Syllabus
for
MA / MSc Course in Geography & Environment Management

REVISED IN 2018: EFFECTIVE FROM THE ACADEMIC SESSION 2018-2019

Department of Geography and Environment Management

Vidyasagar University

Midnapore

Paschim Medinipur, West Bengal

PIN – 721 102

DIVISION OF MARKS
Total marks: 1100 (Core) + 100 (Elective/CBCS)

For Internal Students				Elective/CBCS
Semesters	**Theoretical**	**Practical**	**Total**	**Total**
Semester- I	200	100	300	-
Semester- II	150	100	250	50
Semester- III	150	100	250	50
Semester- IV	200	100	300	-
Total	**700**	**400**	**1100**	**100**

STRUCTURE OF SYLLABUS

SEMESTER-I
(Duration: July – December)

Type	Paper	Unit	Marks				Credit	Total Class Hours
			End-term Exam.	Internal Exam.	Unit Total	Paper Total		
THEORETICAL	**GEO 101: Earth's Surface Process**	GEO 101.1: Geotectonics	20	5	25	50	4	60 hours
		GEO 101.2: Geomorphology	20	5	25			
	GEO 102: Hydrospheric Science	GEO 102.1: Oceanography	20	5	25	50	4	60 hours
		GEO 102.2: Hydrology	20	5	25			
	GEO 103: Climate, Soil and Agriculture	GEO 103.1: Climatology	20	5	25	50	4	60 hours
		GEO 103.2: Soil and Agriculture	20	5	25			
	GEO 104: Environmental Geography	GEO 104.1: Basics of Environment and Ecology	20	5	25	50	4	60 hours
		GEO 104.2: Landscape ecology and planning	20	5	25			
PRACTICAL	**GEO 195: Hydrological Techniques and Sedimentological Analysis**	GEO 195.1: Hydrological Techniques	25	-	25	50	4	60 hours
		GEO 195.2: Sedimentological Analysis	25	-	25			
	GEO 196: Thematic Mapping	GEO 196.1: Physical and Social Thematic Mapping	25	-	25	50	4	60 hours
		GEO 196.2: Environmental Mapping	25	-	25			

SEMESTER-II
(Duration: January – June)

Type	Course	Unit	Marks				Credit	Total Class Hours
			End-term Exam.	Internal Exam.	Unit Total	Paper Total		
THEORETICAL	**GEO 201: Environmental Approaches & Application**	GEO 201.1: Environmental Ethics and Regulation	20	5	25	50	4	60 hours
		GEO 201.2: Environmental Engineering	20	5	25			
	GEO 202: Population and Development	GEO 202.1: Population Geography	20	5	25	50	4	60 hours
		GEO 202.2: Population and Development	20	5	25			
	GEO 203: Regional Geomorphology and Resource Management	GEO 203.1: Regional Geomorphology of India and WB	20	5	25	50	4	60 hours
		GEO 203.2: Land water forest conflict and conservation	20	5	25			
	ELECTIVE PAPER (THEORY)							
	C-GEO 204: Resource Management and Earth System science	**C-GEO 204.1 *: Resource and its Management***	**20**	**5**	**25**	**50**	**4**	**60 hours**
		C-GEO 204.2 *: Earth system science*	**20**	**5**	**25**			
PRACTICAL	**GEO 295: Statistical Techniques**	GEO 295.1: Basic Statistics in Geography	25	-	25	50	4	60 hours
		GEO 295.2: Advance Quantitative Method	25	-	25			
	GEO 296: Remote Sensing and Computer Application	GEO 296.1: Principles of Remote Sensing and Aerial Photograph	25	-	25	50	4	60 hours
		GEO 296.2: Computer Basics and Application	25	-	25			

SEMESTER- III
(Duration: July – December)

Type	Course	Unit	Marks				Credit	Total Class Hours
			End-term Exam.	Internal Exam.	Unit Total	Paper Total		
THEORETICAL	**GEO 301: Approaches to Regional Development**	GEO 301.1: Regional Approach in Geography	20	5	25	50	4	60 hours
		GEO 301.2: Rural Development	20	5	25			
	GEO 302: Settlement and Transport Geography	GEO 302.1: Settlement Geography	20	5	25	50	4	60 hours
		GEO 302.2: Transport Geography	20	5	25			
	SPECIAL PAPERS (ANY ONE) GEO 303	**303A: Advanced Geomorphology**						
		GEO 303A.1: Process Geomorphology -1	20	5	25	50	4	60 hours
		GEO 303A.2: Process Geomorphology -2	20	5	25			
		303B: Coastal Management						
		GEO 303B.1: Coastal Processes	20	5	25	50	4	60 hours
		GEO 303B.2: Coastal Environments: Focus on Indian Regions	20	5	25			
		303C: Urban Geography & Regional Planning						
		GEO 303C.1: Foundation of Urban Geography	20	5	25	50	4	60 hours
		GEO 303C.2: Contemporary Urban Issues	20	5	25			
		303D: Remote Sensing and Geographic Information System						
		GEO 303D.1: Physical Basis of Remote Sensing	20	5	25	50	4	60 hours
		GEO 303D.2 Photogrammetry, Aerial Photo and Satellite System	20	5	25			
	ELECTIVE(CBCS) PAPER (THEORY)							
	C-GEO 304 : Environmental Issues and Management	***C-GEO 304.1 Emerging Issues and policies on Environment***	**20**	**5**	**25**	**50**	**4**	**60 hours**
		C-GEO 304.2: Environmental Hazards and Disaster Management	**20**	**5**	**25**			
PRACTICAL	**GEO 395: GIS Application in Research**	GEO 395.1: Application of Remote Sensing and GIS	25	-	25	50	4	60 hours
		GEO 395.2: Research Methodology	25	-	25			
	GEO 396 Special paper based fieldwork (ANY ONE , as per the choice of special Theory paper type (A/B/C/D)	GEO 396A.1: Field work (Advanced Geomorphology)	25	-	25	50	4	60 hours
		GEO 396A.2: Field Report (Advanced Geomorphology)	25	-	25			
		GEO 396B.1: Field work (Coastal Management)	25	-	25	50	4	60 hours
		GEO 396B.2: Field Report (Coastal Management)	25	-	25			
		GEO 396C.1: Field work (Urban)	25	-	25	50	4	60 hours
		GEO 396C.2: Field Report (Urban)	25	-	25			
		GEO 396D.1: Field work (Remote Sensing)	25	-	25	50	4	60 hours
		GEO 396D.2: Field Report (Remote Sensing)	25	-	25			

SEMESTER-IV

(Duration: January – June)

Type	Course	Unit	Marks				Credit	Total Class Hours
			End-term Exam.	Internal Exam.	Unit Total	Paper Total		
THEORETICAL	**GEO 401: Geographical Philosophy**	GEO 401.1: Schools in Geographical Thought	20	5	25	50	4	60 hours
		GEO 401.2: Contemporary Discourses in Geography	20	5	25			
	GEO 402: Political Geography and Globalization	GEO 402.1: Political Geography	20	5	25	50	4	60 hours
		GEO 402.2: Geography of Globalization	20	5	25			
	GEO 403: Society and Regional Planning	GEO 403.1: Social and Cultural Geography	20	5	25	50	4	60 hours
		GEO 403.2: Regional Planning	20	5	25			
	SPECIAL PAPERS (ANY ONE) GEO 404	**404A: Advanced Geomorphology**						
		GEO 404A.1: Advanced Geomorphic Techniques	20	5	25	50	4	60 hours
		GEO 404A.2: Applied Geomorphology	20	5	25			
		404B: Coastal Management						
		GEO 404B.1: Coastal Ecology and Hazards	20	5	25	50	4	60 hours
		GEO 404B.2: Coastal Issues and Management	20	5	25			
		404C: Urban & Regional Planning						
		GEO 404C.1: Theoretical Bases of Regional Planning	20	5	25	50	4	60 hours
		GEO 404C.2: Planning for Urban Development	20	5	25			
		404D: Remote Sensing and Geographic Information System						
		GEO 404D.1: Advanced Remote Sensing	20	5	25	50	4	60 hours
		GEO 404D.2: Advanced GIS and Applications of Remote Sensing	20	5	25			
PRACTICAL	**GEO 495: Spatial Analysis and Prototype Research**	GEO 495.1: Spatial Analysis in Geography	25	-	25	50	4	60 hours
		GEO 495.2: Research Exercise in Geography	25	-	25			
	GEO 496: Geodesy and GIS	GEO 496.1: Map Transformation and Geodesy	25	-	25	50	4	60 hours
		GEO 496.2: Geographical Information System (GIS)	25	-	25			

Outcome of the academic programme on M.A. / M.Sc. in Geography

1. Fostering the ability of the students to encounter practical problems with theoretical knowledge in Geography and Environment.
2. Promotion of research aptitude and field work aptitude as well as laboratory based practical works for the students of Geography.
3. Capacity enhancement of the students in spatial mapping on digital platform for the Geographical research and studies.
4. Orientation of the students of Geography to develop competitive examinations aptitude among them including NET / SET/ and other professional jobs.
5. Preparing students for Higher Academic programmes for institutes of National and International repute.
6. On completion of the M.A./M.Sc in Geography, students are able to get absorbed in various Govt Departments (like planning and developmental commissions, forestry, environmental, and disaster management departments) travel agencies, manufacturing firms, etc. They can be cartographer (NATMO), surveyor (Survey of India), GIS and Remote Sensing experts, environmental planner, Environment Reporter, urban and regional planner, transportation manager, Teacher/Professor etc.

SYLLABUS

Semester- I (300 Marks)

THEORETICAL COURSES (200 Marks)

PAPER - GEO 101: EARTH'S SURFACE PROCESS

Full Marks: 50 Credit: 4

GEO 101.1: GEOTECTONICS

Course Outcome:

The focus of this course is to give an in-depth concept on the fundamental physical laws towards understanding the initial phases of the early universe with special reference to the Earth and the Moon. It also focuses on the basic understanding of the genesis of the Earth's magnetic field and palaeomagnetism that will enhance the understanding about the Earth's geological history and theories about the continental drift and sea floor spreading. The course is also designed to have some advanced level of understanding of the absolute dating techniques to find the ages of geological formation. It also includes the processes and mechanisms of mountain building. All these concepts and techniques will surely enhance the ability of the students for critical analysis and thereby synthesis of the Earth's system process. The completion of this course will give impetus to the research insights for the students who would like to pursue their future carrier in geosciences.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Origin and evolution of solar system with special reference to the Earth/Moon.
2. Relative and absolute dating: principles and techniques.
3. Origin of earth's magnetic field, paleomagnetism, geomagnetic polarity reversal and paleomagnetic timescale, paleomagnetic polar wandering curves and reconstruction of plate tectonic motions.
4. Mechanism of plate dynamics. Application of plate tectonic theory in explaining orogenesis, volcanism, earthquake.
5. Neo-tectonics and its worldwide evidences.

GEO 101.2: GEOMORPHOLOGY

Course Outcome:

Students will learn about the mechanism and working principle of processes that lead to shape present earth-surface. Field demonstration on process-form relationship help in concretizing ideas. This understanding may help in formulating hydrological, geologic and economic planning. Learners may take part in hazard management too.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Concepts in geomorphology: historical and functional approaches, uniformitarianism and catastrophism, base level, grade and profile of equilibrium.
2. Weathering: factors, processes and landforms. Mass wasting: resultant landforms and safety factor.
3. Slope Evolution: process-form relationship on slope elements, theories of Wood, Davis, Penck, King, Young and Savigear. Dynamic metastability in slope evolution.
4. Fluvial processes and forms: threshold energy for entrainment and transport, channel form and patterns, flood plains, alluvial fan, terraces and delta.
5. Applied geomorphology in planning, hydrology and economic geology. Geomorphology in hazard Management (flood, landslide and subsidence).

PAPER - GEO 102: HYDROSPHERIC SCIENCES

Full Marks: 50 Credit: 4

GEO 102.1: OCEANOGRAPHY

Course Outcome:

The students will be able to understand the marine environment and oceanographic processes that leads to earth system processes. They can extend their ideas in understanding environmental and climatic processes too. An aptitude on the distribution of marine resources as well as their utilization and possible impact are also developed among the students.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Marine Environment and Processes: Major subdivisions of the marine environment, winds and ocean circulation, waves in the ocean, origin of the tides and tidal characteristics.

2. Physical and chemical structure of oceans: Water masses and their properties. Sediment in the sea.
3. Coastal Habitats: Estuaries, lagoons, salt marshes, mangrove swamps, coral reefs- origin, circulation, sedimentation and ecology.
4. The Dynamic Shoreline: Coastal water movement, circulation in surf zone, beaches, beach profiles, sediment budgets, coastal dunes, barrier islands, tidal inlets, cliffed coasts, deltas, effects of storms. Human impacts on the coastline.
5. The Ocean's Resources: Law of the sea, law of the sea treaty, exclusive economic zones/coastal regulation zones, mineral resource- oil and natural gas, gas hydrates, sand and gravel, manganese nodules, cobalt-rich oceanic crusts, phosphate deposits, biotic resources.

