science and train the undergraduates to secure employment in the sectors like geospatial analysis, developmental planning, and environment management.

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1. Structure of the 4-year Undergraduate Programme (Honours) offered by Geography

Table 1: Semester-wise and Course category-wise distribution of credits

SEM	Course Code	Course Name	Course Type	Credit	Component	
I	GEODSC101T/ 101P	Physical Geography + Lab	Major	3+2	Th	P
	GEOMIN101T	Physical Geography	Minor	4+1	Th	Tu
	GEOHMD101M	Geomatics and Spatial Analysis	Multi-Disciplinary	3		
	AE-1		AEC	3		
	GEOHSE101M	Remote Sensing	SEC	3		
	VAC		VAC	3		
II	GEODSC202T/ 202P	Human Geography + Lab	Major	3+2	Th	P
	GEOMIN202T	Human Geography	Minor	4+1	Th	Tu
	GEOHMD201M	Geomatics and Spatial Analysis	Multi-Disciplinary	3		
	AE-1		AEC	3		
	GEOHSE202M	Advanced Spatial Statistical Techniques	SEC	3		
	VAC		VAC	3		
	Exit option	with certificate after 1 Year				
III	GEODSC303T/ 303P	Geotectonics and Geomorphology + Lab	Major	3+2	Th	P
	GEOMIN303T/ 303P	General Cartography+ Lab	Minor	3+2	Th	P
	GEOHMD301M	Geomatics and Spatial Analysis	Multi-Disciplinary	3		
	AE-1		AEC	3		
	XXXHSE303M	To be chosen from minor subjects other than Geography	SEC	3		
	VA-1 (3)		VAC	3		
IV	GEODSC404T/ 404P	Climatology + Lab	Major	3+2	Th	P
	GEODSC405T	Economic Geography	Major	4+1	Th	Tu
	GEODSC406T	Geography of India and West Bengal	Major	4+1	Th	Tu
	GEODSC407T/ 407P	Cartographic Techniques and Thematic Mapping	Major	3+2	Th	P
	Exit option	with diploma after 2 Years				
V	GEODSC508T	Population Geography	Major	4+1	Th	Tu
	GEODSC509T/ 509P	Environmental Geography + Lab	Major	3+2	Th	P
	GEODSC510T	Soil and Biogeography	Major	4+1	Th	Tu
	GEODSC511T/ 511P	Remote Sensing, GIS, and GNSS + Lab	Major	3+2	Th	P
VI	GEODSC612T	Evolution of Geographical Thought	Major	4+1	Th	Tu
	GEODSC613T/ 613P	Hazard Management+ Lab	Major	3+2	Th	P
	GEODSC614T	Social Geography	Major	4+1	Th	Tu
	GEODSC615P	Surveying Techniques and fieldwork Lab	Major	4+1	P	P
	Exit option	with Major after 3 Years				
VII	GEODSC716T	Hydrology and Oceanography	Major	4+1	Th	Tu
	GEODSC717T/ 717P	Statistical Methods in Geography + Lab	Major	3+2	Th	P
	GEOSMC701P	Project Report based on Field Work	Special Minor	4+1	P	P
VIII	GEODSC818T	Research Methodology	Major	4+1	Th	Tu
	GEODSC819T/ 819P	Applied Geomorphology and Climatology	Major	3+2	Th	Tu
	GEODSC820T	Rural and Urban Geography	Major	4+1	Th	Tu
	GEODSC821T	Regional Development and Planning	Major	4+1	Th	Tu

Th= Theory, P= Practical, Tu= Tutorial. M= Courses with both theory and practical components.

XXXMD= Multi-disciplinary course offered by another subject apart from Geography

2. Structure of the 4-year Undergraduate Programme (Honours with Research) offered by Geography

Table 2: Semester-wise and Course category-wise distribution of credits

SEM	Course Code	Course Name	Course Type	Credit	Component	
I	GEODSC101T/101P	Physical Geography + Lab	Major	3+2	Th	P
	GEOMIN101T	Physical Geography	Minor	4+1	Th	Tu
	GEOHMD101M	Geomatics and Spatial Analysis	Multi-Disciplinary	3		
	AE-1		AEC	3		
	GEOHSE101M	Remote Sensing	SEC	3		
	VA-1		VAC	3		
II	GEODSC202T/202P	Human Geography + Lab	Major	3+2	Th	P
	GEOMIN202T	Human Geography	Minor	4+1	Th	Tu
	GEOHMD201M	Geomatics and Spatial Analysis	Multi-Disciplinary	3		
	AE-1		AEC	3		
	GEOHSE202M	Advanced Spatial Statistical Techniques	SEC	3		
	VA-1 (3)		VAC	3		
	Exit option	with certificate after 1 Year				
III	GEODSC303T/303P	Geotectonics and Geomorphology + Lab	Major	3+2	Th	P
	GEOMIN303T	General Cartography+ Lab	Minor	3+2	Th	P
	GEOHMD301M	Geomatics and Spatial Analysis	Multi-Disciplinary	3		
	AE-1		AEC	3		
	XXXHSE303M	To be chosen from minor subjects other than Geography	SEC	3		
	VA-1 (3)		VAC	3		
IV	GEODSC404T/404P	Climatology + Lab	Major	3+2	Th	P
	GEODSC405T	Economic Geography	Major	4+1	Th	Tu
	GEODSC406T	Geography of India and West Bengal	Major	4+1	Th	Tu
	GEODSC407T/407P	Cartographic Techniques and Thematic Mapping	Major	3+2	Th	P
	Exit option	with diploma after 2 Years				
V	GEODSC508T	Population Geography	Major	4+1	Th	Tu
	GEODSC509T/509P	Environmental Geography + Lab	Major	3+2	Th	P
	GEODSC510T	Soil and Biogeography	Major	4+1	Th	Tu
	GEODSC511T/511P	Remote Sensing, GIS, and GNSS + Lab	Major	3+2	Th	P
VI	GEODSC612T	Evolution of Geographical Thought	Major	4+1	Th	Tu
	GEODSC613T/613P	Hazard Management+ Lab	Major	3+2	Th	P
	GEODSC614T	Social Geography	Major	4+1	Th	Tu
	GEODSC615P	Surveying Techniques and fieldwork Lab	Major	4+1	P	P
	Exit option	with Major after 3 Years				
VII	GEODSC716T	Hydrology and Oceanography	Major	4+1	Th	Tu
	GEODSC717T/717P	Statistical Methods In Geography + Lab	Major	3+2	Th	P
	GEOSMC701P	Project Report based on Field Work	Special Minor	4+1	P	P
VIII	GEODSC818T	Research Methodology	Major	4+1	Th	Tu
	GEORES801M*	Dissertation *	Major	15	M	

Th= Theory, P= Practical, Tu= Tutorial. M= Courses with both theory and practical components.

XXXMD= Multi-disciplinary course offered by another subject apart from Geography

For Honours with Research any two courses to be selected from GEOADS18T/ 19T/ 20T/ 21T. Dissertation *= only for Honours with Research

3. Structure of the 3-year Multidisciplinary Undergraduate Programme with Geography as one of the subjects

Table 3: Semester-wise and Course category-wise distribution of credits

Sem	Course Code	Course Name	Course Type	Credit	Component	
I	GEOMIN101T/GEOCOR101T	Physical Geography	Core Course	4+1	Th	Tu
	XXBMC01T		Core Course	4+1		
	XXCMC01T		Core Course	4+1		
	AE-1		AEC	3		
	VA-1		VAC	3		
II	GEOMIN202T/GEOCOR202P	Human Geography	Core Course	4+1	Th	Tu
	XXBMC02T		Core Course	4+1		
	XXCMC02T		Core Course	4+1		
	AE-1		AEC	3		
	VA-1		VAC	3		
	Exit option	with certificate after 1 Year				
III	GEOMIN303T/303P /GEOCOR303T/303P	General Cartography + Lab	Core Course	3+2	Th	P
	XXBMC03T		Core Course	4+1		
	XXCMC03T		Core Course	4+1		
	AE-1		AEC	3		
	GEOGSE301M	Remote Sensing	SEC	3		
IV	GEOCOR404T	Environmental Geography	Core Course	4+1	Th	Tu
	XXBMC04T		Core Course	4+1		
	XXCMC04T		Core Course	4+1		
	GEOGMD401M	Geomatics and Spatial Analysis	Multi-Disciplinary	3		
	GEOGSE402M	Advanced Spatial Statistical Techniques	SEC	3		
	Exit option	with diploma after 2 Years				
V	GEOCOR505T	Soil and Biogeography	Core Course	4+1	Th	Tu
	XXBMC05T		Core Course	4+1		
	XXCMC05T		Core Course	4+1		
	GEOGMD501M	Geomatics and Spatial Analysis	Multi-Disciplinary	3		
	XXXGSE503M	To be chosen from another subject other than Geography	SEC	3		
VI	GEOCOR606T	Regional Development	Core Course	4+1	Th	Tu
	XXBMC06T		Core Course	4+1		
	XXCMC06T		Core Course	4+1		
	GEOGMD601M	Geomatics and Spatial Analysis	Multi-Disciplinary	3		
	XXXGSE604M	To be chosen from another subject other than Geography	SEC	3		

Th= Theory, P= Practical, Tu= Tutorial. M= Courses with both theory and practical components.

XXXMD= Multi-disciplinary course offered by another subject apart from Geography

XXBMC01T, XXCMC01T= Multi-disciplinary core course of subject B and subject C respectively

Discipline Specific Major Courses for Geography

Code (Theory)	Code (Practical)	Course name	Page Number
GEODSC101T	GEODSC101P	Physical Geography	9–10
GEODSC202T	GEODSC202P	Human Geography	11–12
GEODSC303T	GEODSC303P	Geotectonics and Geomorphology	13–14
GEODSC404T	GEODSC404P	Climatology	15–16
GEODSC405T		Economic Geography	17
GEODSC406T		Geography of India and West Bengal	18
GEODSC407T	GEODSC407P	Cartographic Techniques and Thematic Mapping	19
GEODSC508T		Population Geography	20
GEODSC509T	GEODSC509P	Environmental Geography	21–22
GEODSC510T		Soil and Biogeography	23
GEODSC511T	GEODSC511P	Remote Sensing, GIS, and GNSS	24–25
GEODSC612T		Evolution of Geographical Thought	26
GEODSC613T	GEODSC613P	Hazard Management	27–28
GEODSC614T		Social Geography	29
	GEODSC615P	Surveying Techniques and fieldwork	30
GEODSC716T		Hydrology and Oceanography	31–32
GEODSC717T	GEODSC717P	Statistical Methods In Geography	33–34
GEODSC818T		Research Methodology	36–36
GEODSC819T	GEODSC819P	Applied Geomorphology and Climatology	37–39
GEODSC820T		Rural and Urban Geography	40–41
GEODSC821T		Regional Development and Planning	42–43

Minor Courses for Major/ Honours Students of Other Disciplines/ Core Courses for the 3-year Multidisciplinary Undergraduate Programme offered by Geography

Code (Theory)	Code (Practical)	Course Type	Course name	Page Number
GEOMIN101T/ GEOCOR101T		Minor	Physical Geography	44
GEOMIN202T/ GEOCOR202T		Minor	Human Geography	45
GEOMIN303T/ GEOCOR303T	GEOMIN303P/ GEOCOR303P	Minor	General Cartography+ Lab	46
GEOCOR404T		Minor	Environmental Geography	47
GEOCOR505T		Minor	Soil and Biogeography	48
GEOCOR606T		Minor	Regional Development	49
	GEOSMC701P	Special Minor	Project Report based on Field Work	50

Skill Enhancement Courses offered by Geography

Code	Course Type	Course name	Page Number
GEOHSE101M/ GEOGSE301M	SEC	Remote Sensing	51
GEOHSE202M/ GEOGSE402M	SEC	Advanced Spatial Statistical Techniques	52

Multi-Disciplinary Course Offered by Geography

Code	Course Type	Course name	Page Number
(For Honours and Major) GEOHMD101M/ GEOHMD201M/ GEOHMD301M (For 3 Yr Multi-disciplinary) GEOGMD401M/ GEOGMD501M/ GEOGMD601M)	Multi-disciplinary	Geomatics and Spatial Analysis	53

Introductory Level Courses

Discipline Specific Major Courses for Geography

GEODSC101T – Physical Geography ✧

3 Credits [45 hours of teaching]

Unit I: Geotectonics and Geomorphology

1. Internal Structure of Earth based on Seismic Evidence.
2. Influence of lithology on landforms: Granite and Basaltic landforms.
3. Factors controlling landform development; endogenetic and exogenetic forces.
4. Evolution of landforms under fluvial process
5. Nature and classification of hazards in Indian context

Unit II: Climatology, Soil and Biogeography

6. Nature, composition and layering of the atmosphere
7. Distribution of pressure belts and planetary wind system, jet streams, and index cycle.
8. Factors of soil formation
9. Evolution of an ideal soil profile
10. Concept of ecosystem — basic ecological principles, ecotone, communities, niche, succession, and habitat.
11. Concept of Biomes: study of Tropical rainforest, Taiga, Savannah, Desert, Tundra and Temperate grasslands

Reading List

- Coch, N.K. 1994. Geohazards: Natural and Human, Pearson College.
- Conserva H. T., 2004: Illustrated Dictionary of Physical Geography, Author House, USA.
- Critchfield, H.J., 1983: General Climatology. Prentice Hall India Ltd. (2010 Reprint)
- Dash, M.C., 2001. Fundamentals of Ecology, 2nd edition, Tata McGraw-Hill, New Delhi.
- Franzmeier, D.P., McFee, W.W., Graveel, J.G., Kohnke, H., 2016: Soil Science Simplified, 5th ed, Waveland Press.
- Gabler R. E., Petersen J. F. and Trapasso, L. M., 2007: Essentials of Physical Geography , Thompson, Brooks/Cole, USA.
- Garrett N., 2000: Advanced Geography, Oxford University Press.
- Goudie, A., 1984: The Nature of the Environment: An Advanced Physical Geography, Basil Blackwell Publishers, Oxford.
- Hamblin, W. K., 1995: Earth's Dynamic System, Prentice Hall, N.J.
- Husain M., 2002: Fundamentals of Physical Geography, Rawat Publications, Jaipur.
- Kormondy, E.J. 1996. Concepts of Ecology, 4th edition, Prentice-Hall, India, New Delhi.
- Monkhouse, F. J. 2009: Principles of Physical Geography, Platinum Publishers, Kolkata.
- Sharma, P.D. 2011. Ecology and Environment, Rastogi Publications.
- Singer, M., Munns, D.N. 2005. Soils: An Introduction, 6th ed, Pearson.
- Strahler A. N. and Strahler A. H., 2008: Modern Physical Geography, John Wiley & Sons, New York.
- Weil, R.R., Brady, N.C. 2022. The Nature and Properties of Soils, 15th ed, Pearson Education.

GEODSC101P – Physical Geography (Lab) ✧

2 Credits [60 hours of teaching]

An A3-size laboratory notebook, comprising class assignments of the following is to be prepared and submitted. The exercises are to be drawn in pencil. All texts are to be handwritten. All exercises in the laboratory notebook should be duly signed by concerned teacher.

1. Graphical construction of linear scales: Plain.
2. Altimetric frequency distribution; Demarcation of broad physiographic zones.
3. Denoting drainage, geomorphic, settlement and transport attributes using sketches.
4. Identification of drainage and channel patterns from Survey of India 1:50,000 topographical maps.
5. Construction and interpretation of wind rose diagram
6. Viva voce based on laboratory notebook.

Reading List

Monkhouse F.J., Wilkinson H.R. 1971. Maps and Diagrams, their compilation and construction, 3rd ed (2017 reprint), Alphaneumera.

Basu, P. 2021. Advanced Practical Geography — a Laboratory Manual, 4 ed, Books and Allied. Sarkar, A. 2015. Practical Geography: A Systematic Approach, 3rd ed, Orient Blackswan.

Singh, R.L., Singh, R.P.B. 2008. Elements of Practical Geography, Kalyani Publishers.

Vaidyanadhan, R., Subbarao, K.V. 2014. Landforms of India from Topomaps and Images, Geological Society of India.

GEODSC202T – Human Geography ✧

3 Credits [45 hours of teaching]

Unit I Scope and Approaches

1. Elements of Human Geography: Nature, scope and recent trends.
2. Approaches to Human Geography; Resource, Locational, Landscape, Environmental

Unit II Social and Population Geography

3. Evolution of human societies: Hunting and food gathering, pastoral nomadism, subsistence farming, industrial society and post-industrial urban society.
4. Human adaptation to environment: Eskimo, Masai and Maori
5. Population distribution, density and growth of world population.
6. Demographic Transition Theory

Unit III Economic and Settlement Geography

7. Sectors of the economy: primary, secondary, tertiary and quaternary, quinary
8. Types of agriculture: Intensive subsistence rice farming, Plantation agriculture (Tea)
9. Site, situation, types and patterns of Rural Settlements
10. Classification of Urban Settlements after Census of India.

Reading List

- Bose, N.K. 2020. Tribal Life in India, 5th ed (updated by Tripathi, C.B.), National Book Trust. Chandna R.C. 2022. Geography of Population, Part 1: Concepts, Determinants and World Patterns, Kalyani Publishers.
- Chandna, R.C. (2010) Population Geography, Kalyani Publisher.
- Daniel, P.A. and Hopkinson, M.F. (1989) Geography of Settlement, Oliver & Boyd, London.
- Dorrel, D., Henderson, P. 2018. Introduction to Human Geography. University of Georgia Press. Fouberg, E.H., Nash, A.B., Murphy, A.B., de Blij, H., 2015. Human Geography: People, Place, and Culture, 11th ed, Wiley.
- Ghosh, S. (2015) Introduction to settlement geography. Orient Black Swan Private Ltd., Kolkata
- Gregory, D., Johnston, R., Pratt, G., Watts, K., Whatmore, S. (Eds) 2009. The Dictionary of Human Geography, 5th ed, Wiley-Blackwell.
- Johnston R; Gregory D, Pratt G. et al. (2008) The Dictionary of Human Geography, Blackwell Publication.
- Jordan-Bychkov et al. (2006) The Human Mosaic: A Thematic Introduction to Cultural Geography. W. H. Freeman and Company, New York.
- Knox, P.L., Marston, S.A. 2014. Human Geography, Places and Regions in Global Context, 6th ed, Pearson Education.
- Majumdar, P.K. 2013. India's Demography: Changing Demographic Scenario in India, Rawat Publications.
- Mercier, M., Norton, W. 2019. Human Geography, 10th ed, Oxford University Press.
- Paul, C., Crang, P., Goodwine, M.G. 2014, Introducing Human Geographies, 3rd ed, Routledge. Rubenstein J.M., 2018, Contemporary Human Geography, 4th ed, Pearson.
- Short, R.J. 2017. Human Geography: A Short Introduction, 2nd ed, Oxford University Press. Sing, R.Y. 2009, A Geography of Settlements, Rawat Publications

GEODSC202P– Human Geography (Lab) ✧

2 Credits [60 hours of teaching]

An A3-size laboratory notebook, comprising class assignments of the following is to be prepared and submitted. The exercises are to be drawn in pencil. All texts are to be handwritten. All exercises in the laboratory notebook should be duly signed by concerned teacher.

1. Growth rate of population: Arithmetic growth comparing two decadal datasets
2. Density of population of Indian states or West Bengal districts by choropleth method
3. Identification of types of settlements according to sites from Survey of India 1:50,000 topographical maps
4. Correlating physical and cultural attributes using transect chart.
5. Proportional pie-diagrams, and proportional square representing economic data and land use data.
6. Viva voce based on laboratory notebook

Reading List

BOOKS

Basu, P. 2021. Advanced Practical Geography — a Laboratory Manual, 4 ed, Books and Allied.

Monkhouse F.J., Wilkinson H.R. 1971. Maps and Diagrams, their compilation and construction, 3rd ed. (2017 reprint), Alphaneumera.

Sarkar, A. 2015. Practical Geography: A Systematic Approach, 3rd ed, Orient Blackswan.Singh,

R.L., Singh, R.P.B. 2008. Elements of Practical Geography, Kalyani Publishers.

WEBSITE:

Census of India: <https://censusindia.gov.in/census.website/data/census-tables>

Intermediate Level Courses

GEODSC303T – Geotectonics and Geomorphology ✧

3 Credits [45 hours of teaching]

Unit I: Geotectonics

1. Earth's tectonic and structural evolution with reference to geological time scale, with special reference to the events of the Pleistocene
2. Isostasy: Models of Airy and Pratt, and their applicability.
3. Plate Tectonics as a unified theory of global tectonics: Processes and landforms at plate margins and hotspots
4. Folds and Faults—Formation and classification

Unit II: Geomorphology

5. Degradational processes: Weathering, mass wasting and resultant landforms
6. Development of river network and landforms on uniclinal and folded structures, Surface expression of faults.
7. Coastal processes and landforms
8. Glacial and glacio-fluvial processes and landforms
9. Aeolian and fluvio-aeolian processes and landforms
10. Models on landscape evolution: Views of Davis, Penck and Hack

Reading List

- Bierman, P.R., Montgomery, D.R., 2019. Key Concepts in Geomorphology, 2nd ed, W. H. Freeman.
- Billings, M.P. 1971. Structural Geology, Pearson India.
- Burbank, D.W. 2011. Tectonic Geomorphology, 2nd ed, Wiley India.
- Fossen, H. 2016. Structural Geology, 2nd ed, Cambridge University Press.
- Frisch, W., Meschede, M., Blakey, R.C. 2022. Plate Tectonics: Continental Drift and Mountain Building, Springer.
- Goudie, A.S. (Ed) 2004. Encyclopaedia of Geomorphology, vol. 1 & 2, Routledge.
- Gregory, K.J., Lewin, J. 2014. The Basics of Geomorphology: Key Concepts, Sage.
- Gupta, A. 2011. Tropical Geomorphology, Cambridge University Press.
- Harvey, A. 2022. Introducing Geomorphology: A Guide to Landforms and Processes, Dunedin Academic Press.
- Huggett, R., Shuttleworth, E., 2022. Fundamentals of Geomorphology, 5th ed, Routledge.
- Kale, V.S., Gupta, A. 2001. Introduction to Geomorphology, Orient Longman.
- Kearey, P., Klepeis, K.A., Vine, F.J. 2011. Global Tectonics, 3rd ed, Wiley-India
- Knighton, A.D. 1984. Fluvial Forms and Processes, Edward Arnold.
- Knoll, A.H. 2021. A Brief History of Earth: Four Billion Years in Eight Chapters, Custom House.
- Lutgens, F., Tarbuck, E., Tasa, D. 2017. Essentials of Geology, 13th ed, Pearson.
- McCullagh, P. 1978. Modern Concepts in Geomorphology, Oxford University Press.
- Schumm, S.A., Dumont, J.F., Holbrook, J.M. 2002. Active Tectonics and Alluvial Rivers, Cambridge University Press.
- Selby, M.J. 1986. Earth's Changing Surface, Oxford University Press.
- Strahler, A. 2016. Introducing Physical Geography, 6th ed, Wiley.
- Summerfield, M.J. 2003. Global Geomorphology: An Introduction to the Study of landforms, Longman.
- Thornbury, W.D. 1969. Principles of Geomorphology, 2nd ed, Wiley-India / CBS.

GEODSC303P – Geotectonics and Geomorphology (Lab) ✧

2 Credits [60 hours of teaching]

An A3-size laboratory notebook, comprising class assignments of the following is to be prepared and submitted. The exercises are to be drawn in pencil. All texts are to be handwritten. All exercises in the laboratory notebook should be duly signed by concerned teacher.

1. Megascopic identification of (a) mineral samples: Bauxite, calcite, chalcopyrite, feldspar, galena, gypsum, hematite, magnetite, mica, quartz, talc, tourmaline; and (b) rock samples: Granite, basalt, dolerite, laterite, limestone, shale, sandstone, conglomerate, slate, phyllite, schist, gneiss, quartzite, marble
2. Interpretation of geological maps with uniclinal structure, folds, unconformity, and intrusions
3. Reference scheme of Survey of India Everest and Open Series Maps; Map margin information. Extraction and interpretation of geomorphic information from Survey of India 1:50,000 topographical maps of plateau region: Construction and interpretation of relief profiles (serial, superimposed, projected and composite)
4. Drainage basin delineation, stream ordering (Strahler) on the delineated drainage basin
5. Morphometric analysis: Preparation of Relative Relief (Smith), Average Slope (Wentworth) and Drainage Density (Horton) on a delineated drainage basin.
6. Construction of hypsometric curve and derivation of hypsometric integer of a drainage basin of a plateau region
7. Determination of channel sinuosity index (channel length/valley length measured through straight line) and braiding index of rivers from topographical maps (c. 10-km reach)
8. Viva voce based on laboratory notebook

Reading List

- Basu, P. 2021. Advanced Practical Geography — a Laboratory Manual, 4 ed, Books and Allied.
- Bolton. T. 2009 (reprint). Geological Maps: Their Solution and Interpretation, Cambridge Univ. Press.
- Farndon, J. 2012. The Illustrated Guide to Rocks & Minerals, Southwater.
- Gupta K.K. and Tyagi, V. C., (1992): Working with Map, Survey of India, DST, New Delhi.
- Pillent, C. 2002. Smithsonian Handbooks: Rocks & Minerals, Dorling Kindersley.
- Saha, P.K. and Basu, P. (2009): Advanced Practical Geography, Books and Allied (P) Ltd., Kolkata.
- Sarkar, A. 2015. Practical Geography: A Systematic Approach, 3rd ed., Orient Blackswan Private Ltd.
- Sen, P.K. 1989. Geomorphological Analysis of Drainage Basin: An Introduction to Morphometric and Hydrological Parameters, University of Burdwan.
- Sorrell, C.A. Rocks and Minerals: A Guide to Field Identification, St. Martin's Press.
- Vaidyanadhan, R., Subbarao, K.V. (2014). Landforms of India from Topomaps and Images, Geological Society of India

GEODSC404T – Climatology ✧

3 Credits [45 hours of teaching]

Unit I: Elements of the Atmosphere

1. Insolation: controlling factors. Heat budget of the atmosphere
2. Temperature: horizontal and vertical distribution. Inversion of temperature: types, causes and consequences
3. Greenhouse effect and formation, depletion, restoration, and significance of the ozone layer

Unit II: Atmospheric Phenomena and Climatic Classification

4. Condensation: Process and forms. Mechanism of precipitation: Bergeron-Findeisen theory, collision and coalescence. Forms of precipitation
5. Air mass: Typology, origin, characteristics and modification
6. Types of fronts: warm and cold; frontogenesis and frontolysis
7. Weather: stability and instability; barotropic and baroclinic conditions
8. Atmospheric disturbances: Tropical and mid-latitude cyclones
9. Monsoon circulation and mechanism with reference to India
10. Climatic classification after Köppen, Thornthwaite (1955)

Reading List

BOOKS

- Ahrens, C.D. 2012. Essentials of Meteorology: An Invitation to the Atmosphere. 9th Ed, Cengage Learning.
- Barry R. G. and Carleton A. M., 2001: Synoptic and Dynamic Climatology, Routledge, UK.
- Barry, R.G, Chorley R.J. 2009. Atmosphere Weather and Climate. 9th Ed, Routledge.
- Critchfield, H. J. 1983. General Climatology. Prentice Hall India Ltd (2010 Reprint).
- Lal, D.S. 2012. Climatology. Sharda PustakBhawan.
- Lutgens, F.K., Tarbuck, E.J. 1998. The Atmosphere: An Introduction to Meteorology, 9th Ed, Prentice-Hall Inc.
- Oliver, J.E., Hidore J.J. 2002. Climatology: An Atmospheric Science, Pearson Education India

WEBSITES:

- India Meteorological Department: <https://mausam.imd.gov.in> Intergovernmental Panel on Climate Change: <https://www.ipcc.ch>
- World Bank Climate Change Knowledge Portal: <https://climateknowledgeportal.worldbank.org> World Meteorological Organization: <https://public.wmo.int/en>

GEODSC404P – Climatology (Lab) ✧

2 Credits [60 hours of teaching]

An A3-size laboratory notebook, comprising class assignments of the following is to be prepared and submitted. The exercises are to be drawn in pencil. All texts are to be handwritten. All exercises in the laboratory notebook should be duly signed by concerned teacher.