GEO 102.2: HYDROLOGY

Course Outcome:

Students will learn about the working principle of earth system processes that lead to water availability and necessity for water management in the context of global climatic change. This understanding may help in water budgeting and formulating plan for water use and water management. Learners may take leading role in awareness generation among community for rain water harvesting and judicial water use.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Hydrological systems, estimating water potential, water budgeting at watershed level. Hydrologic frequency analysis (Gumbel's equation and log probability law).
2. Precipitation estimates: point rainfall analysis, area-depth curve, theissen network and isohyetal method for estimating rainfall volumes.
3. Infiltration and evapotranspiration: soil-vegetation complex and infiltration estimates. Methods of estimating evapotranspiration.
4. Runoff estimates using curve number, stream discharge estimates by area-velocity method. Ground water: storage structure, flow, recharge and discharge.
5. Hydrographs and Rating curve: Time dimensions of hydrographs: concept of unit hydrograph and rating curves and their significance. flood & drought as hydrological hazards.

PAPER – GEO 103: CLIMATE, SOIL & AGRICULTURE

Full Marks: 50 Credit: 4

GEO 103.1: CLIMATOLOGY

Course Outcome:

The course deals with the basic understanding of the climate system. The fundamental physics of surface pressure distribution, the general circulation model and sea surface temperature (SST) variation will allow students to get insights to the space-time scale variation of weather and climate. Students will understand the weather and climatic processes working on earth and this understanding will help them to assess and predict the weather phenomena and its related hazards. Through this understanding, they can take part in hazard and disaster management programmes.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Nature and Scope of Climatology and its relationship with Meteorology, climatological systems operating in different space and timescale: thunderstorm, tropical cyclone and associated hazards, jet Stream, planetary wind systems.
2. The General Circulation: GCM, Tropical circulation- mechanism of Indian monsoon, Walker circulation and ENSO phenomena, Temperate Circulation.
3. The Climatic Zones of the world with special reference to tropical climates: wet, wet and dry, savanna, desert and highland.
4. Sea surface temperature and it's climatic significance; Maritime influence on coastal weather: seasonal changes and storm events.
5. Climatic changes through geological periods- evidences and possible causes; Global Warming- Natural and anthropogenic causes and probable consequences.

GEO 103.2: SOIL AND AGRICULTURAL GEOGRAPHY

Course Outcome:

Learners will understand about functional integration of various process that results in formation and distribution of different types of soil and their implication of agricultural systems. They will be able to achieve integrated knowledge on soil and landscape. They will develop special aptitude on soil survey techniques to analyse patio-temporal distribution of agricultural systems.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Variation in physico-chemical properties of soil with climate and dominance of local factors: organic matter content, pH clay content, clay mineralogy, soil colour, calcium carbonate and soluble salt content.
2. Soil Geomorphology: soil landscape analysis in relation to geomorphic surfaces and surface morphometry, catena concept- catena and soil hydrology, slope description and catena, soil catena under different environment, soil morphology and chrono-sequence.
3. Approaches in agricultural geography: agricultural systems (ecological or near-ecological systems). Approaches to study agricultural geography, Jonnason's theory on agricultural landuse.
4. Determinants of agricultural pattern: physical and institutional, precision farming, use of modern technology.
5. Issues and policies in modern Agriculture: Impact of green revolution, GM Crops and agricultural hazards, food security, agricultural policies and their implication.

PAPER – GEO 104: ENVIRONMENTAL GEOGRAPHY

Full Marks: 50 Credit: 4

GEO 104.1: BASICS OF ENVIRONMENT AND ECOLOGY

Course Outcome:

The living things interact with each other in various ways and with the non-living components that make up the environment in which we live. These non-living components include rocks, soils and water, as well as the atmosphere. All these interactions produce a complicated set of interrelationships and these interrelationships can take many forms. Thus, this paper on basics of environment and ecology prepares students for careers as leaders in understanding and addressing complex environmental issues from a problem-oriented, interdisciplinary perspective. Ecology is a scientific way of thinking about the world. This means that it involves a certain way of investigating, studying and writing about the systems. Student can learn the core concepts and methods from ecological and environmental perspectives and their application in environmental problem solving.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Concept of Environment, major elements of environment, functioning of environmental systems, role of biotic and abiotic elements.
2. Ecosystem: structure, function and processes, patterns of energy flow.
3. Biogeochemical cycles (Nitrogen, Carbon, Phosphorus), ecosystem metabolism, ecosystem process (photosynthesis and respiration), trophic levels (food web and chain) decomposition, ecosystem stability.

4. Terrestrial ecosystems: Forest, Grassland, Desert and Agriculture.
5. Biodiversity: Genetic, species, community and ecosystem diversity; biodiversity uses, threats to biodiversity, biodiversity conservation.

GEO 104.2: LANDSCAPE ECOLOGY AND PLANNING

Course Outcome:

Landscape ecology is the study of the pattern and interaction between ecosystems within a region of interest, and the way the interactions affect ecological processes, especially the unique effects of spatial heterogeneity on these interactions. This paper provides students with an introduction to the discipline of landscape ecology. Thus, this paper focuses on the characteristic scale of spatial pattern; defining the elements of pattern; connectedness, fractal geometry, how these aspects of pattern are interconnected in landscapes, and how they vary. It may help students detecting, analyzing, or simulating landscape change; and modeling populations or communities in landscape mosaics and educate students for professional life.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Landscape: Definition, concept, nature and role, ecological description of landscape.
2. Structure of Landscape: Patches (shape, size, nature and boundary), corridors (type, network, matrix) and mosaics, habitat arrangement measuring metrices (Shanon Diversity Index and Simpson Diversity Index).
3. Landscape Dynamics: Energy flow, species movement, nutrient movement.
4. Anthropogenic Modification: Agricultural intensification, deforestation and development.
5. Landscape management and planning: Role of keystone species, conservation of fragmented habitats, sustainable landscape, and role of Traditional Ecological Knowledge (TEK) in conserving landscape. Role of GIS in landscape planning.

PRACTICAL COURSES

(100 Marks)

PAPER –

GEO 195: HYDROLOGICAL TECHNIQUES AND SEDIMENTOLOGICAL ANALYSIS

Full Marks: 50 Credit: 4

GEO 195.1: HYDROLOGICAL TECHNIQUES

Course Outcome:

Students will develop skills in application of theoretical knowledge of hydrology. They will learn on field as well as laboratory techniques for estimating different hydrological attributes as for example rainfall, run off, infiltration etc. in order to construct water budget. Students are enabled to analyse magnitude frequency of different hydrological hazards like fold and droughts and their social and economic applications. This knowledge will help them in formulating various hydrological projects and their successful management.

Full Marks- 25
*Pattern of Setting Questions: **Three** compulsory questions bearing marks **7, 7 and 6** respectively, will be set covering the whole unit. **5** marks will be allotted for Laboratory Note Book and Viva-voce.*

1. Point rainfall analysis, area-depth curves, Thiessen network and Isohyetal methods to determine rainfall volumes.
2. Estimating infiltration using infiltrometre and other field techniques. Drawing infiltration curve.
3. Evaporation estimation: Use of evaporation pan and empirical equations using climatic data.
4. Runoff and discharge estimation: Curve Number methods for estimating runoff: area-velocity method for discharge estimate.
5. Construction of hydrograph, unit-hydrograph and rating curves.

GEO 195.2: SEDIMENTOLOGICAL ANALYSIS

Course Outcome:

Students will develop aptitude and abilities on different methods of sediment sampling from field. They will also be trained thoroughly on laboratory method and field method of sediment analysis. This will help them to understand various types of environment and process domain under which sediments were deposited. Thus they can develop skills for reconstructing past.

*Pattern of Setting Questions: **Three** compulsory questions bearing marks **7, 7 and 6** respectively, will be set covering the whole unit. **5** marks will be allotted for Laboratory Note Book and Viva-voce.*

1. Phi-scale of grain size distribution, texture analysis of sediment samples using standard techniques, statistical representation.
2. Form and shape analysis of pebble grade sediments.
3. Megascopic and microscopic examination of sediments.
4. Identification of sedimentary and bioturbation structures.
5. Sedimentary environmental facies analysis.

PAPER – GEO 196: THEMATIC MAPPING Full Marks: 50 Credit: 4

GEO 196.1: ENVIRONMENTAL MAPPING

Course Outcome:

Students will develop cartographic skills for constructing various thematic maps and foster their abilities in showing the spatial distribution of various environmental elements and their proper interpretation. This ability will help them to formulate environmental plans and to manage and conserve vegetation, soil, water etc.

Full Marks- 25
*Pattern of Setting Questions: **Three** compulsory questions bearing marks **7, 7 and 6** respectively, will be set covering the whole unit. **5** marks will be allotted for Laboratory Note Book and Viva-voce.*

1. Estimation and mapping of soil properties: texture, structure, moisture, colour, pH, organic matter, NPK, soil profile mapping.
2. Estimation of Water Properties: BOD, COD, Dissolved Oxygen, pH, suspended solid, turbidity and electric conductivity.
3. Ecological Micro- zonation Mapping.
4. Vegetation density mapping
5. Association between soil parameters, vegetation types and density.

GEO196.2: PHYSICAL AND SOCIAL THEMATIC MAPPING

Course Outcome:

Students will develop cartographic skills for constructing various thematic maps and foster their abilities in showing the spatial distribution of various physical as well as social elements and their proper interpretation. Skill of understanding spatial integration among physical and social elements will be developed to foster the abilities of holistic abilities.

Full Marks- 25
*Pattern of Setting Questions: **Three** compulsory questions bearing marks **7, 7 and 6** respectively, will be set covering the whole unit. **5** marks will be allotted for Laboratory Note Book and Viva-voce.*

1. Morphometry and Drainage Network Analysis of watershed.

2. Mapping of farming practices: Crop-combination, diversification and cropping intensity.
3. Mapping of social vulnerability and social disparities, ethnic mapping.
4. Estimation and Mapping of Social Well-being, HDI, GDI, GEM.
5. Estimation of Human Poverty Index –(HPI-I and II) for developed and developing countries.

SUGGESTED REFERENCES

GEO101.1: Geotectonic

Holmes, Arthur (1978): *Holmes Principles Of Physical Geology*, Francis & Taylor.

Bloom, Arther L., 2003. Geomorphology – A systematic analysis of Late Cenozoic Landforms, 3rd Edn.

Chorley, R., Schumm, S. and Sugden, D.E. 1994. *Geomorphology*, Methuen, London: 605p.

Cook and Doorncamp. 1988. *Geomorphology in Environment Management*, London

Kale, V.S. and Gupta, A. 2001. *Introduction to Geomorphology*, Orient Longman Ltd., Hyderabad: 274p.

Keary, P. and Vine, M. 1997. *Global Tectonics*, 2nd edition, Blackwell Scientific Publications, Oxford: 302p.

Lowrie, W. (2007): *Fundamentals of Geophysics*, Cambridge University Press.

Ollier, C.D. 1981: *Tectonic Geomorphology*, Longman Scientific & Technical, London:

Summerfield, M.A. (Editor) 1991. *Global Geomorphology : An Introduction to the Study of Landforms*, John Wiley and Sons Ltd., New York: 560p.

Valdiya, K.S. 1998. *Dynamic Himalaya*, University Press (India) Ltd., Hyderabad: 178p

GEO101.2: Geomorphology

Bloom, Arther L., (2003): *Geomorphology – A systematic analysis of Late Cenozoic Landforms*, 3rd Edn.

Brutsaert, W. (2005): *Hydrology: An Introduction*, Cambridge University Press, Cambridge.

Chorley, R., Schumm, S. and Sugden, D.E. (1994): *Geomorphology*, Methuen, London: 605p.

Coch,N.K, (1994): *Geohazards: Natural and…* ,Prentice-Hall,Englewood Cliffs

Cook and Doorncamp. (1988): *Geomorphology in Environment Management*, London

Faniran, A. and Jeje, L.K. (1983): *Humid Tropical Geomorphology*, Longman, London:

Goudie,A.(Ed)(1990):Geomorphological Techniques,2nd edition,Allen UnwinCrows Nest(Australia).

Huggett,R(2006): Fundamentals of Geomorphology,Routledge,London.

Kale, V.S. and Gupta, A. 2001. *Introduction to Geomorphology*, Orient Longman Ltd., Hyderabad: 274p.

Knighton, D.1998 : *Fluvial Forms and Processes: A New Perspective*, Arnold, London: 385p.

Lal, D. S., 2003. Oceanography, 3rd Edn. 288p.

Morisawa, M. (editor) 1994. *Geomorphology and Natural Hazards*, Elsevier, Amsterdam: 355p.

Morisawa, M. 1985. *Rivers*, Longman, London: 222p

Murthy, K.S. 1998. *Watershed Management in India*, 3rd edition, Wiely Eastern Ltd. / New Age International Ltd., New Delhi: 198p

Newson, M. 1992. *Land Water and Development, River Basin Systems and their Sustainable Management*, Routledge, London: 350p.