1. Interpretation of daily weather map of India (any two): Pre-Monsoon, Monsoon and Post-Monsoon
2. Construction and interpretation of hythergraph and climograph (G. Taylor)
3. Construction and interpretation of monthly rainfall dispersion diagram (quartile method). Climatic water budget
4. Viva voce based on laboratory notebook

Reading List

BOOKS

Basu, P. 2021. Advanced Practical Geography — a Laboratory Manual, 4 ed, Books and Allied.

Monkhouse, F.J., Wilkinson, H.R. 1971. Maps and Diagrams: Their Compilation and Construction, 3rd ed (2017 reprint), Alphaneumera-Kolkata.

Sarkar, A. 2015. Practical Geography: A Systematic Approach, 3rd ed, Orient Blackswan.

Singh, R.L., Singh, R.P.B. 2008. Elements of Practical Geography, Kalyani Publishers.

WEBSITES:

India Meteorological Department: <https://mausam.imd.gov.in>

Climatological tables of observatories of India:

<https://www.imdpune.gov.in/library/public/Climatological%20Tables%201991-2020.pdf>

GEODSC405T — Economic Geography✧

5 Credits [75 hours of teaching]

Unit I: Concepts and Theories

1. Meaning and approaches to Economic Geography.
2. Concepts in Economic Geography: Goods and services, production, exchange and consumption
3. Concept of economic man, theories of choices
4. Economic distance and transport costs
5. Factors affecting location of economic activity with special reference to agriculture (Von Thünen), and industry (Weber).

Unit II: Economic Activities

6. Primary activities: Agriculture, forestry, fishing and mining
7. Secondary activities: Manufacturing (cotton textile, iron and steel), concept of manufacturing regions, special economic zones and technology parks
8. Tertiary activities: Transport, trade and services
9. Economic globalisation: Concepts and contemporary issues
10. International trade, role of WTO.
11. Emergence of economic blocs (Post WW-II): BRICS: Evolution, structure and significance

Reading List

BOOKS

- Adams, F.G., 2011. Globalization: Today and Tomorrow, Routledge. Anderson, W.P. 2012. Economic Geography, Routledge.
- Alexander J. W., 1963: Economic Geography, Prentice-Hall Inc., Englewood Cliffs, New Jersey
- Aoyama, Y., Murphy, J.T., Hanson, S. 2010. Key Concepts in Economic Geography, Sage.
- Coe N. M., Kelly P.F. and Yeung H.W. 2019. Economic Geography: A Contemporary Introduction, 3rd ed, Wiley-Blackwell.
- Combes P., Mayer T. and Thisse J. F., 2008: Economic Geography: The Integration of Regions and Nations, Princeton University Press.
- MacKinnon, D., Cumbers, A. 2019. An Introduction to Economic Geography: Globalisation, Uneven Development and Place, 3rd ed, Routledge.
- Waters M. 2001. Globalization, Routledge.
- Wheeler, J.O., Muller, P.O., Thrall, G.I., Fik, T.J. 1998. Economic Geography, 3rd ed, Wiley.
- Willington D. E., 2008: Economic Geography, Husband Press.
- Wood, A., Roberts, A. 2010. Economic Geography: Places, Networks and Flows, Routledge.

WEBSITES:

BRICS: <http://infobrics.org>

World Trade Organisation: <https://www.wto.org> United Nations: www.un.org/en

GEODSC406T – Geography of India and West Bengal ✧

5 Credits [75 hours of teaching]

Unit I: Geography of India

1. Tectonic and stratigraphic provinces, physiographic divisions
2. Climate, soil and vegetation regions
3. Tribes of India with special reference to Gaddi, Toda, Santal and Jarwa
4. Agricultural regions. Green revolution (Phase I and II) and their impacts
5. Mineral and power resources distribution and utilisation of iron ore, coal, petroleum and natural gas
6. Industrial development: Automobile and information technology
7. Regionalisation of India: Physiographic (R.L. Singh) and economic (P. Sengupta)

Unit II: Geography of West Bengal

8. Physical perspectives: Physiographic divisions, forest and water resources
9. Resources: Agriculture, mining, and industry
10. Population: Growth, distribution and human development
11. Regional Issues: Darjeeling Hills and Sundarban

Reading List

BOOKS

- Bandyopadhyay, S., Kar, N.S., Das, S., Sen, J. 2014. River system and water resources of West Bengal: A Review. In Vaidyanadhan, R. (Ed) Rejuvenation of Surface Water Resources of India: Potential, Problems and Prospects, Geological Society of India Special Publication.
- Dhara, M.K., Basu, S.K., Bandyopadhyay, R.K., Roy, B., Pal, A.K. (Eds.) 1999. Geology and Mineral Resources of the States of India, Part-1: West Bengal. Geological Survey of India Miscellaneous Publication.
- Ghurey, G.S. 1963. The Scheduled Tribes of India, 1980 reprint, Transaction Books.
- Johnson, B.L.C. (Ed) 2001. Geographical Dictionary of India, Vision Books.
- Khullar, D.R. 2011. India: A Comprehensive Geography, Kalyani Publishers
- Mandal, H., Mukherjee, S., Datta, A. 2002. India: An Illustrated Atlas of Tribal World, Anthropological Survey of India.
- Pathak, C.R. 2003. Spatial Structure and Processes of Development in India, Regional Science Association-Kolkata.
- Sharma, T.C. 2012. Economic Geography of India, Rawat Publications.
- Singh, J. 2003. India-A Comprehensive & Systematic Geography, Gyanodaya Prakashan.
- Singh, R.L. 1971. India: A Regional Geography, National Geographical Society of India.
- Spate, O.H.K., Learmonth, A.T.A. 1967. India and Pakistan: A General and Regional Geography, Methuen.
- Tiwari, R.C. 2007. Geography of India, PrayagPustakBhawan.
- Valdiya, K.S. 2010. The Making of India: Geodynamic Evolution, Macmillan Publishers India Ltd.

WEBSITES:

- Census of India: <https://censusindia.gov.in/census.website>
- Government of India Data Platform: <https://data.gov.in> Hierarchy of states:
- India Meteorological Department: <https://mausam.imd.gov.in>
- <https://www.imdpune.gov.in/library/public/Climatological%20Tables%201991-2020.pdf>
- ISRO Bhuvan 2D Platforms: <https://bhuvan-app1.nrsc.gov.in/bhuvan2d/bhuvan/bhuvan2d.php>
- West Bengal Development Report 2010: <https://www.scribd.com/document/433016798/sdr-wb1909-pdf>
- Trending Economics (India's industrial production): <https://tradingeconomics.com/india/industrial-production>
- UNDP Human Development Report on India (2016): <https://hdr.undp.org/data-center/specific-country-data#/countries/IND>
- <https://hdr.undp.org/data-center/country-insights#/ranks>
- West Bengal District Statistical Handbooks: <http://wbpspm.gov.in/publications/District%20Statistical%20Handbook>

GEODSC407T – Cartographic Techniques and Thematic Mapping✧

3 Credit [45 hours of teaching]

1. Scientific notation, concepts of rounding, logarithm and anti-logarithm, natural and log scales
2. Maps: Classification and types. Components of a map
3. Concept and application of scales: Comparative, diagonal and vernier
4. Coordinate systems: Polar and rectangular
5. Concept of generating globe and UTM projection
6. Map projections: Classification, properties and uses
7. Representation of data: Line, Bar, Isopleths
8. Representation of area data: Dots and spheres, proportional circles and Choropleth
9. Preparation and interpretation of land use land cover maps
10. Preparation and interpretation of socio-economic maps

GEODSC407P – Cartographic Techniques (Lab)✧

2 Credits [60 hours of teaching]

An A3-size laboratory notebook, comprising class assignments of the following is to be prepared and submitted. The exercises are to be drawn in pencil. All texts are to be handwritten. All exercises in the laboratory notebook should be duly signed by concerned teacher.

1. Graphical construction of scales: Comparative, diagonal and Vernier.
2. Construction of projections: Polar Zenithal Gnomonic, Stereographic, Orthographic, Simple Conic with one standard parallel, Bonne's, Cylindrical Equal Area, and Mercator's
3. Preparation of Thematic maps:
 - Age-Sex Pyramid
 - Dots and Sphere diagram showing distribution of rural and urban population.
 - Flow chart.

Reading List

Kennedy, M., Kopp, S. 2001. Understanding Map Projections, Esri Press.

Kimerling, A.J., Buckley, A.R., Muehrcke, P.C., Muehrcke, J.O. 2011. Map Use: Reading, Analysis, Interpretation, 7th ed, Esri Press.

Monkhouse, F.J., Wilkinson, H.R. 1971. Maps and Diagrams: Their Compilation and Construction, 3rd ed (2017 reprint), Alphaneumera-Kolkata.

Pearson II, F. 1990. Map Projections: Theory and Applications 2nd ed, CRC Press.

Robinson, A.H., Morrison, J.L., Phillip, C.M., Kimerling, A.J., Guptill, S.C. 1995. Elements of Cartography, 6th ed, Wiley.

Sarkar, A. 2015. Practical Geography: A Systematic Approach, 3rd ed, Orient Blackswan Private Ltd.

Singh, R.L., Singh, R.P.B. 2008. Elements of Practical Geography, Kalyani Publishers.

Higher Level Courses

GEODSC508T – Population Geography ✧

5 Credits [75 hours of teaching]

Unit I: Population Dynamics

1. Development of Population Geography as a field of specialization. Relation between population geography and demography. Sources of population data, their level of reliability and problems of mapping.
2. Population distribution: density and growth. Classical and modern theories in population distribution and growth, Demographic transition model.
3. World patterns determinants of population distribution and growth. Concept of optimum population.
4. Population distribution, density and growth profile in India.

Unit II: Population and Development

5. Concepts of Age-Sex Composition; Rural and Urban Composition; Literacy and education
6. Measurements of fertility and mortality. Concept of cohort and life table
7. Population composition of India: Urbanisation and Occupational structure.
8. Causes and types of national and international migration with reference to India.
9. Population and development: Problem of declining sex-ratio. Concept of human development index and its components.
10. Population policies in developed and less development countries. India's population policies, population and environment, implication for the future.

Reading List

- Barrett, H.R. 1995. Population Geography, Oliver and Boyd.
- Bartram, D. Poros, M. Monforte, P. 2014. Key Concepts in Migration. Sage.
- Binde, N., Kanitkar, H. 2000. The Principle of Population Studies, Himalaya Publications.
- Chandna, R.C. 2016. Geography of Population: Concepts, Determinants and Patterns, Kalyani Publishers.
- Dyson, T. 2011. Population and Development: The Demographic Transition, Rawat Publications.
- Gregory, D., Johnston, R., Pratt, G., Watts, S., Whatmore, S. (Eds) 2009. The Dictionary of Human Geography, 5th ed, Wiley.
- Hassan, M.I. 2005. Population Geography, Rawat publications.
- Hussain, M. 1994. Human Geography. Rawat publications.
- Jhingan, M.L., Bhatt, B.K., Desai, J.N. 2014. Demography, Vrinda Publications.
- Jones, H. R. 2000. Population Geography, 3rd ed, Chapman.
- Lutz, W., Warren, C.S., Scherbov, S. 2004. The End of the World Population Growth in the 21st Century, Earthscan.

GEODSC509T—Environmental Geography✧

3 Credits [45 hours of teaching]

Concepts

1. Geographers' approach to environmental studies
2. Concept of holistic environment and systems approach
3. Ecosystem: Concept, structure and functions
4. Ecosystem Services: Concept, Identifying Ecosystem Services (Provisioning services, Cultural services, supporting services, regulating services).
5. Wetland ecosystem with special reference to East Kolkata Wetlands

Environmental problems and policies

6. Rural environmental issues with special reference to sanitation and public health
7. Urban environmental issues with special reference to waste management
8. Ocean environmental issues with special reference to plastic pollution
9. Environmental policies – National Environmental Policy, 2006, Earth Summits (Stockholm, Rio, Johannesburg), National Action Plan on Climate Change
10. Global initiatives for environmental management (special reference to Montreal Protocol, Kyoto Protocol, Paris Climate Summit)

Reading List

BOOKS

- Basu, R. and Bhaduri, S. (Eds) 2007. Contemporary Issues and Techniques in Geography, Progressive Publishers.
- Chandna, R.C. 2002. Environmental Geography, Kalyani Press.
- Chapman, J.L., Reiz, M.J. 1993. Ecology: Principle and Applications, Cambridge University Press.
- Cunningham, W.P., Cunningham, M.A. 2004. Principals of Environmental Science: Inquiry and Applications, Tata Macgraw Hill.
- Gilpin, A., 1994. Environmental Impact Assessment: Cutting Edge for the 21st Century, Cambridge University Press.
- Goudie, A. 2001. 2013. The Human Impact on the Natural Environment: Past, Present, and Future, 7th ed, Wiley-Blackwell.
- Miller, G.T. 2004. Environmental Science: Working with the Earth, Thomson Brooks.
- Odum, E.P., Barrett, G.W. 2005. Fundamentals of Ecology, Ceneage Learning.
- Raven, P.H., Hassenzahl, D.M., Hager, M.C., Gift, N.Y., Berg, L.R. 2015. Environment, 9th ed, Wiley.
- Sharma, P.D. 2011. Ecology and Environment, Rastogi Publications.
- Singh, S. 2013. Environmental Geography, PrayagPustakBhawan.
- Withgott, J.H., Laposata, M. 2017. Environment: The Science behind the Stories, 6th ed, Pearson.

WEBSITES:

- BBC – Science & Environment: https://www.bbc.com/news/science_and_environment
- Centre for Science and Environment: <https://www.cseindia.org>
- Ministry of Environment, Forest and Climate Change: <https://moef.gov.in/en>
- The Energy and Resources Institute: <https://www.teriin.org>
- The World Bank – Environment: <https://www.worldbank.org/en/topic/environment>
- United Nations Environment: <https://unfccc.int/process/bodies/supreme-bodies/conference-of-the-parties-cop>

GEODSC509P—Environmental Geography (Lab) ✧

2 Credits [60 hours of teaching]

An A4/ A3-size laboratory notebook, comprising class assignments of the following is to be prepared and submitted. The exercises are to be drawn in pencil. All texts are to be handwritten. All exercises in the laboratory notebook should be duly signed by concerned teacher.

1. Preparation of questionnaire for perception survey on environmental problems
2. Preparation of check-list for Environmental Impact Assessment of an urban / industrial project
3. Quality assessment of water using portable tester: pH, salinity, and hardness
4. Interpretation of changes in air quality using multi-seasonal and multi-city or multi locational (within a single city) CPCB / WBPCB data
5. Viva voce based on laboratory notebook

Reading List

BOOKS:

Clifford, N., Cope, M., Gillespie, T.W., French, S. (Eds) 2016. Key Methods in Geography, 3rd ed, Sage
Gilpin, A., 1994. Environmental Impact Assessment: Cutting Edge for the 21st Century, Cambridge University Press.
Northey, N., Draper, D., Knight, D.B. 2015. Making Sense in Geography and Environmental Sciences: A Student's Guide to Research and Writing, 6th ed., Oxford University Press.

WEBSITES:

BBC – Science & Environment: www.bbc.com/news/science_and_environment
Central Pollution Control Board: www.wbpcb.gov.in
Centre for Science and Environment: www.cseindia.org
Ministry of Environment, Forest and Climate Change: www.envfor.nic.in
The Energy and Resources Institute: www.teriin.org
The World Bank – Environment: www.worldbank.org/en/topic/environment
United Nations Environment Programme: www.unenvironment.org
West Bengal Pollution Control Board: www.cpcb.nic.in
West Bengal Pollution Control Board: <https://www.wbpcb.gov.in/>

GEODSC510T– Soil and Biogeography✧

5 Credit [75 hours of teaching]

Unit I: Soil Geography

1. Definition and significance of soil properties: Texture, structure, and moisture
2. Definition and significance of soil properties: pH, organic matter, and NPK
3. Soil profile. Origin and profile characteristics of lateritic, podsol and chernozem soils
4. Soil erosion and degradation: Factors, processes and management measures. Humans as active agents of soil transformation
5. Principles of soil classification: Genetic and USDA. Concept of land capability and its classification

Unit II: Biogeography

6. Concepts of biosphere, ecosystem, biome, ecotone, community, niche, succession and ecology
7. Concepts of trophic structure, food chain and food web. Energy flow in ecosystems
8. Bio-geochemical cycles with special reference to carbon dioxide and nitrogen
9. Geographical extent and characteristic features of: Tropical rain forest, Savanna, Hot desert and Taiga biomes
10. Spatial distribution of world fauna.
11. Phytogeographical regions; Plant species, family and genera
12. Deforestation: Causes, consequences and management

Reading List

- Chapman J.L., Reiz, M.J. 1993. Ecology: Principle and Applications, Cambridge University Press.
- Chiras, D.D., Reganold, J.P. 2009. Natural Resource Conservation: Management for a Sustainable Future. Pearson.
- Cox, B., Moore, P.D., Ladle, R. 2016. Biogeography: An Ecological and Evolutionary Approach, Wiley-Blackwell.
- Daji, J.A., Kadam, J.R., Patil, N.D. 1996. A Textbook of Soil Science, Media Promoters and Publishers Pvt Ltd.
- Dash, M.C., 2001. Fundamental of Ecology, 2nd edition, Tata McGrawHill, New Delhi
- Dey, N. K., Ghosh.P. 1993. India: A Study in Soil Geography, Sribhumi Publishing Company.
- Franzmeier, D.P., McFee, W.W., Graveel, J.G., Kohnke, H. 2016. Soil Science Simplified, 5th ed, Waveland Press.
- Huggett, R. 1998. Fundamentals of Biogeography, Routledge, London:
- Lomolino, M.V., Riddle, B.R., Whittaker, R.J. 2016. Biogeography, 5th ed, Oxford University Press.
- MacDonald, G.2001. Biogeography: Introduction to Space, Time, and Life, Wiley
- Morgan, R.P.C. 1995. Soil Erosion and Conservation, 2nd edition, Longman.
- Santra. A. 2006. Handbook on Wild and Zoo Animals, International Book Distributing Co.
- Sharma, P.D. 2011. Ecology and Environment, Rastogi Publications.
- Weil, R.R. and Brady, N.C. 2016. The Nature and Properties of Soil, 15th edition, Pearson.
- White, R. 2006. Principles and Practice of Soil Science: The Soil as a Natural Resource, Blackwell

GEODSC511T – Remote Sensing, GIS and GNSS✧

3 Credits [45 hours of teaching]

Unit I: Remote Sensing

1. Principles of Remote Sensing (RS): Types of RS satellites and sensors [5]
2. Sensor resolutions and their applications with reference to IRS and Landsat missions [5]
3. Image referencing schemes and acquisition procedure of free geospatial data from NRSC / Bhuvan and USGS [5]
4. Preparation of False Colour Composites from IRS LISS-3 and Landsat TM / OLI data. [5]
5. Principles of image interpretation. Preparation of inventories of land use land cover (LULC) features from satellite images [5]
6. Acquisition and utilisation of free Digital Elevation Model data: CartoDEM, SRTM and ALOS [5]

Unit II: Geographical Information Systems and Global Navigation Satellite System

7. Concept of GIS and its applicability
8. GIS data structures types: Spatial and non-spatial, raster and vector [5]
9. Principles of preparing attribute tables, data manipulation, and overlay analysis [6]
10. Principles and significance of buffer preparation [4]
11. Principles of GNSS positioning and waypoint collection [5]
12. Principles of transferring of GNSS waypoints to GIS. Area and length calculations from GNSS data [5]

Reading List

BOOKS

- Bhatta, B. 2011. Global Navigation Satellite Systems: Insights into GPS, GLONASS, Galileo, Compass and Others, CRC Press.
- Bhatta, B. 2011. Remote Sensing and GIS, 2nd ed, Oxford Univ. Press.
- Bolstad, P. 2016. GIS Fundamentals: A First Text on Geographic Information Systems, 5th ed, XanEdu Publishing.
- Brewer, C.A. 2015. Designing Better Maps: A Guide for GIS Users, 2nd ed, Esri Press.
- Harvey, F. 2015. A Primer of GIS: Fundamental Geographic and Cartographic Concepts, 2nd ed, The Guilford Press.
- Indian Space Research Organisation. 2017. Effective Use of Space Technology.
- Jensen, J.R., 2013. Remote Sensing of the Environment: An Earth Resource Perspective, Pearson Education India.
- Joseph, G. and Jegannathan, C. 2018. Fundamentals of Remote Sensing, 3rd ed, Universities Press.
- Lillesand, T.M., Kiefer, R.W. and Chipman, J.W., 2015. Remote Sensing and Image Interpretation, 7th ed, Wiley.
- Sarkar, A. 2015. Practical Geography: A Systematic Approach. 2nd ed, Orient Black Swan Private Ltd.

WEBSITES:

- ALOS Global Digital Surface Model: www.eorc.jaxa.jp/ALOS/en/aw3d30/index.htm
- International Society for Photogrammetry and Remote Sensing: www.isprs.org
- ISRO Bhuvan 2D and 3D Platforms: bhuvan.nrsc.gov.in/map/bhuvan/bhuvan2d.php
- bhuvan.nrsc.gov.in/globe/3d.php#
- NASA Landsat Science: www Landsat.gsfc.nasa.gov
- National Remote Sensing Centre: www.nrsc.gov.in
- USGS Global Visualization Viewer: www.glovis.usgs.gov

GEODSC511P – Remote Sensing, GIS and GNSS (Lab) ✧

2 Credits [60 hours of teaching]

An A3/ A4-size laboratory notebook, comprising class assignments of the following is to be prepared and submitted. The exercises are to be represented as computer prints from Q-GIS / Garmin Basecamp or MapSource / MS Excel software as applicable. Methods and interpretations are to be handwritten. Note: All exercises to be done using QGIS (2.10 and above)

1. Georeferencing of maps and images
2. Image enhancement. Preparation of FCC and identification of features using standard FCC and other band combinations across different image bands of IRS L3 or Landsat OLI data [15]
3. Supervised image classification, class editing, and post-classification analysis [15]
4. Digitisation of features. Data attachment, overlay and preparation of annotated thematic maps (choropleth, pie chart and bar graphs).
5. Waypoint collection from GNSS receivers and exporting to GIS database [10]
6. Viva-voce based on laboratory notebook (5 Marks)

Reading List

WEBSITES:

Garmin: support.garmin.com/en-US/?productID=52801&tab=manuals

International Society for Photogrammetry and Remote Sensing: www.isprs.org

ISRO Bhuvan 2D and 3D Platforms: bhuvan.nrsc.gov.in/map/bhuvan/bhuvan2d.php

NASA Landsat Science: www Landsat.gsfc.nasa.gov

National Remote Sensing Centre: www.nrsc.gov.in

Q-GIS: qgis.org/en/site/forusers/index.html

USGS Global Visualization Viewer: www.glovis.usgs.gov

GEODSC612T – Evolution of Geographical Thought ✧

5 Credits [75 hours of teaching]

Unit I: Nature of Pre Modern Geography

1. Development of Geography: Contributions of Greek and Chinese geographers
2. Impact of 'Dark Age' in Geography and Arab contributions
3. Geography during the age of 'Discovery' and 'Exploration' (contributions of Columbus, Vasco da Gama, Magellan, James Cook).
4. Transition from cosmography to scientific Geography (contributions of Bernard Varenus and Immanuel Kant). Dualism and Dichotomies (Ideographic vs. Nomothetic, Physical vs. Human, Regional vs. Systematic, Determinism vs. Possibilism,)

Unit II: Foundations of Modern Geography and Recent Trends

5. Evolution of Geographical thoughts in Germany, France, Britain and United States of America
6. Contributions of Humboldt and Ritter
7. Contributions of Richthofen, Hettner, Ratzel and Vidal deLaBlaché
8. Trends of geography in the post-World War-II period: Quantitative Revolution, systems approach.
9. Evolution of Critical Geography: Behavioural, humanistic and radical.
10. Changing concept of time-space in geography in the 21st Century

Reading List

- Adhikari, S. 2015. Fundamentals of Geographical Thought, Orient Blackswan.
- Clifford, N. Holloway S.L., Rice, S.P., Valentine, G. 2009. Key Concepts in Geography, 2nd ed, Sage.
- Couper, P. 2015. A Student's Introduction to Geographical Thought: Theories, Philosophies, Methodologies, Sage.
- Cresswell, T. 2013. Geographic Thought: A Critical Introduction, Wiley-Blackwell.
- Dikshit, R.D. 2004. Geographical Thought: A Contextual History of Ideas, Prentice Hall India.
- Holt-Jensen, A. 2011. Geography: History and Concepts: A Student's Guide, Sage.
- Husain, M. 2015. Evolution of Geographical Thought, 6th ed, Rawat Publications.
- Gregory, D., Johnston, R., Pratt, G., Watts., Whatmore, S. (Eds) 2009. The Dictionary of Human Geography, 5th ed, Wiley.
- Pete, P. 1998. Modern Geographical Thought, Wiley-Blackwell.