Ollier, C.D. 1981: *Tectonic Geomorphology*, Longman Scientific & Technical, London:

Paul, R.P. (2006): Invitation to Oceanography, 4th Edition, Jones and Bartlett pub.

Pethick, J. 1984. *An Introduction to Coastal Geomorphology*, Edward Arnold, London: 259 p.

Pirazzolia, P.A. (1996): Sea Level Changes: The Last 20000 years, Wiley, New York

Pugh, D. (2004): Changing Sea Level: Effect of Tides, Weather and Climates, Cambridge University Press, Cambridge

Ritter,D.F.,Kochel,R.C.and Miller,J.R.(2006):Process Geomorphology,4th Edition, Waveland Press,N.Y.

Selby, M.J. 1985. *An Introduction to Geomorphology*, Clarendon, Oxford: 607p.

Sharma, H.S. 1987. *Tropical Geomorphology : A Morphogenetic Study of Rajashan*, South Asia Books, Jaipur: 124p.

Singh, S. (2008): Oceanography, Prayag Pustakalaya, Allahabad

Smith,K.(2004):Environmental Hazards, Assessing Risk and reducing Disaster, 4th Edition, Routledge, London.

Starkel, L. and Basu, S. 2000 *Rains, Landslides and Floods in the Darjeeling Himalaya*, Indian National Science academy, New Delhi: 168p.

Sverdrup, K.A and et. All (2005): The World's Oceans, McgawHill, New York.

Thomas,D.S.G.(Editor)(2008):Arid Zone Geomorphology: Process, Form and Change in Drylands, 2nd Edition,Wiley, Chichester.

Thornbury, W.D. (1969): *Principles of Geomorphology*, Wiley Eastern Limited, New Delhi: 594 p

Tinkler, 1985. *A Short History of Geomorphology*, Croom Helm Ltd., Beckenham: 315p

Trujillo, A.P and Thurmnan, H.V. (2007): Essential of Oceanography, 9th Edition, , Prentice Hall.

G E O 1 0 2 . 1 : O c e a n o g r a p h y

Boaden (et al.) (1982): *Introduction to Coastal Ecology*, Blackie.

Garrison, T.S. (2007*): Oceanography: An Introduction to Marine Science*, 6th Edition, BrooksCole, Chicago

Levinton, J.S. (1982): *Marine Ecology*, PrenticeHall.

Pinet, P.R. (2006): *Invitation to Oceanography*, Jones & Bartlett.

Sverdrup, K.A.; Duxbury, A.C. and Duxbury, A.B. (2005): *The world Oceans*, McGrawhill.

Thorson, G. (1971*): Life in the Sea*, World University Library, New York.

Vatal, and Sharma (1972): *Oceanography for Geographers*, Chaitanya publising house, Allahabad.

Wirthmann, A. (2000): *Geomorphology of the Tropics*, Translated by Busche, D. Springer-Verlag, Berlin: 225p.

Woodroffe, C. D. (2003): *Coasts: Form Processes and Evolution*, Cambridge University Press, Cambridge.

G E O 1 0 2 . 2 : H y d r o l o g y

Bedinent, P.B.et.al. (2008*): Hydrology and Floodplain Management*, Prentice Hall,Upper Saddle River, NJ07458.

Biswas,A.K. (1972*): History of Hydrology*, North Holland Pub.Cc. Amsterdam.

Boca Raton, F.L Viessman and Lewis (1996): *Introduction to Hydrology*, Harper Collins, Newyork.

Chow V.T., Maidment ,D.R. and Mays, L.W. (1988*): Applied Hydrology*, Mc Graw Hill, Newyork.

Dingman, SL. (2002): *Physical Hydrology*, 2nd Edition, Prientice Hall, EnglewoodCliffs

Hyot, W.G. and W. Langbain (1955): *Floods*, Prentice Hall University Press, Princeton.

Keith, D. and Mays,L.W. (2004): *Ground water hydrology*, 3rd Edition, Wiley, Chichester.

Kintede-Levario, H. (2007): *Design for Water: Rain Water Harvesting, Storm Water Catchment and Alternate Water Reuse*, New society publishers, Gabriola Island.

Mays, L.W. (1996): *Water Resources Handbook*, Mc Graw Hill, Newyork.

Murthy, K.S. (1998): *Watershed Management in India*, 3rd edition, Wiely Eastern Ltd. / New Age International Ltd., New Delhi: 198p.

Pethick, J. (1984): *An Introduction to Coastal Geomorphology*, Edward Arnold, London: 259 p

Singh, V.P. and D.K. Frevest (2006): *Watershed Models*, CRC Press,

Todd, D.K. (2004): *Groundwater Hydrology*, 3re Edition, Wiley, Chichester

GEO103.1: Climatolog

Barry, R.G. and Chorley, R.T. (1992): *Atmosphere, Weather and Climate*, 6th edition, Routledge, London: 392p.

Critchfield, H.J. (1983): *General Climatology*, 4th edition, Prentice Hall India Ltd., New Delhi: 453p.

Das, P.K. (1995) : *Monsoons*, 2nd edition, National Book Trust, New Delhi: 347p.

Lal, D.S. (1993) : *Climatology*, 3rd edition, Chaitanya Pub. House, New Delhi: 412p.

Linacre, E. and Geerts, B. (1997): *Climates and Weather Explained*, Routledge, London: 464p.

Lutgens, F.K.. and Tarbuck, E.J. (1998): *The Atmosphere: An Introduction to Meteorology*, 7th edition, Prentice-Hall

Moran, J.M. and Morgan, M.D. (1997) : *Meteorology: The Atmosphere and the Science of Weather*, 5th edition, Prentice-Hall Inc., Upper Saddle River: 530p.

GEO103.2: Soil and Agricultural Geography

Bhattacharjee, J.C. (1997): *Introduction to Pedology*, Oxford & IBH.

Biswas, T.D. and Mukherjee, S.K. (1987): *Textbook of Soil Science*, Tata-McGraw-Hill, 314p.

Boul, S.W. (2003): *Soil Genesis & Classification*, Wiley-Blackwell.

Brady, N.C & Well, R.R., (2005): *Nature and Properties of Soils*, (3rd. Indian Reprint); Pearson PHI.

Daji, Kadam, Patil: (Revised edn.) (1996*): A Text Book of Soil Science;* Media Promoters & Pub. Pvt. Ltd.

Das, P.C. (2002): *Soils of India*, Kalyani Pub.

Davies, D.B.; Eagle, D.J. and Finney, J.B. (1993): *Soil Management*, Farming Press.

De, N.K. & Ghosh, P. (1993): *A Study In Soil Geography*, Shribhumi.

Fitzpatrick,E.A. (1983): *Soils-Their Formation, Classification and Distribution*, Longman Group Ltd.

Foth, H.D. (1990): *Fundamentals of Soil Science*, 8th edition, John Wiley and Sons, New York: 360p.

Gerrard, J. (2000): *Fundamentals of Soils*, Routledge.

Joffe, J.S. (1953): *The ABC of Soils*, (2nd.Edn) Oxford Book Co.

Miller, R.W. & Donahue, R.L. (1997): *Soils in Our Environment*, (7th. Edn); PHI.

Mitchell, C. W. (1991): *Terrain Evaluation: An Introductory Handbook to the History, Principles and Methods of practical terrain assessment*; Longman Scientific & Technical.

Morgan, R.P.C. (1995): *Soil Erosion and Conservation*, 2nd edition, Longman, London: 198p.

Piegorsch, W.W & Bailer, A.Z. (2005): *Analyzing Environmental Data*; John Wiley and Sons.

Sarkar, Dipak. (2003*): Fundamentals and Applications of Pedology*, Kalyani Pub.

Sehgal, J. (1996): *Pedology- Concepts & Applications*, Kalyani Pub.

Singer, M.J. and MuMs, D.N. (1996): *Soils: An Introduction*, Prentice Hall, London: 480p.

Wild, A. (1993): *Soils and the Environment: An Introduction*, Cambridge University Press, Cambridge: 287p.

Hussain, Majid (2003): *Agricultural Geography*, Anmol Publications Pvt Ltd, India.

Grig, B, David (1995): *An Introduction to Agricultural Geography*, Routledge,

Gautam, Alka (2012): *Agricultural Geography*, Sharda Pustak Bhawan, Allahabad.

Singh, J. S and Dhillon, S. S. (2004): *Agricultural Geography*, Tata McGraw-Hill Education.

Shiva, Vandana (1991): *The Violence of Green Revolution: Third World Agriculture, Ecology and Politics***,** Zed Books.

Joshi, V. Mahesh (1999): *Green revolution and its impacts.* New Apcon, New Delhi.

Kamath M.G. (2000): *A dictionary of Indian agriculture,* Allied Publishers New Delhi.

Jha D N (2001): *Agriculture and Regeonal Planning*, Mittal Publications New Delhi.

Deininger Dina and Umali Maguire Charles (2006): *Agriculture in liberalizing economics: changing roles for governments*, World Bank Washington.

Rao C H Hanumantha (2005): *Agriculture, food security, poverty, and environment: essays on post-reform India*, Oxford University Press New Delhi.

Report: Asian Development Bank (2010): *Agriculture, food security, and rural development*, Oxford University Press New Delhi.

Bhatia B.M. (2008): *Indian agriculture: a policy perspective,* Sage Publications India New Delhi.

Agrawal A.N (2005): *Indian agriculture: problems, progress and prospects,* Vani Educational Books New Delhi

GEO104.1 : Basics of Environment and Ecology

Alexander, D. (1993): *Natural Disasters*, Research Press, New Delhi: 619p.

Allaby, M. (1996): *Basics of Environmental Science*, Routledge, London: 297p.

Chapman J.L. and Reiss, M.J. (1993): *Ecology: Principles and Applications*, Cambridge University Press.

Chapman, D. (1994): *Natural Hazards*, Oxford University Press, Melbourne: 174p.

Choudhuri, A.B. (2007): *Endangered Wetland*.

Elsom, D.M. (1992): *Atmospheric Pollution: A Global Problem*, 2nd edn, Blackwell Pub. Co., London: 422p.

Farmer, A. (1997): *Managing Environmental Pollution*, Routledge, London: 246p.

Marsh, W.M. and Grossa, J.M. (1996): *Environmental Geography: Science, Landuse and Earth Systems*, John Wiley & Sons.

Park, C. (1998): *The Environment: Principles and Applications*, Routledge, London:

Pickering, K. and Owen, L.A.(1997) : *An Introduction to Global Environmental Issues*, 2nd edition, Routledge, London.

Prabhakar, V.R. (1998): *Social and Community Forestry*, Indian Pub. Distrb., New Delhi: 224p.

Roberts, N. (editor) (1994): *The Changing Global Environment*, 3rd edition, Blackwell Pub. Co., London: 531 p.

Nick Middleton: The Global *casino:an introduction to environmental issues, Arnold* ,A member of the Hodder Headline Group LONDON Distribuced in rhe Uniced Scaces ofAmerim by Oxford University Press Inc., New York.

Robert M. May and Angela R. McLean(2007): Theoretical Ecology:Principles and Applications,Oxford UniversityPress

Barry cox; Peter Dale Moore(2010): Biogeography an ecological and evolutionary approach ,Hoboken, NJ : wiley

GEO104.2: Landscape Ecology and Planning

Turner, Monica G., Gardner, Robert H., O'Neill, Robert V.:Landscape Ecology in Theory and Practice Pattern and Process,Springer

Farina, Almo:Principles and Methods in Landscape Ecology Towards a Science of the Landscape Series: Landscape Series, Vol. 3,Springer

Forman R.T.T.: Land mosaic. The ecology of landscape and region. Academic press Cambridge UK

Vink A.P.A.: Landscape ecology and land use, Longman, London & New York

Turner M.G. :Landscape Heterogeneity and disturbance
Springer-Verlag , Germany

Turner M.G. & Gardner R.H .: Quantitative method in landscape ecology Springer-Verlag New York

Frohn Robert C. (1997): Remote Sensing for Landscape Ecology: New Metric Indicators for Monitoring, Modeling, and Assessment of Ecosystems, Taylor & Francis

Rubenstain, J. M. and Becon, J. M. (1990): Cultural Geography, John Wiley and Sons Inc., New York.

Spencer, J. E. and Thomas, W. L. (1969): Cultural Geography, John Wiley
and Sons Inc., New York.

Jones, Emrys (1965): Human Geography, Chatto and Windies, London. Jones, E. and Eyles, J. (1977): An Introduction to Social Geography, Oxford University Press, Oxford

Hutchinson and Smith, D. (1996) : Ethnicity : Oxford University Press, Delhi

Jordon and Lester, G. (1995) : The Human Mosaic, Harper and Row, New York

Knoy, P. L. (1988) : Social Well-being – A Spatial Perspective, Oxford University Press, London

Gadgil Madhav , Guha Ramachandra : The Use and Abuse of Nature: incorporating This Fissured Land: An Ecological History of India and Ecology and Equity, Oxford University Press.

Wu jianguo and Hobbs Richard j. (2007): Key Topics in Landscape Ecology, Cambridge University Press

GEO195.1: Hydrological Techniques

Bedinent, P.B.et.al. (2008*): Hydrology and Floodplain Management*, Prentice Hall,Upper Saddle River, NJ07458.