GEODSC613T – Hazard Management ✧

3 Credits [45 hours of teaching]

Unit I: Concepts

1. Classification of hazards and disasters.
2. Approaches to hazard study: Risk perception and vulnerability assessment. Hazard paradigms.
3. Responses to hazards: Preparedness, trauma and aftermath. Resilience and capacity building.
4. Hazards mapping: Data and geospatial techniques (for hazards enlisted in Unit II and DS14P)

Unit II: Hazard-specific Study with focus on India

5. Earthquake: Factors, vulnerability, consequences and management
6. Landslide: Factors, vulnerability, consequences and management
7. Tropical Cyclone: Factors, vulnerability, consequences and management
8. Flood: Factors, vulnerability, consequences, and management [5]
9. Riverbank erosion: Factors, vulnerability, consequences and management
10. Biohazard: Classification, vulnerability, consequences, and management [5]

Reading List

BOOKS

- Coch, N.K. 1994. Geohazards: Natural and Human, Pearson College.
- Coenraads, R. (Ed.) 2006. Natural Disasters and How We Cope, Millennium House.
- Cutter, S.L. 2006. Hazards Vulnerability and Environmental Justice, Routledge
- Government of India. 1997. Vulnerability Atlas of India, Revised ed, Building Materials & Technology Promotion Council, Ministry of Urban Development.
- Hyndman, D., Hyndman, D. 2016. Natural Hazards and Disasters, 5th ed, Brooks Cole.
- Kapur, A. 2010. Vulnerable India: A Geographical Study of Disasters, Sage.
- Keller, E.A., DeVecchio, D.E. 2014. Natural Hazards: Earth's Processes as Hazards, Disasters, and Catastrophes, 4th ed, Routledge.
- Pine, J.C. 2014. Hazards Analysis: Reducing the Impact of Disasters, 2nd ed, CRC Press.
- Robbins, P., Hintz, J., Moore, S.A. 2014. Environment and Society: A Critical Introduction 2nd ed, Wiley.
- Smith, K. 2013. Environmental Hazards: Assessing Risk and Reducing Disaster, 6th ed, Routledge.

WEBSITES:

- AGU landslide Blog: blogs.agu.org/landslideblog
- Disaster News Network: secure.disasternews.net
- India Meteorological Department Cyclone Page: www.rsmcnewdelhi.imd.gov.in/index.php?lang=en
- USGS Earthquake Hazards Programme: www.earthquake.usgs.gov

GEODSC613P – Hazard Management (Lab) ✧

2 Credits [60 hours of teaching]

An individual Project Report is to be prepared and submitted based on any one case study among the following disasters of West Bengal incorporating a preparedness plan

1. Earthquake
2. Landslide
3. Land subsidence
4. Thunderstorm/ Cyclone
5. Flood
6. Riverbank / Coastal erosion
7. Fire
8. Industrial accident
9. Road / Railway accident
10. Structural collapse
11. Environmental pollution
12. Biohazard

One case study will be done by a group of 5 to 10 students. Different groups may choose different case studies from any one or different types of disasters listed above. The report should be prepared on secondary data and handwritten on A4 page in candidates' own words not exceeding 2000 words excluding references. The report should contain a proper title. The report should incorporate relevant tables, maps, diagrams and references do not to exceed five pages. Photographs are not required. A copy of the stapled report in a transparent front file, duly signed by the concerned teacher, will be submitted during examination. Without the report the candidates will not be evaluated.

GEODSC614T – Social Geography ✧

5 Credits [75 hours of teaching]

Unit I: Society, Identity and Crisis

1. Social Geography: Concept, Origin, Nature and Scope
2. Concept of Space, Social differentiation and stratification; social processes
3. Social Categories: Caste, Class, Religion, Race and Gender and their Spatial distribution
4. Basis of Social region formation; Evolution of social-cultural regions of India
5. Peopling Process of India: Technology and Occupational Change; Migration.
6. Social groups, social behaviour and contemporary social environmental issues with special reference to India

Unit II: Social Wellbeing and Planning

7. Concept of Social Well-being, Quality of Life, Gender and Social Well-being
8. Measures of Social Well-being: Healthcare, Education, Housing, Gender Disparity
9. Social Geographies of Inclusion and Exclusion, Slums, Gated Communities, Communal Conflicts and Crime.
10. Social Planning during the Five Year Plans in India
11. Social Policies in India: Education and Health
12. Social Impact Assessment (SIA): Concept and importance

Reading List

- Ahmed A., 1999. Social Geography, Rawat Publications.
- Casino, V. J. D., Jr., 2009. Social Geography: A Critical Introduction, Wiley Blackwell.
- Cater, J. and Jones T., 2000: Social Geography: An Introduction to Contemporary Issues, Hodder Arnold.
- Gregory, D., Johnston, R., Pratt, G., Watts., Whatmore, S. (Eds) 2009. The Dictionary of Human Geography, 5th ed, Wiley.
- Holt, L., 2011. Geographies of Children, Youth and Families: An International Perspective, Taylor & Francis.
- Majumdar, P.K. 2013. India's Demography: Changing Demographic Scenario in India, Rawat Publications.
- Mukherji, S. 2013. Migration in India: Links to Urbanization, Regional Disparities and Development Policies, Rawat Publications
- Panelli, R., 2004. Social Geographies: From Difference to Action, Sage.
- Rachel, P., Burke, M., Fuller, D., Gough, J., Macfarlane, R. and Mowl, G. 2001. Introducing Social Geographies, Oxford University Press.
- Smith, D. M., 1994. Geography and Social Justice, Blackwell, Oxford.
- Smith, S.J., Pain, R., Marston, S. A., Jones, J. P., 2009. The SAGE Handbook of Social Geographies, Sage Publications.
- Valentine, G. 2014. Social Geographies: Space and Society, Routledge.

GEODSC615P – Surveying Techniques and Fieldwork ✧

5 Credits [150 hours of teaching]

Unit I: Surveying

1. Open and closed traverse survey using Prismatic Compass; Bowditch correction for closing error adjustment
2. Profile line survey and Radial Contouring using a Dumpy Level; plotting radial contouring data.
3. Profile survey using Abney level
4. Determination of heights of objects with accessible and inaccessible base by Transit Theodolite (instrument and object not in same vertical plane method).
5. Viva voce based on laboratory notebook

Unit II: Fieldwork

Every student needs to participate in fieldwork and prepare a field report according to the following guideline, failing which he/she will not be evaluated for this paper.

1. Each student will prepare a report based on primary data collected from field survey and secondary data collected from different sources.
2. Students will select either one rural area (*mouza*) or an urban area (municipal ward) for the study, with the primary objective of evaluating the relation between physical and cultural landscape.
3. The fieldwork should be completed within seven days.
4. The report should be handwritten in English on A4 size paper in candidate's own words within 5,000 words (Introductory Chapter: 1000 words; Physical Aspects: 1500 words; Socio-economic Aspects: 1500 words; Concluding Chapter: 500 words, approximately) excluding tables, photographs, maps, diagrams, references and appendices.
5. Maps and diagrams should not exceed 15 pages.
6. All sections of the report should contain relevant maps, diagrams and photographs using primary and secondary data, clearly citing sources.

A copy of the bound report, duly signed by the concerned teacher, will be submitted during examination.

Reading List

- Arora, K.R. (2010): Surveying (Volumes I & II), Standard Book House, New Delhi.
- Basak, N.N. 2017. Surveying and Levelling, 2nd ed, McGraw Hill Education.
- Kulkarni, S.V. and Kanetkar, T.R. (1965): Surveying and Levelling (Volumes I & II), A.V.G. Prakashan, New Delhi.
- Sarkar, A. (2008): Practical Geography: A Systematic Approach, Orient Black Swan, Kolkata.
- Singh, R.L. and Singh, P.B. (2009): Elements of Practical Geography, Kalyani Publishers, New Delhi.
- Subramanian, R. (2012). Surveying and Levelling, 2nd ed, Oxford University Press.
- Lenon, B., Cleves, P. 2015. Geography Fieldwork and Skills, Harper-Collins.
- Parsons, T., Knight, P.G. 2015. How To Do Your Dissertation in Geography and Related Disciplines, 3rd ed, Routledge.
- Phillips, R., Johns, J. 2012. Fieldwork for Human Geography, Sage.
- Thornbush, M.J., Allen, C.D., Fitzpatrick, F.A. (Eds) 2014. Geomorphological Fieldwork, Elsevier.

Advanced Courses

GEODSC716T – Hydrology and Oceanography ✧

5 Credits [75 hours of teaching]

Unit1: Components of Hydrology

- 1.1 Hydrological system models and their classification; principles of hydrologic budget calculation; hydrological measurements and data sources
- 1.2 Water inputs: Water vapour; precipitation and its variability, Intensity-Duration-Frequency (IDF) relationships.
- 1.3 Water storages: Interception, throughfall and depression storage — controlling factors and estimation.
- 1.4 Water losses: Evaporation, transpiration and evapotranspiration — controlling factors and estimation.

Unit 2: Surface and Groundwater Hydrology and Related Applications

- 2.1 Catchment processes: Generation of direct runoff, streamflow and baseflow.
- 2.2 Vertical distribution of water: zone of aeration and saturation. Water-bearing properties of rocks, groundwater flow — Darcy's law.
- 2.3 Water harvesting: models, techniques and feasibility
- 2.4 Water management in tropical farmlands: techniques and approaches.

Unit 3: Morphology of Ocean Basins

- 3.1 Wilson cycle— opening and closure of ocean basin, Characteristics of continental margins, ridges, guyots, trenches, canyons, fracture zones, island arcs and their tectonic settings.
- 3.2 Marine sediments: Classification, origin, composition and distribution.
- 3.3 Morphology and evolution of coral islands, conditions for coral growth, distribution of coral reefs; problem of coral bleaching.
- 3.4 Evolution and bottom topography of Indian ocean: with respect to submarine ridges, islands, continental shelf, trenches, straits and marginal seas.

Unit 4: Ocean Circulation and Marine Resources

- 4.1 Atmosphere-Ocean-Climate coupling: Feedback mechanisms, ocean mixed layer dynamics, fluxes in the boundary layer, gas exchange, ENSO and its impact.
- 4.2 Ocean circulation: Sea surface currents, deep ocean circulation; generation of wind-waves and tide
- 4.3 Sea level change: Types and causes
- 4.4 Utilisation of the oceanic resources: Nature and types, Regulatory measures like EEZ and CRZ.

Reading List

- Dingman, S.L. 2015. Physical Hydrology, 3rd ed, Macmillan Publishing Co.
- Fitts, C.R. 2002. Groundwater Science, Elsevier.
- Garrison, T. 2016. Oceanography: An Invitation to Marine Science, 9th ed, Cengage Learning.
- Kearey, P., Klepeis, K.A., Vine, F.J. 2011. Global Tectonics, 3rd ed, Wiley-India.
- Karanth, K.R., 1988: Ground Water: Exploration, Assessment and Development, Tata- McGraw Hill, New Delhi.
- Pinet, P.R. 2014. Invitation to Oceanography. 7th ed, Jones and Barlett Publishers.
- Pinneker, E.V. 2010. General Hydrogeology, Cambridge University Press.
- Pugh, D., Woodworth, P. 2014. Sea-Level Science: Understanding Tides, Surges, Tsunamis and Mean Sea-Level Changes, 2nd ed, Cambridge University press.
- Raghunath, H.M. 2006. Hydrology: Principles, Analysis, Design, 3rd ed, New Age International Publishers.
- Reddy, P.J.R. 2014. A Textbook of Hydrology, University of Science Press.
- Subramanya, K. 2013. Engineering Hydrology, McGraw Hill Education.
- Sverdrup, K.A., Armrest, E.V. 2010. An Introduction to the World Oceans, 10th ed, McGraw Hill.
- Todd, D.K., Larry, W.M. 2004. Groundwater Hydrology, John Wiley & Sons.
- Ward, A.D., Trimble, S.W., Burckhard, S.R., Lyon, J.G. 2016. Environmental Hydrology, 3rd ed, CRC Press.

GEODSC717T – Statistical Methods in Geography✧

3 Credits [45 hours of teaching]

Unit1: Geographical Data, Sampling and Descriptive Statistics

- 1.1 Types of statistics: Descriptive and Inferential. Meaning and description. Geographical data: Spatial and temporal data, discrete and continuous data, grouped and ungrouped data nominal, ordinal, interval and ratio scales of measurements, frequency distribution.
- 1.2 Measures of central tendencies: Mean, median, mode. Probability: normal, poisson and binomial, normal probability curve and its application
- 1.3 Measures of dispersion: Variance, coefficient of variability, standard deviation, skewness and kurtosis.

Unit 2: Theory of Probability

- 2.1 Probability: Empirical definition, axioms, probabilities of compound events.
- 2.2 Determination of the probability of a continuous random event using normal distribution. Properties of normal distribution
- 2.3 Determination of the probability of a discrete random event using Binomial and Poisson distributions. Properties of Binomial and Poisson distribution.

Unit 3: Sampling and Hypothesis Testing

- 3.1 Sampling theories and methods; application of random numbers, sampling error and its estimation.
- 3.2 Hypothesis testing: formulation, acceptance and rejection, significance level and type of errors.
- 3.3 Test of significance: Students t Test (Parametric test) and Chi Square Test (Non-parametric test).

Unit 4: Bivariate Analysis: Correlation and Regression

- 4.1 Concept of bivariate correlation and regression; bi-variate analysis and curve fitting — linear, exponential. power relationship.
- 4.2 Calculation of Pearson's product moment correlation coefficient and rank correlation, residuals and mapping of residuals.
- 4.3 Time-series analysis: Properties, trends and periodicity. Curve fitting by moving average and least square method.

Reading List

- Acevedo, M.F. 2012. Data Analysis and Statistics for Geography, Environmental Science and Engineering, CRC Press.
- Harris, R., Jarvis, C. 2011. Statistics for Geography and Environmental Science, Prentice Hall.
- McGrew Jr., J.C., Lembo Jr., A.J., Monroe, C.B. 2014. An Introduction to Statistical Problem Solving in Geography, 3rd ed, Waveland Press.
- Pal S. K., 1998. Statistics for Geoscientists: Techniques and Applications, Concept Pub Co.
- Rogerson, P.A. 2015. Statistical Methods for Geography: A Student's Guide, 4th ed, Sage.
- Sarkar, A. 2015. Practical Geography: A Systematic Approach, 3rd ed, Orient Blackswan.