Biswas,A.K. (1972*): History of Hydrology*, North Holland Pub.Cc. Amsterdam.

Boca Raton, F.L Viessman and Lewis (1996): *Introduction to Hydrology*, Harper Collins, Newyork.

Chow V.T., Maidment ,D.R. and Mays, L.W. (1988*): Applied Hydrology*, Mc Graw Hill, Newyork.

Dingman, SL. (2002): *Physical Hydrology*, 2nd Edition, Prientice Hall, EnglewoodCliffs

Hyot, W.G. and W. Langbain (1955): *Floods*, Prentice Hall University Press, Princeton.

Keith, D. and Mays,L.W. (2004): *Ground water hydrology*, 3rd Edition, Wiley, Chichester.

Kintede-Levario, H. (2007): *Design for Water: Rain Water Harvesting, Storm Water Catchment and Alternate Water Reuse*, New society publishers, Gabriola Island.

Mays, L.W. (1996): *Water Resources Handbook*, Mc Graw Hill, Newyork.

Murthy, K.S. (1998): *Watershed Management in India*, 3rd edition, Wiely Eastern Ltd. / New Age International Ltd., New Delhi: 198p.

Pethick, J. (1984): *An Introduction to Coastal Geomorphology*, Edward Arnold, London: 259 p

Singh, V.P. and D.K. Frevest (2006): *Watershed Models*, CRC Press,

Todd, D.K. (2004): *Groundwater Hydrology*, 3re Edition, Wiley, Chichester

GEO195.2: Sedimentological Analysis

Maclane, M (1995): Sedimentology, Oxford University Press, New York, Oxford.

Folk, L. Robert (1978): Petrology of sedimentary rocks, Hemphill Publishing Company, Austin, Texas.

Collinson, J.D and Thompson, D.B. (1989): Sedimentary structures, CBS Publishers and Distributors, New Delhi.

Miall, A.D. (2006): Geology of the fluvial deposits: Sedimentary facies, basin analysis and petroleum geology, Springer.

Reading, H.G. (1996) Sedimentary environments: Processes, Facies and Stratigraphy, Blackwell Science.

Sengupta, S (1994): Introduction to sedimentology, Oxford and IBH Publishing New Delhi

Lindholm Roy C. (1986): A practical approach to sedimentology, C B S Publishers and Distributors New Delhi

GEO196.1: Physical and Social Thematic Mapping

Basu, R. and Bhaduri, S. (2007): Contemporary Issues and Techniques in Geography, Progressive Pub.

Dent., D.B (1993): *Cartography: Thematic map design*, Sea Brown Publishers

Misra, R.P and Ramesh, A (1989): *Fundamental of Cartography*, Concept, Delhi

Monkhouse F.J. and Wilkinson, H.R. (1971): *Maps and Diagrams: Their Compilation and Construction*, B.I. Publications Private Limited, New Delhi: 527p.

Nag, P and Dutta, G.K (1992): *Thematic Cartography and Remote Sensing*, Concept

Wilford, J,N (2000): *The Map Makers*, A.A. Knopf

GEO196.2: Environmental Mapping

William J. Sutherland (2006): Ecological Census Techniques Edited by Cambridge 2nd edition

Lagacherie Philippe, McBratney Alex and Voltz Marc(2006) : Digital Soil Mapping :An Introductory Perspective,Elsevier

Scull, P.; J. Franklin, O.A. Chadwick & D. McArthur (June 2003). Predictive soil mapping - a review. Progress in Physical Geography ,Sage Publications.

Monkhouse, F.J. 1971: Maps and Diagrams, Methuen, London

Singh, R.L. and Singh, R.P.B. 1992: Elements of practical Geography.

Robinson, A.H., Morrison, J.L., Muehrcke, P.C., Kimerling, A.J. and Guptill, S.C. 1995: Elements of Cartography, John Wiley and Sons, New York.

Basu, R. and Bhaduri, S. ed, 2007: Contemporary Issues and Techniques in Geography, Progressive Publishers, Kolkata.

Gupta, K. K. and Tyagi, V. C. (1992): Working with maps, Survey of India Publication, Dehradun

Semester- II (300 Marks)

THEORETICAL COURSES (200 Marks)

PAPER- GEO 201: ENVIRONMENTAL APPROACHES &APPLICATION

Full Marks: 50 Credit: 4

GEO 201.1: ENVIRONMENTAL ETHICS AND REGULATIONS

Course Outcome:

Environmental Ethics examines the ways we supposed to value the environment and the non-human inhabitants of the earth. It examines the moral relationship between human beings and non-human beings (including the environment itself). This paper will consider the implications of this examination for an ethical life. It demonstrates the ethical conduct in all scientific activities. The paper includes both philosophical bases(moral obligations, the nature of value) and policy measures to be adopted for the betterment of the environment and earth. The students will be able to explain and apply principles of environmental ethics and apply philosophical concepts used in environmental ethical decision-making. They may apply theories and concepts to particular cases, and ability to provide critical assessment of arguments.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Environmental ethics and education; Concept, development of environmental philosophy, Ecocentrism and Anthropocentrism, the land ethic (Aldo Leopold), Gaia concept, Eco-feminism. Formal and non-formal environmental education, Tbilisi conference, environmental awareness.
2. Approaches to conservation of environment: Landscape ecology and ethno-ecology, environmental stewardship.
3. Environmental Impact Assessment (EIA), Environmental Management Planning (EMP), Environmental Performance Assessment (EPA).
4. Global Environmental Issues: Stockholm Conference, the Earth Summits, Inter-Governmental Panel for Climate Change (IPCC).
5. Environmental Laws in India: Wild life Act, Forest Acts, Environmental Protection Act, National Environmental Tribunal Act.

GEO 201.2: ENVIRONMENTAL ENGINEERING

Course Outcome:

Students will learn about the necessity and mechanism of waste water treatment and understand the procedures to manage air and noise pollution. This course aims to enable the learners to participate in making of pollution free environment. This fundamental understanding and knowledge help them to get engaged in various non-government and government initiatives in this regard.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Definition and domain of Environmental Engineering, Waste water treatment: Primary, Secondary and Tertiary treatment; Disposal.
2. Sludge treatment; Solid (Municipal) waste management, Hazardous waste management.
3. Air pollution; Indoor pollution, Air sampling and measurement, Air pollution control technologies.
4. Noise Pollution; Measurement of noise, Biophysical impacts, Mitigation technologies.
5. Arsenic and Fluoride Pollution; Spatial distribution, Impacts, Mitigation.

PAPER– GEO 202: POPULATION & DEVELOPMENT

Full Marks: 50 Credit: 4

GEO 202.1: POPULATION GEOGRAPHY

Course Outcome:

Through this module students will learn the various aspects of population growth process, its impact on economy, society and politics. Various policy regarding the control and development of human resources, their necessity, and outcome will be understood. This understanding will help them to take part in various govt schemes and programmes relating to population issues.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Scope, development and recent trends of population geography and its interdisciplinary nature.
2. Population composition and structure: Types, spatial and temporal variation and determinants of age, sex, literacy and rural-urban ratio.

3. Demographic Transition: Facts, theories, different waves. Its social, political and economic impacts.
4. Population projection: Concept, types and methods.
5. Population- resource relationship: Critical analysis of over, under and optimum population, population resource regions, carrying capacity and change in carrying capacity over time. Population policy issues, population equilibrium.

GEO 202.2: POPULATION & DEVELOPMENT

Course Outcome:

The course is designed to give an account of the population and development debate including some of the measures of human development measurements. Students will also aware about the migration pattern of people from one place to other. They will be able to calculate the Human Development Index and other indices to assess the quality of human population. Any planning activities relating to economy and population need such knowledge to proper implementation and outcome.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. The fate of Millennium development goals, Human development and gender issues: HDI, GDI, GEM-concept, measures and criticism, disparities
2. Population growth: Link to economic development, resource scarcity, food security and sustainable development. Concept of logistic and exponential growth
3. Population and development integration with special reference to India
4. Theories and approaches of population growth and regulation: Malthus, Marx and Neo-Malthusiasm
5. Migration: Concept of social mobility, concept, types, patterns, theories (Ravenstein, Lee, Louis and Zelinsky), consequences.

PAPER– GEO 203: REGIONAL GEOMORPHOLOGY & RESOURCE MANAGEMENT

Full Marks: 50 Credit: 4

GEO 203.1: REGIONAL GEOMORPHOLOGY OF INDIA AND WEST BENGAL

Course Outcome:

Students will be able to learn about the regional boundaries of geomorphological regions in India and also understand the physiographic diversity of India and West Bengal, their unique characteristics and regional importance.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Geomorphology of Darjeeling Himalaya and Terai Region with special reference to landslides and alluvial fans.
2. Tectonics, drainage and geomorphology of Western Ghats with special reference to Deccan Trap.
3. Geomorphology and soil-landform assemblages of Chhotanagpur Plateau and its adjacent areas of West Bengal, Geomorphology of Rajasthan desert with special reference to Marusthali.
4. Form, process and evolution of Ganga, Subarnarekha and Godavari delta.
5. Tectonics and Geomorphology of the Islands of Bay of Andaman and Nicobar, Rameswaram and Laksha-Minikoi and Amindivi.

GEO 203.2: LAND, WATER AND FOREST: CONFLICT AND CONSERVATION

Course Outcome:

Students will acquire knowledge about primary resources, their conflicts in uses, availability and need for conservations. They will understand the environmental and economic services of land, water and forests. It will enhance their ability of being a resource planner.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Land class systems, land use capability classes.
2. Land degradation, land conservation and land improvement.
3. Water assessment: water quality, water availability and scarcity of water, saline ground water in coastal areas, functions of wetlands.
4. Characterization diversity of rainforests and mangrove forests
5. Degradation and management of forest, social forestry and agro-forestry.

ELECTIVE PAPERS (CBCS)

PAPER- C-GEO 204: Resource Management and Earth System science

Full Marks: 50 Credit: 4

C-GEO 204.1: RESOURCE AND ITS MANAGEMENT

Course Outcome:

The course is designed for basic understanding for the students from different discipline other than Geography. It includes the fundamental concepts of natural and human resources and their management and planning strategies. On completion of this course, the students get a founding knowledge of the natural resources in environment.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Geography as a science of synthesis; social relevance of geography
2. Resource assessments, management and mapping
3. Human resource development in backward region.
4. Indicators of livelihood security.
5. Microlevel resource planning in watershed scale.

C-GEO 204.2: EARTH SYSTEM SCIENCE

Course Outcome:

The course is designed with an interdisciplinary approach for the students from outside Geography. It includes the fundamental ideas of Geotectonics, atmospheric composition and processes, the surface geomorphology and sea bathymetry. On completion of this course, these fundamental concepts will help the students from other branches to have a basic idea of geosciences.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Earth surface processes and Geo-tectonics.
2. Composition of atmosphere and atmospheric processes.
3. Bottom relief of major oceans; temperature and salinity distribution.
4. Principles of mapping and applications.
5. Regional geomorphology of West Bengal.

PRACTICAL COURSES (100 Marks)

COURSE NO. – GEO 295: STATISTICAL TECHNIQUES

Full Marks: 50 Credit: 4

Course Outcome:

The course, split into two units, corresponds to the basic and advance statistics, is a starting point of escalating the statistical analytical skills. It includes the founding concepts of probability distribution including the advanced linear modelling with matrix solution to the multivariate linear and non-linear model. These concepts are essential for augmenting the analytical skills of any beginner in Geography that includes both physical and social aspects of academic discipline. Upon completion of this course, the students get the benefit of having a strong mathematical and statistical analytical skills.

GEO 295.1: BASIC STATISTICS IN GEOGRAPHY

Full Marks- 25
*Pattern of Setting Questions: **Three** compulsory questions bearing marks **7, 7 and 6** respectively, will be set covering the whole unit. **5** marks will be allotted for Laboratory Note Book and Viva-voce.*

1. Measurement in Geography: Nominal, ordinal, interval and ratio measurement.
2. Concept of covariance, correlation and regression: Bi-variate analysis - linear, exponential, Product moment correlation, Spearman's Rank correlation, correlation matrix, partial correlation, residuals - mapping of residuals.
3. Probability distribution: addition and Law of multiplication, concept of probability distributions (binomial distributions, normal probability distribution), properties of normal curve.
4. Hypothesis testing: Formulation, Rejection rule, one and two tailed tests, significance level, degrees of freedom type I and type II errors, Standard Error. Different types of significance test for various purposes. Chi- square test, student's t- test.
5. Sampling techniques for geographical analysis.

GEO 295.2: ADVANCED QUANTITATIVE METHODS

Course Outcome:

The course, split into two units, corresponds to the basic and advance statistics, is a starting point of escalating the statistical analytical skills. It includes the founding concepts of probability distribution including the advanced linear modelling with matrix solution to the multivariate linear and non-linear model. These concepts are essential for augmenting the analytical skills of any beginner in Geography that includes both physical and social aspects of academic discipline. Upon completion of this course, the students get the benefit of having a strong mathematical and statistical analytical skills.

Full Marks- 25
*Pattern of Setting Questions: **Three** compulsory questions bearing marks **7, 7 and 6** respectively, will be set covering the whole unit. **5** marks will be allotted for Laboratory Note Book and Viva-voce.*

1. Analysis of Variance: Objectives; One-way and Two-way ANOVA.

2. Fitting Second Degree Polynomial curves to bivariate geographical data and testing by ANOVA.
3. Multiple Regression: Linear multiple regression equation, Multiple and partial correlation coefficient.
4. Elementary multiple regression modeling techniques: Stepwise variable entry method, Path Analysis.
5. Model building techniques

PAPER- GEO 296: REMOTE SENSING AND COMPUTER APPLICATION

Full Marks: 50 Credit: 4

GEO 296.1: PRINCIPLES OF REMOTE SENSING AND AERIAL PHOTOGRAPHY

Course Outcome:

The course content is focused on basic understanding of satellite remote sensing and aerial photography. Basic principles of satellite motion and sensor parameters including the principles of air photo help the students to formalize with the modern space based analytical techniques. Upon completion of this course, the students will get benefit from rigorous practice and comprehensive theories.

Full Marks- 25
*Pattern of Setting Questions: **Three** compulsory questions bearing marks **7, 7 and 6** respectively, will be set covering the whole unit. **5** marks will be allotted for Laboratory Note Book and Viva-voce.*

1. Physics of Remote Sensing: Electro Magnetic Radiation (EMR), Radiation laws (wavelength-frequency-energy relationship of EMR numerical problems).
2. Satellite System: Keplers's Laws, Major-Semi-major axis, eccentricity, velocity (Numerical problems).
3. Satellite Sensors: Concept of IFOV, resolution and determination of pixel size, referencing scheme of satellite system (path/row calculation).
4. Basics of Aerial Photograph: Basics geometry of aerial photograph, determination of scale and height, Distortions, Image parallax, Relief displacement.
5. Stereoscopy and Aerial Photo Interpretation: Stereoscopy, Pseudoscopy, Mirror Stereoscope, mosaic, edge information, mapping of Physical and Cultural features with the Air photo interpretation keys: shape, size, pattern, tone, texture, shadow, site and associations.

GEO 296.2: COMPUTER BASICS AND APPLICATIONS

Course Outcome:

The course is designed to get a comprehensive knowledge of fundamentals of computer application. It also includes the exercise from Microsoft excel and SPSS regarding the basic statistical computation. The course, therefore, lay the foundation for software-based computing skills. Upon completion, the students get adequate level of skills to do statistical analysis.

Full Marks- 25
*Pattern of Setting Questions: **Three** compulsory questions bearing marks **7, 7 and 6** respectively, will be set covering the whole unit. **5** marks will be allotted for Laboratory Note Book and Viva-voce.*

1. Computer components: Hardware and software: CPU, Input and Output devices; Common computer languages, System Software, Application Software and Operating Systems.
2. Representation of data; Numbering Systems; Binary Arithmetic; Basic Logic Gates; Boolean Logic and Reduction Techniques.
3. Computation, Storing and Formatting Spreadsheets: Computation of Rank, Mean, Median, Mode, Standard Deviation, Moving Averages, Sample Variation; Derivation of Correlation, Covariance and regression; Selection of technique and interpretation using MS-Excel and SPSS Environment.
4. Regression, correlation, curve fitting, multivariate analysis.
5. Internet Surfing- generations of data and extraction of information for power-point presentation, Manipulation and editing of graphic files.

SUGGESTED REFERENCES

GEO201.1: Environmental Ethics and Regulation

Farmer, A. (1997): *Managing Environmental Pollution*, Routledge, London: 246p.

Ghosh, S.K. (2007): *Environmental Act in India*,

Joshi, A. (2008): *Global Environmental Agreements: Insight and Implication*, Eastern Book Corporation

Marsh, W.M. and Grossa, J.M. (1996): *Environmental Geography: Science, Landuse and Earth Systems*, John Wiley & Sons.

Maryk, Theodore (1996): *Major Environmental Issues Facing 21st Century*, Prentice Hall

Park, C. (1998): *The Environment: Principles and Applications*, Routledge, London:

Pickering, K. and Owen, L.A.(1997) : *An Introduction to Global Environmental Issues*, 2nd edition, Routledge, London.

Prabhakar, V.R. (1998): *Social and Community Forestry*, Indian Pub. Distrb., New Delhi: 224p.

Roberts, N. (editor) (1994): *The Changing Global Environment*, 3rd edition, Blackwell Pub. Co., London: 531 p.

Santra, S.C. (2001): *Environmental Science*; New Central Book Agency, Kolkata.

GEO201.2: Environmental Engineering

Brady,N.C. and Well, R.R. (2005): *The Nature and Properties of Soil*, Pearson Education, Singapore.

Masters, G .M. (1991): *Introduction to Environmental Engineering and Sciences*, Prentice Hall India Ltd. New Delhi:

Nazaroff, W.W. and Alvarej, C.L. (2001*): Environment Engineering Science*; John Wiley & Sons, Newyork.

Pielou, E.C. (1975): *Ecological Diversity*, John Wiley & Sons, Newyork

Schwab,G.O. et.al. (1993): *Soil and Water Conservation Engineering*, 4th Edition, John Wiley & Sons, Newyork

Sing,V.P. Yavada,R.N.(2003): *Environmental Pollution*, Allied Publishers Pvt. Ltd. New Delhi.

Vesilind, P.A. and Morgan, S.M. (2004): *Introduction to Environmental Engineering* (2nd Edition), Thomson, Australia.

GEO202.1: Population Geography

Binde and Kanitkar (2000): *The Principle of Population Studies*, Himalaya Publication

Chandna, R.C. (1998): *Geography of Population*, Rawat, New Delhi.

Clarke, J.I. (1973): *Population Geography*, Pergamon press, Oxford

Hassan, Mohammad. Izhar, (2005): *Population Geography*, Rawat publication, Jaipur

Hussain, M. (1994): *Human Geography*, Rawat Pub. Co., New Delhi: 485p.

Mitra, A. (1978): *India's Population (Vol. 1 and 2),* Abhinav, New Delhi

Premi, M.K.(2006): *Demography and its exposition*, Jwahar Publication, New Delhi

Majumdar, P.K (2010): Fundamentals of Demography, Rawat publication, Jaipur

Mukherji, S. (2013): Migration in India, Rawat publication, Jaipur

Dyson, T. (2010): Population and Development, Rawat publication, Jaipur

GEO202.2: Population and Development

Deshpande, Ashwini. (2007): *Globalization and Development: A Handbook Of New Perspectives*; Oxford University Press, N Delhi.

Dreze, Jeaw and Sen, A. (2002): *India: Development and Participation*, Oxford University Press

Gould, W. T. S. (2009): *Population and Development* (Series - Routledge Perspectives on Development); Taylor & Francis.

Nag, Prithvish; Kumar, Chandra Shekhar and Sengupta, Smita. (2001): *Environment, Population and Development*; Concept Publishing Company.

Ranjan, Alok. (1999): *Population And Development: The Indian Perspective*; Universal Publishers.

Shandilya, T. K. (1995): *Population Problem and Development*; Deep & Deep Publications.

Srivastava, A. K. (2004*): Population Development, Environment and Health*; Aph Publishing Corporations.

Sroaff, Meera. (2004): *Population and Sustainable Development*; Adhyayan Publishers and Distributors.

Youngs, G (2001); Globalization, Communication and Technology, Cambridge
Parr-S,F and Kumar, A.K (2005): Readings in Human Development, Oxford University Press, New Delhi
Morris, a (1998):Geography and Development, University College London Press, London

GEO203.1: Regional Geomorphology of India and West Bengal

Ahmad, Enayat. (1972): *Coastal geomorphology of India*; Orient Longman.

Biswas, A. (1987): *Laterites and lateritoids, Explorations in the tropics*: V.S. Datye et. al., Prof. K.R.Dikshit felicitation Committee, Pune, PP.137-140.

Mukhopadhyay, S.C: *Geomorphology Of The Subarnarekha Basin: The Chota Nagpur Plateau (eastern India*, the University of Burdwan,

Rawat, T. (2008*): Environment of the Himalayas*, Eastern Book Corporation

Sehgal, J and Blum, W.E et al. (1998): *Red and Lateritic Soils*, Oxford and IBH pub.

Sharma, Hari Shanker. (1982): *Perspectives in Geomorphology*; Concept.

Sharma, H. S. (1991): *Indian Geomorphology,* Concept Publishing Company.

Starkel, L. and Basu, S. 2000 *Rains, Landslides and Floods in the Darjeeling Himalaya*, Indian National Science academy, New Delhi: 168p.

GEO203.2: Land, Water and Forest: Conflict and Conservation

De, N.K and Jana, N.C (1997): The Land: A Multifaceted Appraisal and Management, Sribhumi Publishing Co.

FAO (1974): A Framework for Land classification; Soil Bulletin No. 32, FAO, Rome.

FAO (1976): Approach to Land classification; Soil Bulletin No. 22, FAO, Rome.

Human Resource Development (2008): Issues on Ecosystem and Environment, UNDP.

Saberwal Vasant K. Rangarajan Mahesh (2003): Battles over nature : science and the politics of conservation, Permanent Black Delhi.

Singh J S Singh S P Gupta S R (2008): Ecology environment and resource conservation, Anamaya publishers New Delhi.

Rangaranan Mahesh: Fencing the forest : conservation and ecological change in india's central provinces 1860-1914, Oxford University Press Oxford.

Desai Mamata (2008): Environmental conservation : management and development : the sustainable approach, acb publications Kolkata.

Yasmi Yurdi (201o): Conflict over forests and land in Asia Impacts, causes, and management, The Centre for People and Forest, RECOFTC: Website: www.recoftc.org.

C-GEO 204.1: Resource and its Management

A. P. Subudhi, B. S. Sokhi, Dr. P. S. Roy (2001): *Remote Sensing and GIS: Application in Urban and* , Government of India, – Urbanization

Chris Rowley (2012): Human *Resource Management in the Asia-Pacific Region: Convergence Revisited*, Routledge.

Christian M. Stracke (2011): Competence Modelling for Human Resources Development and European Policies: Bridging Business, Education and Training; E-competences Tools, GITO mbh Verlag,

Daniel Maxwell (2000): *Urban Livelihoods and Food and Nutrition Security in Greater Accra, Ghana*, Intl Food Policy Res Inst, - Health & Fitness

Deep Ford, Crescenzo Dell'Aquila, Piero Conforti (2007): *Agricultural Trade Policy and Food Security in the Caribbean: Structural Issues, Multilateral Negotiations and Competitiveness*, Food & Agriculture Org., - Business & Economics

Eric Craswell, Mike Bonnell, Deborah Bossio, Siegfried Demuth, Nick van de Giesen (2007): *Integrated Assessment of Water Resources and Global Change*: *A North-South Analysis,* Springer Science & Business Media,

H. W. Shyamalie and A. S. Saini (2011): *Socio-Economic Status and Livelihood Security of Women in the Hills of India and Sri Lanka,* Readworthy.

Isobel W. Heathcote (2009): *Integrated Watershed Management: Principles and Practice*, John Wiley & Sons, - Business & Economics
K. V. Sundaram, M. Moni, Mrityunjay M. Jha (2004): *Natural Resources Management and Livelihood Security: Survival Strategies and Sustainable Policies*, Concept Publishing Company, - Sustainable agriculture
Long-term Strategy for Human Resources Development: Food, Agriculture and Natural Resources by Southern African Centre for Cooperation in Agricultural and Natural Resources Research and Training, 1997
Lorraine Corner: *Poverty alleviation and human resources development*
Maiti, R.K.(2016): *Modern Approaches to Fluvial Geomorphology*, Primus Books, New Delhi, 221p.
Mark N.K. Saunders and Paul Tosey (2015): *Handbook of Research Methods on Human Resource Development*, Edward Elgar Publishing.
Michael Zanko (2002): *The Handbook of Human Resource Management Policies and Practices in Asia-Pacific Economies*, (Volume 1), Edward Elgar Publishing.
Murthy, K.S. (1998): *Watershed Management in India*, 3rd edition, Wiely Eastern Ltd. / New Age International Ltd., New Delhi: 198p
Prashant K Srivastava, Saumitra Mukherjee, Manika Gupta, Tanvir Islam (2011): *Remote Sensing Applications in Environmental Research*, Springer.
Rob F. Poell, Tonette S. Rocco, Gene L. Roth (2014): *The Routledge Companion to Human Resource Development*, Routledge.
S. Sankar, P. C. Anil, M. Amruth (2000): *Criteria and Indicators for Sustainable Plantation Forestry in India*, CIFOR, – Eucalyptus
Thomas N. Garavan, Alma M. Mccarthy, Michael J. Morley (2016): *Global Human Resource Development: Regional and Country Perspectives*, Routledge.
Vijay P. Singh, Ram Narayan Yadava (2003): *Watershed Management*, Allied Publishers.