GEODSC717P – Statistical Methods in Geography (Lab) ✧

2 Credits [60 hours of teaching]

An A4/ A3-size laboratory notebook, comprising class assignments of the following is to be prepared and submitted. The exercises are to be drawn in pencil. All texts are to be handwritten. All exercises in the laboratory notebook should be duly signed by concerned teacher.

1. Construction of data matrix with each row representing an areal unit (districts / blocks / *mouzas* / towns) and corresponding columns of relevant attributes
2. Based on the above, a frequency table, measures of central tendency and dispersion would be computed and interpreted using histogram and frequency curve
3. From the data matrix a sample set (20%) would be drawn using, random, systematic and stratified methods of sampling and locate the samples on a map with a short note on methods used
4. Based on of the sample set and using two relevant attributes, a scatter diagram and linear regression line would be plotted and residual from regression would be mapped with a short interpretation
5. Viva voce based on laboratory notebook

Reading List

Books:

- Acevedo, M.F. 2012. Data Analysis and Statistics for Geography, Environmental Science and Engineering, CRC Press.
- Basu, P. 2021. Advanced Practical Geography — a Laboratory Manual, 4 ed, Books and Allied. Acevedo, M.F. 2012. Data Analysis and Statistics for Geography, Environmental Science and Engineering, CRC Press.
- Harris, R., Jarvis, C. 2011. Statistics for Geography and Environmental Science, Prentice Hall.
- Mahmood, A. 1999. Statistical Methods in Geographical Studies, Rajesh Publications.
- McGrew Jr., J.C., Lembo Jr., A.J., Monroe, C.B. 2014. An Introduction to Statistical Problem Solving in Geography, 3rd ed, Waveland Press.
- Pal, S.K. 1998. Statistics for Geoscientists: Techniques and Applications, Concept Pub Co.
- Rogerson, P.A. 2015. Statistical Methods for Geography: A Student's Guide, 4th ed, Sage.
- Sarkar, A. 2015. Practical Geography: A Systematic Approach, 3rd ed, Orient Blackswan.

WEBSITES:

- Government of India data platform: <https://data.gov.in>
- Census of India: <https://censusindia.gov.in/census.website> West Bengal District Statistical Handbooks:
<http://wbpspm.gov.in/publications/District%20Statistical%20Handbook>

GEODSC818T – Research Methodology and Mapping Techniques in Geography ✧

5 Credits [75 hours of teaching]

Unit1: Methodology of Geographical Research

- 1.1 Research in geography: Types, selection of research problem, selection of study area
- 1.2 Specifying objectives and framing research questions, formulation of research hypothesis
- 1.3 Literature review, knowing when the literature review is complete, identification of research gap
- 1.4 Identification and exploring relevant secondary data sources

Unit 2: Methodology in human and physical geography

- 2.1 Perception Survey Techniques, preparation of Survey Schedule and Questionnaires for perception survey (open, closed, structured, non-structured), Likert Scale in perception surveys
- 2.2 Interviews, analysis of text, narrative analysis, statement analysis. Focussed group discussion — principles and techniques.
- 2.3 Field methods in physical geography: Instrument-based survey, soil sample collection, preparing soil samples for textural analysis, ground truth verification.
- 2.4 Assessment of soil status by soil testing kit: N, P, K, organic carbon and pH, determination of water quality: Alkalinity, CO₂, DO and Nitrate

Unit–3: Report writing and presentation

- 3.1 Techniques of writing scientific research papers, thesis. Writing of abstract, sectioning, page arrangement and set-up
- 3.2 Style of referencing, preparation of glossary and bibliography
- 3.3 General principles of seminar presentation
- 3.4 Research ethics with special reference to plagiarism

Unit 4: Mapping spatial pattern and inequality

- 4.1 Location of mean centre and standard distance measure.
- 4.2 Population projection using exponential curve and Breaking point analysis
- 4.3 Location Quotient, Functional classification of urban places by Ternary diagram.
- 4.4 Lorenz Curve and Gini Coefficient for measuring inequality.

Reading List

- Clifford, N., Cope, M., Gillespie, T.W., French, S. (Eds) 2016. *Key Methods in Geography*, 3rd ed, Sage.
- Cole, J.P and King, C.A.M. (1970): *Quantitative Geography*, John Wiley and Sons, New York
- Gomes, B., Jones III, J.P. (Eds) 2010. *Research Methods in Geography: A Critical Introduction*, Wiley-Blackwell.
- Healy, F.J., (2010): *Statistics: A tool for Social Research*, Cengage Learning, New York
- Lenon, B., Cleves, P. 2015. *Geography Fieldwork and Skills*, Harper-Collins.
- Montello , D.R, Sutton, P. 2012. *An Introduction to Scientific Research Methods in Geography and Environmental Studies*, Sage.
- Murthy , K.LN. 2004. *Research Methodology in Geography: A Text Book*, Concept Publishing Co.
- Northey, N., Draper, D., Knight, D.B. 2015. *Making Sense in Geography and Environmental Sciences: A Student's Guide to Research and Writing*, 6th ed, Oxford University Press.
- Parsons, T., Knight, P.G. 2015. *How to Do Your Dissertation in Geography and Related Disciplines*, 3rd ed, Routledge.
- Phillips, R., Johns, J. 2012. *Fieldwork for Human Geography*, Sage.
- Riordan, D. 2013. *Technical Report Writing Today*, 10th ed, Wadsworth Publishing.
- Rogerson, P. (2001): *Statistical Methods for Geography*, Sage Publications, London
- Schneider, W. ed., (1988). *Water analysis: A practical guide to physico-chemical, chemical, and microbiological water examination and quality assurance* (No. 628.161 W3). Berlin: Springer-Verlag
- Thornbush, M.J., Allen, C.D., Fitzpatrick, F.A. (Eds) 2014. *Geomorphological Fieldwork*, Elsevier.

GEODSC819T – Applied Geomorphology and Climatology

3 Credits [45 hours of teaching]

Unit 1: Geomorphology in Assessment of Hazards and Engineering Projects

- 1.1 Principles, aspects and purpose of applied geomorphology.
- 1.2 Geomorphic approach to hazard assessment and management: Mechanisms, vulnerability and management of landslides, floods, riverbank erosion and GLOF
- 1.3 Geomorphology in site feasibility assessment of engineering projects: Construction of roads, dams, tunnels, and bridges.
- 1.4 Geomorphic issues associated with channel restoration and dam removal

Unit 2: Geomorphology of Land Utilization and Resource Management

- 2.1 Managing flash floods, urban drainage, and badland reclamation
- 2.2 Principles of terrain evaluation and its significance. Application of remote sensing and GIS techniques in terrain evaluation
- 2.3 Geomorphology in mineral prospecting and groundwater mapping
- 2.4 Geomorphology in watershed management

Unit 3: Climate and the Bio-Physical Environments

- 3.1 Foundation of Applied Climatology: History of applied meteorology; climate as a resource; data sources, ancient and indigenous knowledge of climate prediction
- 3.2 Bioclimatology and health: Human thermal comfort indices (PET, UTCI); climate-sensitive diseases (vector-borne epidemics)
- 3.3 Agroclimatology: Crop-weather relationships, Growing Degree Days (GDD), drought classification (meteorological, hydrological, agricultural), drought monitoring through Standardised Precipitation Index (SPI)
- 3.4 Climatology in aviation and marine navigation

Unit 4: The Changing Climatic Environments

- 4.1 Urban Heat Island: Mechanics of the Urban Heat Island (UHI) effect, urban microclimates, climate-responsive building design and wind ventilation corridors.
- 4.2 Climatology in pollution studies
- 4.3 Climatology in hazard identification and risk reduction: Cyclones and drought
- 4.4 Approaches and techniques of weather forecasting in India; short, medium and long range.

Reading List

- Brooks, C.F., 1925. The cooling of man under various weather conditions. *Monthly Weather Review*, **53**: 28–33.
- Changnon, D., 1998. Design and test of a “hands-on” applied climate course in an undergraduate meteorology program. *Bulletin of the American Meteorological Society*, **79**: 79–84.
- Changnon, S.A., 1973. Atmospheric alterations from man-made biospheric changes. In *Weather Modification: social concerns and public policies*. Western Geographical Series, pp. 134–184.
- Changnon, S.A., 1979. What to do about urban-generated weather and climate changes. *Journal of the American Planning Association*, **45**: 36–48.
- Clark, J.R. (1996): *Coastal Zone Management Handbook*, CRC Press / Lewes Publishers, New York.
- Coch, N.K. (1994): *Geohazards: Natural and Human*, Prentice-Hall, Englewood Cliffs.
- Conrad, V., and Pollack, L., 1944. *Methods in Climatology*. Boston, MA: Harvard University Press.
- Cook, R.U. and Doorncamp, J. C. (1990) *Geomorphology in Environment Management: A New Introduction*, 2nd edition, Clarendon Press-Oxford, Oxford.
- Goudie, A. (editor) (1990): *Geomorphological Techniques*, 2nd edition, Allen Unwin, Crows Nest (Australia).
- Hobbs, J.E., 1997. Introduction: the emergence of applied climatology and climate impact assessment. In *Applied Climatology Principles and Practice*. New York: Routledge, pp. 1–12.
- Mitchell, C.W. (1973) *Terrain evaluation; an introductory handbook to the history, principles, and methods of practical terrain assessment*, Longman publishing, London.
- Morisawa, M. (editor) (1994): *Geomorphology and Natural Hazards*, Elsevier, Amsterdam.
- Oke, T.R., 1973. City size and the urban heat island. *Atmospheric Environment*, **7**: 769–779.
- Oliver, J. E., 1981. *Climatology: Selected Applications*. New York: Wiley.
- Smith, K. (2004): *Environmental Hazards, Assessing Risk and Reducing Disaster*, 4th edition, Routledge, London.
- Stern, P., and Easterling, W., 1999. *Making Climate Forecasts Matter*. Washington, DC: National Academy Press.
- Thompson, R.D., and Perry, A., 1997. *Applied Climatology Principles and Practice*. New York: Routledge.

GEODSC819P – Applied Geomorphology and Climatology

2 Credits [60 hours of teaching]

1. Calculating the flood recurrence interval with given data of a river
2. Preparation and interpretation of rating curves and unit hydrographs of rivers
3. Measuring riverbank shifts from multi-temporal maps/ images in GIS environment.
4. Preparation of Station Model and interpretation of Synoptic Chart
5. Computation of the Human Discomfort Index as per E.C. Thom (1959) due to high temperature and humidity

Reading List

Basu, R. and Bhaduri, S. 2007. Contemporary Techniques in Geography. Progressive Publishers, Kolkata, 262p.

Unit Hydrograph (UHG) Technical Manual, National Weather Service - Office of Hydrology and Hydrologic Research Laboratory, National Operational Hydrologic Remote Sensing Centre.

https://www.nohrsc.noaa.gov/technology/gis/uhg_manual.html

Thom, E. C., 1959. The Discomfort Index. *Weatherwise*, 12(2), 57–61.

<https://doi.org/10.1080/00431672.1959.9926960>

World Meteorological Organization, 2008. Guide to Meteorological Instruments and Methods of Observation. 681p.

National Weather Service Training Centre, Rating Curves and Streamflow Measurements, Basic Hydrologic Concepts, Section VI. <https://training.weather.gov/nwstc/Hydrology/HYDRO/BHModule/BH-unit6.HTML>.

GEODSC820T – Rural and Urban Geography ✧

5 Credits [75 hours of teaching]

Unit 1: Rural Development and Geographical Perspective

- 1.1 Paradigms of rural development: Modernisation paradigm, holistic development paradigm, Gandhian approach. Rural-urban continuum, restructuring of rural spaces in a globalised world.
- 1.2 Rural settlement: Genesis, spatial distribution patterns and types of rural dwellings. Rural service centres. Hierarchy of nodal settlement of market centres and growth centres.
- 1.3 Approaches to rural development: Area-based (DPAP) and Target based (NFFWP)
- 1.4 Rural Employment policies and programmes in India, PMGSY, SJSY, MNREGA, Jan Dhan Yojana

Unit 2: Rural Economy, Social Dynamics and Rural Governance

- 2.1 Agrarian Restructuring: Green Revolution impacts, commercialisation of agriculture, and contract farming.
- 2.2 The Non-Farm Sector: Emerging industry and trade in rural areas with special reference to Rural Service Centre. Rural diversification, periodic markets, rural tourism, and rural-urban migration.
- 2.3 Social Stratification: Intersection of caste, class, and gender in spatial access; rural poverty, food security, and marginalisation.
- 2.4 73rd Constitutional Amendment of India and its implications for governance, Participatory rural planning and management with reference to JFM, Watershed Management, SHGs, MGNREGA, Rural Health Mission.