C-GEO 204.2: Earth system science

Boaden (et al.) (1982): *Introduction to Coastal Ecology*, Blackie.
Chicago Levinton, J.S. (1982): *Marine Ecology*, PrenticeHall.
Garrison, T.S. (2007): *Oceanography: An Introduction to Marine Science*, 6thEdition, BrooksCole,
K S Valdiya, (2010), *The Making of India Geodynamic Evolution* by, Macmillan
Maiti, R.K.(2016): *Modern Approaches to Fluvial Geomorphology*, Primus Books, New Delhi, 221p.
P S Chakraborti and Snjai Nag (2016*), Rivers of West Bengal : Changing scenario*, Kolkata, 225p.
Paul Ashis kr. (2002), *Coastal Geomorphology and Environment*, ACB Publications, Kolkata, 582p
Pinet, Paul. (2006*): Invitation to Oceanography*, Jones & Bartlett.
Sverdrup, K.A.; Duxbury, A.C. and Duxbury, A.B. (2005): *The world Oceans*, McGrawhill.
Thorson, G. (1971): *Life in the Sea, World University Library*, New York.
Vatal, and Sharma (1972): *Oceanography for Geographers*, Chaitanya publising house, Allahabad.
Wirthmann, A. (2000): *Geomorphology of the Tropics*, Translated by Busche, D.Springer-Verlag, Berlin: 225p.
Woodroffe, C. D. (2003): *Coasts: Form Processes and Evolution*, Cambridge University Press, Cambridge.
Dent., D.B (1993): *Cartography: Thematic map design*, Sea Brown Publishers
Misra, R.P and Ramesh, A (1989): *Fundamental of Cartography*, Concept, Delhi
Monkhouse F.J. and Wilkinson, H.R. (1971): *Maps and Diagrams: Their Compilation and Construction*, B.I. Publications Private Limited, New Delhi: 527p.
Nag, P and Dutta, G.K (1992): *Thematic Cartography and Remote Sensing*, Concept
Wilford, J,N (2000): *The Map Makers*, A.A. Knopf

GEO 295.1: Basic Statistics in Geography

Alvi. Z. (1995*): Statistical Geography: Methods and Applications*, Rawat Publication, New Delhi
John, C. D. (2002): *Statistics and Data Analysis in Geology*; John Wiley & Sons.
Mehmood, A (1977): Statistical methods in Geographical studies, Rajesh Pub. New Delhi
Pal, S.K. (1999): *Statistics for Geoscientists*, Concept publishing Company, New Delhi: 423p.
Sarkar, A. (2006): *Practical Geography; A systematic approach*, Orient Longman Ltd, Hydrabad,
Silk, J. (1979): *Statistical techniques in Geography*, George Allen and Unwin, London: 276p.

Swan, A.R.H.; Sandilands, M. and McCabe, P. (1995): *Introduction to Geological Data Analysis*, Blackwell. 446p.
Walford, P. (1995): *Geographical Data Analysis*, John Wiley and Sons Inc., New York: 446p.

GEO 295.2: Advanced Quantitative Methods

Aralinghaus,S.L and Griffity, A.(1995): *Practical Handbook of Spatial Statistics*, CRC Press
Brien, O.L. (1992*): Introducing Quantitative Geography: Measurement, Method and Generalized linear Models*, Routledge.
Clark, W.A.V and Hosking, P.L. (1986*): Statistical Methods for Geographers*, Wiley and Sons.
Fotheringham, S. A and Brunsdon, C and Charlton, M. (2000): *Quantitative Geography: Perspectives on Spatial Data Analysis*, SAGE.
Haining, R.P. (2003): *Spatial Data Analysis*, Cambridge University Press.
Lindsay, J.N. (1997): *Techniques in Human Geography*, Routledge

GEO 296.1: Principles of Aerial Photography and Remote Sensing

Allison, L.J., Schnapf, A.(1983): Meteorological satellites: In Colwell, R.N.(ed.) *Manual of Remote Sensing*.
Campbell, J .B. (1996): *Introduction to Remote Sensing*, 2nd edition, Taylor & Francis, London: 622p.
Chaisman, N. (1992): *Exploring Geographical Information Systems*, John Wiley and Sons Inc., New York: 198p.
Colwell, R.N. (ed.) *Manual of Remote Sensing* (2nd edn). American Society of Photogrammetry, Falls Church,
Curran, P.J. (1988): *Principles of Remote Sensing*, ELBS Edn. Longman Group UK Ltd.
Guha, P.K. (2003): *Remote Sensing for the Beginner*, Affiliated East-West Press Pvt. Ltd., New Delhi
George, J. (2003): *Fundamental Remote Sensing*, Universities Press, New Delhi.
John R Jensen (2006): *Remote Sensing of the Environment: An Earth Resource Perspective*, Pearson Education Delhi
Lillesand, T.M. and Kiefer, R. W. (2003): *Remote Sensing and Image Interpretation*, 5th edition, John Wiley and Sons, New York.
Narayan L R A (2000): *Remote sensing and its applications*, Universities Press Hyderabad
Rajan, M.S. (1995): *Space today*, 2nd edition, National Book Trust, New Delhi, 344p.
Slater, P.N. (1983*): Photographic systems for remote sensing*, Singapore Science Center.
Slater, P.N. (1983): *Photographic systems for remote sensing*, Virginia,

GEO 296.2: Computer Basics and Application

Bartee, Thomas C. (1977): Digital Computer Fundamental; McGraw Hill.
Blissmer (1996): *Working with MS Word*; Houghton Mifflin Co.
Chauhan, S.; Chauhan, A. and Gupta, K. (2006): *Fundamental of Computer*; Firewall Media.
Flake, L.J.; McClintock, C.E. and Turner, S. (1989): Fundamental of Computer Education; Wordsworth Pub. Co.
Johnson, Steve (2007): Microsoft Power Point 2007; Pearson Paravia Bruno.
Leon, A .and Leon,M.(1999): Introduction to Computer, USB Publishers' Distributors Ltd.
Leon, A. and Leon, M.(1999): A beginners Guide to Computers, lean Vikas
Malvino, A.P. and Leach, D.P. (1981): Digital Principles and Appications; Tata McGraw Hill.
Mano, Moris M. and Kime, Charles R. (2004): *Logic and Computer Design Fundamental*; Prentice Hall.
Rajaraman, V. (2003): Fundamentals of Computer, Prentice Hall Publisher
Rajaraman, V. (2008): Computer Primer; Prentice Hall of India Pvt. Ltd.
Sarkar, A. and Gupta, S.K (2002) Elements of computer Science, S Chand and Company, New Delhi
Shepard, Aaron (2007): *Perfect Pages*; Shepard Publications.
Tyson, Herbert L. (2007): Microsoft Word 2007 bible; John Wiley.
Walkenbach, John (2007): Excel 2007 Bible; John Wiley.

Semester- III (300 Marks)

THEORETICAL COURSES (200 Marks)

PAPER - GEO-301: APPROACHES TO REGIONAL DEVELOPMENT

Full Marks: 50 Credit: 4

GEO 301.1: REGIONAL APPROACH IN GEOGRAPHY

Course Outcome:

This course is focused on the fundamental concepts of regional geography including the classical approach to define an area as region. It includes the methods of regional delineation and classification of region based on their properties. On completion of this course, the pupils get a comprehensive understanding of the regional analysis. They will also learn about the concept of planning region and their delineation methods and this understanding may help them to assist in various planning process.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Regional concept in geography: concept, typology, hierarchy, methods of regional delineation and regional system.
2. Contribution of Ratzel, Hartshorne, Hettner and Vidal de la Blache to the development of regional concept. The character of regional geography, Space: the fundamental stuff of geography.
3. Formal regions: Natural, Agro-climatic, socio-cultural regions with special reference to India.
4. Functional region: City region, industrial region with special reference to India.
5. Planning regions in India: Conceptual framework, Purpose, types and methods of delineating planning region.

GEO 301.2: RURAL DEVELOPMENT

Course Outcome:

The focus of the course is to develop an idea about the approach to understanding the rural development. It includes the status report of the rural development in India on various accounts, i.e. agriculture, health, education, rural employment, infrastructure and rural electrification. The role of micro finance is also included to give students an understanding of the rural economic development. The students get an inclusive understanding of the rural development and its dynamics upon completion of this course.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4***

marks *(without division), will be set for answering any two.* ***Group- C*** *(Short Answer Type): Four questions, each of* ***2 marks*** *(without division), will be set for answering any two.*

1. Concept and approach to rural development, Indicators of Development & Rural Development and their measurements.
2. Rural Economics: Agriculture Development and Land Reforms in India.
3. Rural Micro-finance, self-help group and women empowerment.
4. Rural Industries and entrepreneurship: Definition and meaning of rural industries. Relevance of rural industries in solving socio-economic problems with special reference to Food Processing and Tourism.
5. Rural Development Programmes: poverty alleviation schemes- National Rural Employment Guarantee Act, Jawahar Rozgar Yojana, Sampoorna Grameen Rozgar Yojana, Provisions of Urban Amenities in Rural Area (PURA); Infrastructural development programmes- Indira Avas Yojana; Transport Development: Pradhan Mantri Gram Sadak Yojana.

PAPER - GEO- 302: SETTLEMENT AND TRANSPORT GEOGRAPHY

Full Marks: 50 Credit: 4

GEO 302.1: SETTLEMENT GEOGRAPHY

Course Outcome:

The primary aim of studying settlement geography is to acquaint with the spatial and structural characteristics of human settlements under varied environmental conditions. The paper deals with multi disciplinary perspectives on the formation, evolution of human settlement. The paper will help the students to make an understanding on the reasons people settle in certain locations and the geographical features lead to the development of civilizations. The Nature and Scope of Settlement Geography, Characteristics of Rural and Urban Settlements according to Indian Census and nature, scope, evolution and several study methods. The settlement types, pattern and nature and process of urban settlement ,different cultural landscapes.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
Pattern of setting questions: ***Group- A*** *(Long Answer Type): Two questions, each of* ***8 marks*** *(without division), will be set for answering any one.* ***Group- B*** *(Semi-long Answer Type): Four questions, each of* ***4 marks*** *(without division), will be set for answering any two.* ***Group- C*** *(Short Answer Type): Four questions, each of* ***2 marks*** *(without division), will be set for answering any two.*

1. Concept of shelter; Dwelling places as cultural expression.
2. Census categories of settlements; Types, building materials and architectural design of houses- dependence on climate.
3. Site, situation and spacing of settlements- dependence on terrain characteristics and water availability.
4. Concepts and components of rural and urban morphology.
5. Socio-economic segregation of rural settlements. Cities as melting pot of culture.

GEO 302.2: TRANSPORT GEOGRAPHY

Course Outcome:

Students will learn about the role of transport in entire economic and social processes. This course aims to make students understand the locational advantage of different economic and social institutes based on transport principle. They are made aware of the role of public transport in addressing the problems of congestion and air pollution. This understanding may help them in formulating plan for regional development and economic regeneration by proper transport planning.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Concept of distance, Transportation and space, space-time relation through transportation, Transport network analysis, Centrality, Accessibility, Connectivity and Rationality. Transport Models (Gravity Models, Allocation Model, Linear Programming Model, Traffic Congestion Model).
2. Transport cost, Principles of transport cost fixation, comparative cost advantage.
3. Planning for public transport, desired characteristics, modes and optimal pricing, services, ownership and regulation.
4. Transport Policy: Problem oriented planning, and objective-led approach; Infrastructure, Management, Information, Pricing and landuse components; National transport policy (national highways, railways and waterways).
5. Communication Technology- roles in reducing transport demand.

PAPER – GEO 303: SPECIAL PAPERS Full Marks: 50 Credit: 4

303A: ADVANCED GEOMORPHOLOGY

GEO 303A.1: PROCESS GEOMORPHOLOGY-1

Course Outcome:

Students will learn about the mechanism and working principle of geomorphic processes in details that lead to shape present earth-surface. This understanding may help in formulating engineering plan for management of land, water and soil, three basic resources on earth surface. They will also have a clear insight into the process and forms on the surface of Moon and Mars

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Geomorphic Thresholds: Reynold Number, Froude Number, Critical shear Stress and Shield Diagram, Slope stability thresholds.
2. Weathering Process and Soils with special reference to laterisation; Development of badland topography.
3. Slope forms and Processes: Mass Movement, Slope Morphology and Evolution.
4. Fluvial Processes: Drainage network development; Channel Morphology in alluvial and bedrock channels, Open channel flow, Sediment Transport, Fluvial response to changing conditions with special reference to channel patterns. Development of fluvial landforms.
5. Planetary geomorphic processes and landforms: Moon and Mars.

GEO 303A.2: PROCESS GEOMORPHOLOGY-2

Course Outcome:

Students will learn about the mechanism and working principle of geomorphic processes in details that are operating since historical time to shape present earth-surface. This course aims to build an understanding role of humans in shaping earth surface and regulating natural processes and their outcome on natural systems. Learners may take part in sustainable resource management.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Long term landform evolution with special reference to planation development
2. Quaternary Environmental Change and Landform Development with special reference to glaciations and sea level change.
3. Glacial and Periglacial processes and landforms.
4. Anthropogeomorphology: Man as active geomorphic agent. Landuse change and its geomorphic implications.
5. Identification of Geomorphosites with special reference to India.

303B: COASTAL MANAGEMENT

GEO 303B.1: COASTAL PROCESSES

Course Outcome:

The learners will understand the systematic interactions among terrestrial atmospheric and marine processes along the coast as a systematic whole. They will learn the dynamic and functional interrelationship between forms and processes in a coastal region and their dynamic equilibrium.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Definition of coastal zone, relevance of coastal study, classification of coast - Beach stage model.
2. Wave hydrodynamics; wave modification near coast with special reference to attenuation, breaker types, energy dissipation during breaking wave.
3. Tide; diurnal and semi-diurnal, rotating and progressive tide, concept of live storage, tidal environment with special reference to estuary.
4. Coastal current; intensity of long shore component and its implications, cell circulation.
5. Macro land forms with special reference to beaches and dunes; micro and biogenic forms.

GEO 303B.2: COASTAL ENVIRONMENTS: FOCUS ON INDIAN REGIONS

Course Outcome:

Students will get knowledge about long term and short-term development of landforms by several processes in some of the coastal regions in India and form process relationships in different spatial and temporal scales. They will understand the problems of coastal erosion and other hazards in the context of global climatic change.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Tide dominated coastal environment: (Estuaries of India, estuary morphology, estuary hydrolodynamics); wave dominated coastal environments: (The shore face, beaches, barriers and human activity)- Indian experiences.
2. Morphodynamic behavior of coastal systems (Modification of coastal features in temporal and spatial scales with feedback mechanisms).
3. Carbonate platforms and beach rocks (Andaman and Nicobar Islands).
4. Coastal erosion problems (West Bengal, Orissa coasts), land reclamations and associated problems (Sundarban coastal tract).
5. Techniques for assessing coastal hazards areas (Hazard zonation along the coasts).

303C: URBAN GEOGRAPHY AND REGIONAL PLANNING

GEO 303C.1: FOUNDATION OF URBAN GEOGRAPHY

Course Outcome:

This paper will provide knowledge on spatial analysis of functions of urban areas. Social and economic characteristics of cities and suburbs will be discussed under this paper. Urban land use and its impact on environment and ecology will be addressed. This paper will introduce students to the basics of urban geography, such as definition of cities, central place theory, National urban systems, and traditional models of urban spatial structure. More importantly, students will be exposed to contemporary urban topics such as global cities, urban sprawling, urban green space, urban ecology and footprints etc. Emphasis will be placed on the urban experience of developing countries, especially India. The students will be able to assemble knowledge of urbanism and urbanization as historic, geographic, social, and cultural processes, historical development, contemporary condition, and environmental impact of cities and urban related issues growing from exposure to the disciplines of Geography and Planning

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Development of urban geography: Definition of Towns, cities and metropolitan area. Trends of Urbanisation in the World and India.
2. Concept and definitions of urban system: Urban, urbanization, urbanism and urban ecology, National urban system, National urbanisation policy.
3. Today's cities and suburbs: suburban sprawl, smart growth, exurbs, the new cities and gated communities, gentrification, green city, Urban Livability Index.
4. Origin and growth of urban living: bases and processes, Historical perspectives on world urbanization
5. Urban planning, policies and regeneration: Architectural vision, European, Anglo American tradition and planning the social city, the new towns movement, toward planning for sustainable urban development.

GEO 303C.2: CONTEMPORARY URBAN ISSUES

Course Outcome:

Student will understand through this module various socio-economic and environmental problems with the growing urbanisation in our country as well as various parts of the world. This knowledge will help them to surmise the necessity of urban planning and they will be able to evaluate the effectiveness of various govt programmes for urban planning.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)

*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Changing spatial and temporal scenario of metropolitan development in India.
2. The economy of urban areas: structure of urban economy-basic and non-basic activities.
3. Social environment of the city: Social stratification, social class diversity, suburban social class, poverty, strangers, crowding, crime and homelessness.
4. Urban environment problems: Heat island, drainage, sewerage, sanitation, solid waste, transport, pollution and health, the city's ecological footprint.
5. Urban renewal and Urban redevelopment in India: Role of JNNURM, Smart city, AMRUT and Housing for All by 2022.

303D: REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM

GEO 303D.1: PHYSICAL BASIS OF REMOTE SENSING

Course Outcome:

The course is designed to give fundamental and some advanced knowledge of space based remote sensing and aerial photography. From orbital parameters of satellite to complexity of aerial camera and film in association with the flight parameters, all of these will allow students to get an in-depth understanding of remote sensing and aerial photographic system.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Physics of Remote Sensing: Source of Energy, Electro Magnetic Radiation (EMR), Radiation laws (wavelength-frequency-energy relationship of EMR), influence of atmosphere on Remote Sensing operation.
2. Fundamental of Thermal Remote Sensing: Radiant temperature, Kinetic temperature, Black body and real body radiation.
3. Satellite orbits and Trajectories: Principles of satellite movements, orbits and trajectory, orbiting satellites-basic principles, orbital parameters, types of satellites.
4. Satellite Platforms and Sensors: Types of platform for civilian applications, advantages, disadvantages and characteristics of various satellite platforms. Physical principles and characteristics of various satellites sensor, sensor selection parameters, resolution.
5. Remote Sensing Data: Data acquisition and reception, Data products, storage and Dissemination.

GEO 303D.2: PHOTOGRAMMETRY, AERIAL PHOTO AND SATELLITE SYSTEM

Course Outcome:

The course is designed to give fundamental and some advanced knowledge of space based remote sensing and aerial photography. From orbital parameters of satellite to complexity of aerial camera and film in association with the flight parameters, all of these will allow students to get an in-depth understanding of remote sensing and aerial photographic system.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Basics of Aerial Photograph: Types of aerial photographs, Geometry of single Aerial Photograph, Photographic overlap, flight planning, Scale, Lens Distortions, Relief distortions and Tilt distortions. Image displacement and parallax.
2. Aerial Photographic Film: Film density and Characteristics Curve, Colour Infrared Films, Film resolution, Filters.
3. Photogrammetry: Development of Photogrammetry, Classification, processes and Limitations of photogrammetry.
4. Stereo photogrammetry: Conditions for Stereo vision, stereoscopic measurements, Sterescopic 3D viewing, Image parallax, Rectification, Orthorectification.
5. Satellite Systems: Whiskbroom system, Pushbroom system, Microwave system, coarse resolution, fine resolution and very fine resolution system.

ELECTIVE PAPER

PAPER - C-GEO 304: Environmental Issues and Management

Full Marks: 50 Credit: 4

C-GEO 304.1: Emerging Issues and Policies on Environment

Course Outcome:

Students will develop their interest in various aspects of environment and contemporary environmental issues. Students will develop their deep understanding in the nature of increasing intensity and magnitude of various hazards in connection to global pattern of economic disparity, social discrimination and climate change.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Global climate change, water scarcity and politics of water.
2. Environmental degradation and pollution.
3. Environment and development: Debate and Issues.
4. Social and Cultural Hazards.
5. Globalization and Environment.

C-GEO 304.2: Environmental Hazards and Disaster Management

Course Outcome:

Students will foster their skill in managing various types of natural hazards by analysing their risk and vulnerability. They will be trained in the procedures of hazard management through proactive approach by increasing the resilience of the community in tune with national policy of hazard management and international laws.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Concepts and techniques for analysis of risk, hazard, disaster, vulnerabilities and resilience.
2. Cyclone and storm surges, thunderstorms and lighting, earthquake, tsunami wave and landslide hazards.
3. Natural hazard and disaster management in India, Agricultural drought hazard and the national experience.
4. International Disaster Response Laws Rules (IDRL).
5. National policy and appraisal of hazard

PRACTICAL COURSES (100 Marks)

PAPER – GEO 395: GIS APPLICATION IN RESEARCH

Full Marks: 50 Credit: 4

GEO 395. 1: APPLICATIONS OF REMOTE SENSING &GEOGRAPHIC INFORMATION SYSTEM

Course Outcome:

The course is designed for the general ideas of GIS and image-based information. Upon completion of this course, students get benefit from these baseline concepts to further increase their knowledge.

Full Marks- 25
*Pattern of Setting Questions: **Three** compulsory questions bearing marks **7, 7 and 6** respectively, will be set covering the whole unit. **5** marks will be allotted for Laboratory Note Book and Viva-voce.*

1. Geo-referencing of maps and satellite images.
2. Preparation of different types of FCC. Image enhancement, Band rationing, Density slicing..
3. Supervised and Unsupervised Classification Techniques, generation of signature statistics and signature reparability reports. Generation of NDVI.
4. GIS: RS, GIS and GNSS.
5. Map layers: Overlay analysis, buffering and map composition

GEO 395.2: RESEARCH METHODOLOGY

Course Outcome:

The learners will get the initial training on various steps involved in geographical research. They will develop the idea on fundamentals of research methodology including data collection, methodology and report writing. This course aims to develop fundamental research aptitude among all the students.

Full Marks- 25
*Pattern of Setting Questions: **Three** compulsory questions bearing marks **7, 7 and 6** respectively, will be set covering the whole unit. **5** marks will be allotted for Laboratory Note Book and Viva-voce.*

1. Research ethics and paradigm shift of research methodology in Geography.
2. Need for research, basic research types.
3. Identification of research problems, development of theoretical background- literature review, research gap and research question and specification of the objectives of study; hypothesis building, Framework of research writing.
4. Methods of data collection- primary and secondary; Preparation of questionnaire and survey schedule and their differences, research ethics.
5. Methods of writing notes, style of referencing, bibliography and appendices, abstract and synopsis writing.

PAPER – GEO 396: SPECIAL PAPER BASED FIELD WORK

Full Marks: 50 Credit: 4

Course Outcome:

This course aims to present the essence of geography as a field science. Students will develop their aptitude in observation, data generation through field survey, data analysis with various software and advanced techniques. They will also know how to represent spatial data through various cartographic techniques and mapping. A hands on practical training is practiced through rigorous involvement in all the stages of pre-field, field and post field works.

396A: Advanced Geomorphology

GEO 396A.1: FIELD WORK

Field works in Advanced Geomorphology

GEO 396A.2: FIELD REPORT
Presentation of research work-25 (Grand Viva-10 and/or Power Point presentation-15)

Generation of report (within about 100 A4 size pages including 30-40 maps/diagrams/field photographs) on the basis of field works carried out under Unit-47.

396B: Coastal Management

GEO 396B.1: FIELD WORK

Field works in Deltaic/ Non-deltaic or Rocky Coastal Environments

1. Studies on the shore profile forms and channel cross sections using echo-sounder and current meter. Littoral environment observation with special reference hydrological parameters: Waves, tides, winds and currents.
2. Coastal sediment budget analysis.
3. Analysis of population pressure on the coastal zones.
4. Analysis of coastal ecosystem diversity using remote sensing.
5. Hazard mapping and community vulnerability mapping Mapping CRZ violation areas using GPS handset, Nearshore geomorphological mapping with conventional surveying equipments or with Total Station. Mapping of the forms of coastline changes

GEO 396B.2: FIELD REPORT
Presentation of research work-25 (Grand Viva-10 and/or Power Point presentation-15)

Generation of report (within about 100 A4 size pages including 30-40 maps/diagrams/field photographs) on the basis of field works carried out under Unit-47.

396C: Urban Geography and Regional Planning

GEO 396C.1: FIELD WORKS

Evaluation will be done on Participation of the candidate in field work- 10; Report making- 15;

Field works on focused urban issue(s) in an urban area e.g. Small town/ Big city/ Few wards of a Big City

1. Wardwise landuse/land cover survey using high resolution Remote Sensing data. Wardwise distribution of population and its change over time.
2. Survey of spatial distribution of urban facilities (Bank, School, College, Offices, Hospitals etc.), urban transport: Nodes, Network and flow: Collection of database (Primary and Secondary), Water supply system: waste collection and disposal system.
3. Study of Urban sprawling, renewal, economics, environmental problems etc.: Collection of database (Primary and Secondary).

4. Income/Social grouping, Ethnic groups Education; Occupation; Age-sex Composition etc.
5. Enquiries on future prospects and planning strategies

GEO 396C.2: FIELD REPORT
Presentation of research work-25 (Grand Viva-10 and/or Power Point presentation-15)

Generation of report (within about 100 A4 size pages including 30-40 maps/diagrams/field photographs) on the basis of field works carried out under Unit-47

396D: Remote Sensing and Geographic Information System

GEO 396D.1: Field Works
Evaluation will be done on Participation of the candidate in field work- 10; Report making- 15;
Field works for ground truth verification in a selected field area

1. Remote Sensing in Earth Sciences: Geomorphic Mapping; Visual interpretation of landforms; Basic Concepts, Recognition elements, interpretation of drainage pattern, erosion and deposition landforms.
2. Remote Sensing in Agricultural Applications: Soil Mapping, Crop Mapping/ Crop stress determination. Forest Management-Forest density mapping, Forest type mapping.
3. Remote Sensing in Land and Water Management: Landuse/ Land cover Planning, Land resource management; Water Resources: Surface water-ground water, water deciphering, quality inventory and monitoring, quality assessment; Watershed Management: Morphometric Analysis, Hydro-morphogeologic interpretation techniques for targeting ground water potential zones in alluvial, sedimentary and hard rock areas; flood assessment and watershed management.
4. Remote Sensing in Urban and Rural Development: Mapping of human habitation and type.
5. Remote Sensing in Coastal Management: Coastal Landuse, Spatial and temporal changes, SST, Phytoplankton assessment, Sediment assessment.