Unit 3: Urbanisation and Urban Systems

- 3.1 Urban Geography: approaches and recent trends. Concepts of urban, urbanism and urbanisation
- 3.2 Global Urbanization Trends: Megacities, hyper-urbanization, counter-urbanization, and the production of urban space. Law of the Primate City.
- 3.3 Types and characteristics of urban areas: Megalopolis, Satellite Towns, Metropolitan Areas and Urban Agglomerations
- 3.4 Policies of urban development at the national level and its implications National Commission on Urbanization (NCU), Integrated Development of Small and Medium Towns (IDSMT), Jawaharlal Nehru National Urban Renewal Mission (JNNURM); Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

Unit 4: Urban Vulnerabilities, Infrastructure and Urban Governance

- 4.1 Critical Infrastructure: Water scarcity, transit-oriented development (TOD), smart city infrastructures, and digital divide
- 4.2 Solid waste management and ecological consequences, MSWM Rules 2016
- 4.3 Housing: Proliferation of slums, gentrification, eviction. Informal settlement and housing; Affordable Housing schemes in India
- 4.4 Urban transport problems and policies

Reading List

- Carter, H. 1995. *The Study of Urban Geography*, 4th ed, Arnold.
- Gilg, A.W. 1985. *An Introduction to Rural Geography*, Edwin Arnold.
- Gottdiener, M., Budd, M. Lehtovuori, P. 2016. *Key Concepts in Urban Studies*, 2nd ed, Sage.
- Jonas, A.E.G., McCann, E., Thomas, M. 2015. *Urban Geography: A Critical Introduction*, Wiley-Blackwell.
- Kaplan, D., Holloway, S. 2014. *Urban Geography*, 3rd ed, Wiley.
- Knox, P.L., McCarthy, L.M. 2011. *Urbanization: An Introduction to Urban Geography*, 3rd ed, Pearson.
- Krishnamurthy, J. 2000. *Rural Development: Problems and Prospects*, Rawat Publications.
- Latham, A., McCormack, D., McNamara, K. McNeill, D. 2009. *Key Concepts in Urban Geography*, Sage.
- Lee, D.A., Chaudhri, D.P. (Eds) 1983. *Rural Development and State*, Methuen Publishing.
- LeGates, R.T., Stout, F. (Eds) 2015. *The City Reader*, 6th ed, Routledge.
- Levy, J.M. 2016. *Contemporary Urban Planning*, 11th ed, Routledge.
- Macionis, J.J., Parrillo, V.N. 2016. *Cities and Urban Life*, 7th ed, Pearson.
- Misra, R.P. (Ed) 2002 (Reprint). *Regional Planning: Concepts, Techniques, Policies and Case Studies*, Concept Pub. Co.
- Misra, R.P., Sundaram, K.V. (Eds) 1979. *Rural Area Development: Perspectives and Approaches*, Sterling Publishers.
- Pacione, M. 2009. *Urban Geography: A Global Perspective*, Routledge.
- Potter, R.B., Lloyd-Evans, S. 2014. *The City in the Developing World*, Routledge.
- Ramachandran, H., Guimaraes, J.P.C. 1991. *Integrated Rural Development in Asia: Learning from Recent Experience*, Concept Publishing.
- Ramachandran, R. 1989. *Urbanisation and Urban Systems in India*, Oxford University Press.
- Ramachandran, R., 1992: *The Study of Urbanisation*, Oxford University Press
- Robb, P. (Ed) 1983. *Rural South Asia: Linkages, Change and Development*, Curzon Press.
- Singh, K., Shishodia, A. 2016. *Rural Development: Principles, Policies, and Management*, 4th ed, Sage.
- Singh, R.B. (Ed) 2015. *Urban Development, Challenges, Risks and Resilience in Asian Megacities*. *Advances in Geographical and Environmental Studies*, Springer.
- Wanmali, S. 1992. *Rural Infrastructure, the Settlement System and Development of the Regional Economy in Southern India*, International Food Policy Research Institute.

GEODSC821T – Regional Development and Planning

5 Credits [75 hours of teaching]

Unit1: Regional Development

- 1.1 Regions: Concept, types, and delineation
- 1.2 Concepts of growth and development. Indicators of development: Economic, demographic, and environmental
- 1.3 Theories and models for regional development: Harrod Domar Growth Model; Coastal Penetration Model, Kuznets Growth Model, SOLOV model, Paul Krugman Model of Economic Growth.
- 1.4 Underdevelopment: Concept and causes

Unit 2: Regional Disparities and Development in India

- 2.1 Regional disparities in India: Economic and social, Identification of backward areas and policy issues
- 2.2 Regional Policies: Five Year Plans, NITI Aayog's strategies and Rurban Mission
- 2.3 Special Economic Zones - special reference to West Bengal
- 2.4 Regional planning in India: DVC, National Capital Region, Kolkata and Tribal Area Development

Unit–3: Regional Planning Concept and Principles

- 3.1 Regional planning: Principles, objectives and approaches
- 3.2 Types of planning: Temporal, sectoral, spatial, and non-spatial. Centralized and decentralized planning. Multi-level planning
- 3.3 Planning strategies: Top -Down and Bottom-up approach; Participatory planning and governance
- 3.4 Regional planning models: Growth Foci, Service Centre Approach, Rural-Urban Integration.

Unit 4: Regional Planning in India

- 4.1 Planning issues in hill area (as formal region) and city region (as functional region)
- 4.2 Regional disparities: Concept, types; demographic, social and economic disparities in India.
- 4.3 Planning of problem regions: Tribal, coastal, drought prone area, flood prone area
- 4.4 Pandemics and city planning

Reading List

- Bhargava, G. 2001. Development of India's Urban, Rural, and Regional Planning in 21st Century: Policy Perspective, Gyan Publishing House.
- Chand, M., Puri, V.K. 2000. Regional Planning In India, Allied Publishers Ltd.
- Chandna, R.C. 2016. Regional Planning and Development, 6th ed, Kalyani Publishers.
- Glasson, J. 2017. Contemporary Issues in Regional Planning, Routledge.
- Gore, C. 2011. Regions in Question: Space, Development Theory, and Regional Policy, Routledge.
- Gregory, D., Johnston, R., Pratt, G., Watts, M., Whatmore, S. (Eds) 2009. The Dictionary of Human Geography, 5th ed, Wiley.
- Hall, P., Tewdwr-Jones, M. 2010. Urban and Regional Planning, Routledge.
- Higgins, B., Savoie, D.J. 2017. Regional Development: Theories and Their Application, Routledge.
- Kulshetra, S.K. 2012. Urban and Regional Planning in India: A Handbook for Professional Practitioners, Sage.
- Kumar, A., Meshram, D.S., Gowda, K. (Eds) 2016. Urban and Regional Planning Education: Learning for India, Springer.
- Misra, R.P. 1992. Regional Planning: Concepts, Techniques, Policies and Case Studies, Concept Pub Co.
- Ray, J. 2001. Introduction to Development & Regional Planning, Orient Blackswan.
- Combes P., Mayer T. and Thisse J. F., 2008: Economic Geography: The Integration of Regions and Nations, Princeton University Press.
- Wheeler, J.O., Muller, P.O., Thrall, G.I., Fik, T.J. 1998. Economic Geography, 3rd ed, Wiley.
- Willington D. E., 2008: Economic Geography, Husband Press.
- Wood, A., Roberts, A. 2010. Economic Geography: Places, Networks and Flows, Routledge.

Minor Courses for Major/ Honours Students of Other Disciplines offered by Geography / Core Courses for the 3-year Multidisciplinary Undergraduate Programme offered by Geography

GEOMIN101T/ GEOCOR101T – Physical Geography ✧

5 Credit [75 hours of teaching]

Unit I: Geotectonics and Geomorphology

1. Internal Structure of Earth based on Seismic Evidence.
2. Influence of lithology on landforms: Granite and Basaltic landforms.
3. Factors controlling landform development; endogenetic and exogenetic forces.
4. Evolution of landforms under fluvial process
5. Nature and classification of hazards in Indian context

Unit II: Climatology, Soil and Biogeography

6. Nature, composition and layering of the atmosphere
7. Distribution of pressure belts and planetary wind system, jet streams, and index cycle.
8. Factors of soil formation
9. Evolution of an ideal soil profile
10. Concept of ecosystem — basic ecological principles, ecotone, communities, niche, succession, and habitat.
11. Concept of Biomes: study of Tropical rainforest, Taiga, Savannah, Desert, Tundra and Temperate grasslands

Reading List

- Coch, N.K. 1994. Geohazards: Natural and Human, Pearson College.
- Conserva H. T., 2004: Illustrated Dictionary of Physical Geography, Author House, USA.
- Critchfield, H.J., 1983: General Climatology. Prentice Hall India Ltd. (2010 Reprint)
- Dash, M.C., 2001. Fundamentals of Ecology, 2nd edition, Tata McGraw-Hill, New Delhi.
- Franzmeier, D.P., McFee, W.W., Graveel, J.G., Kohnke, H., 2016: Soil Science Simplified, 5th ed, Waveland Press.
- Gabler R. E., Petersen J. F. and Trapasso, L. M., 2007: Essentials of Physical Geography (8th Edition), Thompson, Brooks/Cole, USA.
- Garrett N., 2000: Advanced Geography, Oxford University Press.
- Goudie, A., 1984: The Nature of the Environment: An Advanced Physical Geography, Basil Blackwell Publishers, Oxford.
- Hamblin, W. K., 1995: Earth's Dynamic System, Prentice Hall, N.J.
- Husain M., 2002: Fundamentals of Physical Geography, Rawat Publications, Jaipur.
- Kormondy, E.J. 1996. Concepts of Ecology, 4th edition, Prentice-Hall, India, New Delhi.
- Monkhouse, F. J. 2009: Principles of Physical Geography, Platinum Publishers, Kolkata.
- Sharma, P.D. 2011. Ecology and Environment, Rastogi Publications. Singer, M., Munns, D.N. 2005. Soils: An Introduction, 6th ed, Pearson.
- Strahler A. N. and Strahler A. H., 2008: Modern Physical Geography, John Wiley & Sons, New York.
- Weil, R.R., Brady, N.C. 2022. The Nature and Properties of Soils, 15th ed, Pearson Education.

GEOMIN202T/ GEOCOR202T – Human Geography ✧

5 Credit [75 hours of teaching]

Unit I Scope and Approaches

1. Elements of Human Geography: Nature, scope and recent trends.
2. Approaches to Human Geography; Resource, Locational, Landscape, Environmental

Unit II Social and Population Geography

3. Evolution of human societies: Hunting and food gathering, pastoral nomadism, subsistence farming, industrial society and post-industrial urban society.
4. Human adaptation to environment: Eskimo, Masai and Maori
5. Population distribution, density and growth of world population.
6. Demographic Transition Theory

Unit III Economic and Settlement Geography

7. Sectors of the economy: primary, secondary, tertiary and quaternary, quinary
8. Types of agriculture: Intensive subsistence rice farming, Plantation agriculture (Tea)
9. Site, situation, types and patterns of Rural Settlements
10. Classification of Urban Settlements after Census of India.

Reading List

- Bose, N.K. 2020. Tribal Life in India, 5th ed (updated by Tripathi, C.B.), National Book Trust.
- Chandna R.C. 2022. Geography of Population, Part 1: Concepts, Determinants and World Patterns, Kalyani Publishers.
- Chandna, R.C. (2010) Population Geography, Kalyani Publisher.
- Daniel, P.A. and Hopkinson, M.F. (1989) Geography of Settlement, Oliver & Boyd, London.
- Dorrel, D., Henderson, P. 2018. Introduction to Human Geography. University of Georgia Press.
- Fouberg, E.H., Nash, A.B., Murphy, A.B., de Blij, H., 2015. Human Geography: People, Place, and Culture, 11th ed, Wiley.
- Ghosh, S. (2015) Introduction to settlement geography. Orient Black Swan Private Ltd., Kolkata
- Gregory, D., Johnston, R., Pratt, G., Watts, K., Whatmore, S. (Eds) 2009. The Dictionary of Human Geography, 5th ed, Wiley-Blackwell.
- Jordan-Bychkov et al. (2006) The Human Mosaic: A Thematic Introduction to Cultural Geography. W. H. Freeman and Company, New York.
- Knox, P.L., Marston, S.A. 2014. Human Geography, Places and Regions in Global Context, 6th ed, Pearson Education.
- Majumdar, P.K. 2013. India's Demography: Changing Demographic Scenario in India, Rawat Publications.
- Mercier, M., Norton, W. 2019. Human Geography, 10th ed, Oxford University Press.
- Paul, C., Crang, P., Goodwine, M.G. 2014, Introducing Human Geographies, 3rd ed, Routledge.
- Rubenstein J.M., 2018, Contemporary Human Geography, 4th ed, Pearson.
- Short, R.J. 2017. Human Geography: A Short Introduction, 2nd ed, Oxford University Press.
- Sing, R.Y. 2009, A Geography of Settlements, Rawat Publications

GEOMIN303T/ GEOCOR303T – General Cartography ✧

3 Credits [45 hours of teaching]

Cartographic Techniques

1. Concept of map scale: Types and Application. Reading distances on a map.
2. Map Projections: Criteria for choice of projections. Attributes and properties of: Zenithal Gnomonic Polar Case, Zenithal Stereographic Polar Case, Cylindrical Equal Area, Mercator's Projection, Bonne's Projection. Concept of UTM projection
3. Survey of India topographical maps: Reference scheme of old and open series. Information on the margin of maps.
4. Representation of Data – Symbols, Dots, Choropleth, Isopleth and Flow Diagrams, Interpretation of Thematic Maps.

Reading List

Dent B. D., 1999: *Cartography: Thematic Map Design*, (Vol. 1), McGraw Hill.
Gupta K. K and Tyagi V. C., 1992: *Working with Maps*, Survey of India, DST, New Delhi.
Mishra R. P. and Ramesh A., 1989: *Fundamentals of Cartography*, Concept Publishing.
Robinson A., 1953: *Elements of Cartography*, John Wiley.
Sharma J. P., 2010: *Prayogic Bhugol*, Rastogi Publishers.
Singh R. L. and Singh R. P. B., 1999: *Elements of Practical Geography*, Kalyani Publishers
Singh R. L., 1998: *Prayogic Bhoogol Rooprekha*, Kalyani Publications.
Steers J. A., 1965: *An Introduction to the Study of Map Projections*, University of London.

GEOMIN303P/ GEOCOR303P – General Cartography (Lab) ✧

2 Credits [60 hours of teaching]

Cartographic Techniques

1. Graphical construction of scales: Plain and comparative. [10]
2. Construction of projections: Zenithal Gnomonic Polar Case, Zenithal Stereographic Polar Case, Cylindrical Equal Area, Mercator's Projection, Bonne's Projection. [30]
3. Construction and interpretation of relief profiles from Survey of India topographical map — superimposed, projected and composite, relative relief map, slope map (Wentworth), and Correlation between physical and cultural features from Survey of India topographical maps using transect chart.

GEOCOR404T – Environmental Geography ✧

5 Credits [75 hours of teaching]

Concepts

1. Environmental Geography: Concepts and Approaches;
2. Human-Environment Relationship in equatorial, desert, mountain and coastal regions
3. Concept of holistic environment and system approach
4. Ecosystem: Concept, structure and functions

Environmental problems and policies

5. Environmental Problems and Management: Air Pollution; Water pollution Biodiversity Loss; Solid and Liquid Waste.
6. Environmental problems and management: Desertification and soil erosion
7. Environmental Programmes and Policies: Developed Countries; Developing Countries.
8. New Environmental Policy of India.

Reading List

- Casper J.K. (2010) Changing Ecosystems: Effects of Global Warming. Infobase Pub. New York.
- Hudson, T. (2011) Living with Earth: An Introduction to Environmental Geology, PHI Learning Private Limited, New Delhi.
- Miller, G.T. (2007) Living in the Environment: Principles, Connections, and Solutions, Brooks/ Cole Cengage Learning, Belmont.
- Singh, R.B. (1993) Environmental Geography, Heritage Publishers, New Delhi.
- UNEP (2007) Global Environment Outlook: GEO4: Environment For Development, United Nations Environment Programme. University Press, Cambridge.
- Wright R. T. and Boorse, D. F. (2010) Toward a Sustainable Future, PHI Learning Pvt Ltd, New Delhi.
- Singh, R.B. and Hietala, R. (Eds.) (2014) Livelihood security in Northwestern Himalaya: Case studies from changing socio-economic environments in Himachal Pradesh, India. Advances in Geographical and Environmental Studies, Springer

GEOCOR505T – Soil and Biogeography

5 Credits [90 hours of teaching]

Unit I: Soil Geography

1. Factors of soil formation.
2. Soil profile. Origin and profile characteristics of Lateritic and Chernozem soils
3. Definition and significance of soil properties: Texture, structure and moisture, pH and organic matter
4. Principles of soil classification: Genetic and USDA. Concept of land capability and its classification.

Unit II: Biogeography

5. Concepts of biosphere, ecosystem, biome, ecotone, community, niche and succession.
6. Concepts of food chain and food web. Energy flow in ecosystems
7. Geographical extent and characteristic features of: Tropical rain forest and Grassland biomes
8. Bio-geochemical cycles with special reference to carbon dioxide and nitrogen.

Reading List

- Biswas, T.D. and Mukherjee, S.K. 1997: Textbook of Soil Science, TataMcGraw Hill,
- Brady, N.C. and Weil, R.R. 1996. The Nature and Properties of Soil, 11th edition, Longman, London :
- Chapman J.L. and Reiss, M.J. 1993. Ecology: Principle and Applications, Cambridge University Press, Cambridge:
- Dash, M.C., 2001. Fundamental of Ecology, 2nd edition, Tata McGrawHill, New Delhi
- Huggett, R. 1998. Fundamentals of Biogeography, Routledge, London:
- Kormondy, E.J. 1996. Concept of Ecology, 4th edition, Prentice- Hall, India, New Delhi
- Myers, A. A. and Giller, P.S. (editors) 1988. Analytical Biogeography: an Integrated Approach to the Study of Animal and Plant Distribution. Chapman and Hall, London

GEOCOR606T – Regional Development

5 Credits [90 hours of teaching]

Concepts of Regions and Regional Planning

1. Definition of Region. Types and Need of Regional planning;
2. Choice of a Region for Planning: Characteristics of an Ideal Planning Region; Delineation of Planning Region
3. Regionalization of India for Planning (Agro Ecological Zones)
4. Strategies/Models for Regional Planning: Growth Pole Model of Perroux; Growth Centre Model in Indian Context.
5. Problem Regions and Regional Planning: Backward Regions and Special Area Development Plans in India.

Regional Development

6. Changing concept of development and underdevelopment;
7. Indicators of development: Economic, social and environmental. Concept of human development
8. Development and regional disparities in India since Independence: Disparities in agricultural development and industrial development
9. Development and regional disparities in India since independence : Disparities in human resource development in terms of education and health

Reading List

BOOKS

- Adell, G. (1999) Literature Review: Theories and Models of the Peri-Urban Interface: A Changing Conceptual Landscape, Peri-urban Research Project Team, Development Planning Unit, University College London at Agriculture Organization of the United Nations (FAO) at
- Bhatt, L.S. (1976) Micro Level Planning in India. KB Publication, Delhi
- Deshpande C. D., 1992: *India: A Regional Interpretation*, ICSSR, New Delhi.
- Dreze J. and A. Sen, Indian Development: Select Regional Perspectives (Oxford: Oxford Heritage Publishers.
- Rapley, J. (2007) Understanding Development: Theory and Practice in the 3rd World. Lynne Raza, M., Ed. (1988). Regional Development. Contributions to Indian Geography. New Delhi,
- Rienner, London.
- Schmidt-Kallert, E. (2005) A Short Introduction to Micro-Regional Planning, Food and
- Sdyasuk G. and Sengupta, P. (1967): *Economic Regionalisation of India*, Census of India
- Sen, A. (2000) Development as Freedom. Random House, Toronto University Press, 1996).

Special Minor Course for Honours Programme of Other Disciplines offered by Geography (GEOHSM)

GEOSMC701P – Project Report based on Field Work

5 Credits [150 hours of teaching]

Project work is compulsory for completing B.A/ B.Sc. 3 Year Multi-Disciplinary Course in Geography. Project Work is intended to provide an opportunity to the candidate to field test the learning.

The Project report should be based on field work on some specified topics as suggested by the Department.

Each student will prepare an individual report based on primary and secondary data collected during field work.

The duration of the field work should not exceed 10 days.

The word count of the report should be about **8000** excluding figures, tables, photographs, maps, references and appendices.

The report should include an introduction, literature review, project aims and objectives, methodology, results and discussion and references.

It should not exceed 20 to 25 pages (A4 pages) including maps, diagrams, and photographs etc.

One copy of the report on A 4 size paper should be submitted prior to examination.

Skill Enhancement Courses offered by Geography

(For both Major, Honours and 3 Years Multi-Disciplinary Programmes)

GEOHSE101M – Remote Sensing✧ (For Major/ Honours)

GEOGSE301M – Remote Sensing✧ (For 3 yr Multidisciplinary Prog.)

3 Credits [45 hours of teaching]

1. Principles of Remote Sensing (RS): Classification of RS satellites and sensors
2. Sensor resolutions and their applications with reference to IRS and Landsat missions, image referencing schemes and data acquisition.
3. Preparation of False Colour Composites from IRS LISS-3 and Landsat TM and OLI data. Principles of image rectification and enhancement.
4. Principles of image interpretation and feature extraction. Preparation of inventories of land use land cover features from satellite images.

A project file consisting of four exercises on the above themes is to be submitted

Reading List

Bhatta, B. 2011. Global Navigation Satellite Systems: Insights into GPS, GLONASS, Galileo, Compass and Others, CRC Press.

Jensen, J.R., 2013. Remote Sensing of the Environment: An Earth Resource Perspective, Pearson Education India.

Joseph, G. and Jegannathan, C. 2018. Fundamentals of Remote Sensing, 3rd ed, Universities Press.

Lillesand, T.M., Kiefer, R.W. and Chipman, J.W., 2015. Remote Sensing and Image Interpretation, 7th ed, Wiley.

WEBSITES:

International Society for Photogrammetry and Remote Sensing: www.isprs.org

NASA Landsat Science: www Landsat.gsfc.nasa.gov

National Remote Sensing Centre: www.nrsc.gov.in

USGS Global Visualization Viewer: www.glovis.usgs.gov

GEOHSE202M – Advanced Spatial Statistical Techniques ✧ (For Major/ Honours)

GEOGSE402M – Advanced Spatial Statistical Techniques ✧ (For 3 yr Multidisciplinary Prog.)

3 Credits [45 hours of teaching]

1. Probability theory, probability density functions with respect to Normal, Binomial and Poisson distributions and their geographical applications.
2. Sampling: Sampling plans for spatial and non-spatial data, sampling distributions. Sampling estimates for large and small samples tests involving means and proportions.
3. Correlation and Regression Analysis: Rank order correlation and product moment correlation; linear regression, residuals from regression, and simple curvilinear regression. Introduction to multi-variate analysis.
4. Time Series Analysis: Time Series processes; Smoothing time series; Time series components.

Any statistical Software Package (e.g., SPSS, MS Excel, R, etc.) may be used for practice. A project file consisting of four exercises on the above themes is to be submitted.

Reading List

Acevedo, M.F. 2012. Data Analysis and Statistics for Geography, Environmental Science and Engineering, CRC Press.

Harris, R., Jarvis, C. 2011. Statistics for Geography and Environmental Science, Prentice Hall.

McGrew Jr., J.C., Lembo Jr., A.J. Monroe, C.B. 2014. An Introduction to Statistical Problem Solving in Geography, 3rd ed., Waveland Press.

Pal S. K., 1998. Statistics for Geoscientists: Techniques and Applications, Concept Pub Co.

Rogerson, P.A. 2015. Statistical Methods for Geography: A Student's Guide, 4th ed, Sage.

Multi-Disciplinary Course Offered by Geography 3 Credits [45 hours of teaching]

GEOHMD101M/ GEOHMD201M/ GEOHMD301M — Geomatics and Spatial Analysis [As per the Semester in which it is offered for Major and Honours students]

GEOGMD401M/ GEOGMD501M/ GEOGMD601M — Geomatics and Spatial Analysis [As per the Semester in which it is offered for 3 Yr. Multi-disciplinary students]

Unit I: Cartography

1. Concept and applications of scales and projections. Components and classification of maps
2. Map projections: Classification, properties and uses with special reference to simple conical projection and Universal Transverse Mercator (UTM)
3. Construction of simple conical projection with one standard parallel

Unit II: Surveying

4. Basic concepts of surveying, survey equipment, and their capabilities: Dumpy level, theodolite, total station, and Global Navigation Satellite System (GNSS)
5. Bearing: Magnetic and true, whole-circle and reduced. Concept of geoid and spheroid with special reference to WGS-84.
6. Traverse survey and plotting UTM coordinates using smartphone GNSS application

Unit III: Remote Sensing

7. Principles of remote sensing (RS). Types of RS satellites and sensors with reference to IRS and Landsat missions
8. Principles of • preparing standard false colour composites (FCCs) and • supervised image classification
9. GIS data types: Spatial and non-spatial (attribute table and metadata), raster and vector
10. Principles of preparing attribute tables, data manipulation, query, and overlay
11. Identification of land use / land cover features from standard FCCs and preparation of inventories
12. Change detection of riverbank or coastline shift from multi-dated maps and images

Reading List

BOOKS:

- Basu, P. 2021. Advanced Practical Geography — a Laboratory Manual, 4 ed, Books and Allied.
- Bhatta, B. 2011. Global Navigation Satellite Systems: Insights into GPS, GLONASS, Galileo, Compass and Others, CRC Press.
- Bhatta, B. 2020. Remote Sensing and GIS, 3rd ed, Oxford University Press.
- Bolstad, P. 2016. GIS Fundamentals: A First Text on Geographic Information Systems, 5th ed, Xan EduPublishing.
- Joseph, G., Jagannathan, C. 2018. Fundamentals of Remote Sensing, 3rd ed, Orient Blackswan.
- Kennedy, M., Kopp, S. 2001. Understanding Map Projections, Esri Press.
- Kimerling, A.J., Buckley, A.R., Muehrcke, P.C., Muehrcke, J.O. 2011. Map Use: Reading, Analysis, Interpretation, 7th ed, Esri Press.
- Lillesand, T.M., Kiefer, R.W., Chipman, J.W., 2015. Remote Sensing and Image Interpretation, 7th ed, Wiley.
- Monkhouse, F.J., Wilkinson, H.R. 1971. Maps and Diagrams: Their Compilation and Construction, 3rd ed
- Robinson, A.H., Morrison, J.L., Phillip, C.M., Kimerling, A.J., Guphill, S.C. 1995. Elements of Cartography, 6th ed, Wiley.
- Sarkar, A. 2015. Practical Geography: A Systematic Approach, 3rd ed, Orient Blackswan.
- Singh, R.L., Singh, R.P.B. 2008. Elements of Practical Geography, Kalyani Publishers.

WEBSITES

ISRO Bhuvan 2D and 3D Platforms:

<https://bhuvan-app1.nrsc.gov.in/bhuvan2d/bhuvan/bhuvan2d.php> <https://bhuvan-app1.nrsc.gov.in/globe/3d.php>

National Remote Sensing Centre: www.nrsc.gov.in; Survey of India: <https://www.surveyofindia.gov.in>

USGS Global Visualization Viewer: <https://glovis.usgs.gov>; USGS Landsat Missions: <https://www.usgs.gov/landsat-missions>