GEO 396D.2: FIELD REPORT
Presentation of research work-25 (Grand Viva-10 and/or Power Point presentation-15)

Generation of report (within about 100 A4 size pages including 30-40 maps/diagrams/field photographs) on the basis of field works carried out under Unit-47.

SUGGESTED REFERENCES

GEO301.1: Regional Approach in Geography

Bhat, L.S. (1973): *Regional Planning in India*, Statistical Pub. Society.
Chand, M. and Puri, V.K. (1988): *Regional Planning in India*, Vikas, New Delhi .
Chandana, R.C.(2000): *Regional Planning and Development*, Kalyani Publishers.
Glasson, J. (1974): *An Introduction to Regional Planning*, Hutchinson, London.
Greed (2000): *Introducing Planning*, Athlone Press, London.
Hall, P. (174): *Urban and Regional Planning*, Penguin, London.
Mishra, R.P. (1969): *Regional Planning, Concept, Techniques, Policies*, the University of Mysore Press.
Misra,R.P,Sundaram and Rao (1974): *Regional Planning In India*, Viking, Delhi.
Mitra, A. (1971): L*evels of Regional Development India*, Census of India.

Tim, Hall (2006): *Urban Geography*, Routledge.

GEO301.2: Rural Development

Chand, M. and Puri, V.K. (1988): *Regional Planning in India*, Vikas, New Delhi

Singh, Katar (1986). Rural development : principles, policies and management, Sage Publications India New Delhi.

Vijay, Chand Mal (1989). Rural development administration in India, Akashdeep Publishing House, New Delhi.

Upadhyay, H.C (1991). Modernization and rural development, Anmol Publications, New Delhi.

Riley, John M (2002). Stakeholders in rural development : critical collaboration in state-NGO partnerships, Sage Publications India, New Delhi

Ray, C.N (1994). Politics of rural development : The case of anti-Poverty programme in West Bengal and Gujarat, Rawat Publications, Jaipur.

Mahajan, V.S(1996). Agriculture,rural development and panchayati raj, Deep and Deep Publications, New Delhi.

Kar, Samit (1991). Rural development in West Bengal : a quest, Sarat Book House, Kolkata.

Yugandhar, B.N., Mukherjee, Neela (1991). Studies in village India : Issues in rural development, Concept Publishing, New Delhi.

Subramanian, S (1988). Rural development : an inside Look at Problems and prospects, Yatan Publications, New Delhi.

Kumar, Sunil (1990). Regional rural banks and rural development, Deep and Deep Publications, New Delhi

Saudhu, Baldere S (1996). Banking and rural development, Deep and Deep Publications, New Delhi.

Reddy, K. Venkata(1988). Rural development in India, Himalaya Publishing House, Bombay.

Lakshman, T.K.., Narayan, B.K.. (1984). Rural development in India : a multi-demensional analysis, Himalaya Publishing House, Bombay

Yadav, Subah Singh., Gurjar, Ram Kumar (1997). Rural development and poverty alleviation, Pointer Publishers, Jaipur.

Dutta, Siba kanta (1986). Co-operative societies & rural development, Mittal Publications, New Delhi.

Desai, Vasant (1991). Fundamentals of rural development : a system approach, Himalaya Publishing House, Bombay.

Ahmed, Rais (1996). Comparatives and integrated rural development programme, Mittal Publications, New Delhi.

Ministry of rural development, Government of India, web add: http://rural.nic.in/

GEO302.1: Concepts in Settlement Geography

Brian,K.R(1996):*Landscapes of Settlements:Prehistory to the Present,* Routledge,London

De Blij H.J. (1995): *The Earth: An Introduction to its Physical and Human Geography*, John Wiley and Sons Inc., New

De Blij H.J. (1996): *Human Geography: Culture, Society and Space*, John Wiley and Sons Inc., New York: 531 p.

Ghosh, S. (1998): *Introduction to Settlement Geography*, Orient Longman Ltd., Calcutta: 158p.

Hudson, F.S. (1970): *Geography of Settlements*, Macdonald and Evans Ltd., Plymouth

Hussain, M. (1994): *Human Geography*, Rawat Pub. Co., New Delhi: 485p.

Misra. H.N. (ed) (1987): *Contributions to Indian Geography*, Volume 9: *Rural Geography*, Heritage Pub., New Delhi.

Racine, J. (ed) : *Calcutta 1981*, Concept Pub. Co., New Delhi.

Rodwin (2006): *Shelter, Settlement and Development*, Rawat Pub.

Singh, R. Y. (1994) : *Geography of Settlements*, Rawat Pub. Co., New Delhi: 335p.

Singh, R.L. et. al. (ed) (1976): *Geographic Dimensions of Rural Settlements*, National Geographical Society of India, Varanasi.

Ramachandram, R. (1999): Urbanization and urban systems in India, Oxford University Press, New Delhi

Verma, L (2009): Urban Geography, Rawat publication, Jaipur

Roy Chaudhuri, J. (2001): An Introduction to Development and Regional Planning-with special reference to India, Orient Blackshawn, Hyderaband

GEO302.2: Transport Geography

Adler, H.A (1987): *Economic Appraisal of Transport Project*, John Hapkins Press. Washington.
Dasgupta, A.K. and Pearee, D.W. (1972); *Cost Benefit analysis, theory and practice*; Mac Millan, London.
Flahesly CAO (2006): *Transport Planning and Traffic Engineering*, Butterworth- Heinemann
Gwillian, K.M. (Ed.) (1993): *Transport Policy and Global Warming*, European Conference of Ministers of Transport, Paris.
Lays M.G. (1993*): Wags of the World*, Primarera Press, Sydwen
Pearce D.W. and Markyanda, A. (1989*): Environmental policy Benefits*, Manetany valuation OECD ,Paris.
While, P. (1986): *Public Transport Planning*, Management and operation, Hatechinson, London.

303A

GEO303A.1: Process Geomorphology-1

Anderson Robert S. and Anderson Suzanne P., 2010 Geomorphology (1st Edition, Kindle Edition) by , Cambridge University Press.
Anderson, M.G. (1988) Modelling Geomorphological Systems, John Wiley & Sons, New York
Chorley R.J. (Ed.) (1972) Spatial Analysis in Geomorphology., Methuen & Co., London.
Chorley, R.J. Schumm,S.A. & Sugden, D.E. (1985): Geomorphology, Methuen & Co. Ltd., London, New York.
Christopherson, R.W. (1995): Elemental Geosystems: A Foundation in Physical Geography, Prentice Hall Englewood Cliffs, New Jersey.
Coates, D.R. and Vitek, J.D. (1980) (eds), Thresholds in Geomorphology, George Allen & Unwin, London.
Crozier, M. J. (1986), Landslides: Causes, Consequences and Environment, Croom Helm, London.
Greeley, Ronald (2013) Introduction to Planetary Geomorphology, Cambridge University Press
Gupta, A. (2011) Tropical Geomorphology, Cambridge University Press
Knighton, D. (1990) Fluvial Forms and Processes, Hodder Education, UK.
Leopold, L.B. Wolman, M.G. & Miller, J.P. (1964): Fluvial Processes in Geomorphology, W.H.Freeman
Maiti, R.K. (2016) Modern Approaches to Fluvial Geomorphology, Primus Books.
Mondal S. and Maiti, R.K. (2015) Semi-quantitative Approaches in Landslide Assessment and Prdiction, Springer.
Morisawa, M. (1985) Rivers, Longman, London.
Ollier, C. D. (1969) **Weathering**. Elsevier, New York.
Pity A.F., 1971, Introduction to Geomorphology, Methuen, London.
Ritter, D.F. (1986) Process Geomorphology, Wm. C. Brown Publisher, Dubuque, Iowa.
Ritter, Kochel and Miller Process Geomorphology, 4th edition, Waveland Press 2006 (ISBN 13: 978-1-57766-461-1).
Robinson, Harry (1969): Morphology and Landscape, University Tutorial Press Ltd. London.
Selby, M.J. (2005) Hill slope materials and processes, Oxford University Press, Oxford.
Selby, R.C. (1976), An Introduction to Sedimentology, Academic Press, London.
Sparks, B.W (1972) Geomorphology, Longman, London.
Thomas Michael F. 2014 Geomorphology in the Tropics, , Wiley.
Worcester, P. G. (1948): Textbook of Geomorphology, Princeton, D.Van, Nortrand.
Zaruba, Q. et al (1969) Landslides and their control. Elsevier, Amsterdam.

GEO303A.2: Process Geomorphology-2

Chorley R.J. (Ed.) (1972) Spatial Analysis in Geomorphology., Methuen & Co., London.
Gamen,H.F. (1974) The Origin of Landscapes-A Synthesis in Geomorphology, Oxford University Press.
Kale, V.S. (2018) (ed) Geomorphosites in India. IGI
Lobeck, A.K. (1939) Geomorphology, McGraw Hill, New York.
Ritter, D.F. (1986) Process Geomorphology, Wm. C. Brown Publisher, Dubuque, Iowa.
Spark, B. W. (1986) Geomorphology, Longman, London.
Sparks, B.W (1972) Geomorphology, Longman, London.
Wadia, D.N. (1993) Geology of India, Tata McGraw Hill Edition, New Delhi.
Valdia, K.S. (2010) The Making of India: Geodynamic Evolution
Selby Michael John (1985) Earth's Changing Surface: An Introduction to Geomorphology, Clarendon Press.

303B

GEO303B.1: Coastal Processes

Carter, R.W.G (1988): *Coastal Environments: An Introduction to the Physical, Ecological and Cultural Systems of Coastlines*, Academic Press, London

Dayer K.R. (1979): *Estuary Hydrography, and Sedimentation*, Cambridge Univ. Press, Cambridge.

Devis R.A. (ed) (1978): *Coastal Sedimentary Environmental*; Springer-Verlag, New York.

Harikawa , K. (1978): *Coastal Engineering*, Univ Of Tokyo Press, Tokyo.

Inman, D.L. (1960): *Shore Processes, Encyclopedia of Science & Technology*, Mc Graw Hill, New York.

Knight, B. and Philip, A. (1979): *Estuarine and coastal Land reclamation and water storage*, Saxon House.

Laussn, E and Lato, I.(ed*): Chemistry and Biochemistry of estuaries*, Wiley, New York.

Pethick, J. (2000): *An Introduction to coastal Geomorphology*, Arnold, London.

Stanley, D.J. and Suist D.J.P.(ed)(1976): *Marine Sediment Transport and environmental management*;Wiley, NewYork.

Wagret,P. (1968*): Polderlands*, Methuen, London.

GEO303B.2: Coastal Environments:Focus on Indian Regions

Carter, R.W.G (1988): *Coastal Environments: An Introduction to the Physical, Ecological and Cultural Systems of Coastlines*, Academic Press, London

Dayer K.R. (1979): *Estuary Hydrography, and Sedimentation*, Cambridge Univ. Press, Cambridge.

Devis R.A. (ed) (1978): *Coastal Sedimentary Environmental*; Springer-Verlag, New York.

Harikawa , K. (1978): *Coastal Engineering*, Univ Of Tokyo Press, Tokyo.

Inman, D.L. (1960): *Shore Processes, Encyclopedia of Science & Technology*, Mc Graw Hill, New York.

Knight, B. and Philip, A. (1979): *Estuarine and coastal Land reclamation and water storage*, Saxon House.

Laussn, E and Lato, I.(ed*): Chemistry and Biochemistry of estuaries*, Wiley, New York.

Pethick, J. (2000): *An Introduction to coastal Geomorphology*, Arnold, London.

Stanley, D.J. and Suist D.J.P.(ed)(1976): *Marine Sediment Transport and environmental management*;Wiley, NewYork.

Wagret,P. (1968*): Polderlands*, Methuen, London.

303C

GEO303C.1: Foundation of Urban Geography

Carter, H. (2002): *Urban Geography*, 4th edition Arnold-Heinemann, New Delhi: 434p.

De Blij, H.J. and Muller, P.O. (1997): *Geography: Realms Regions and Concepts*, 8th edition, John Wiley and Sons Ltd., New York: 569p.

Dickinson, J., Gould, B., Clarke, C., Mather, S., Prothero, M., Siddle, D., Smith, C. and Thomas-Hope, E. (1996): *A Geography of the Third World*, 2nd edition, Routledge, London: 334p.

Dickinson, R.E. (1968): *City and Region: A Geographical Interpretation*, Routledge and Kegam Paul Ltd. London.

Ghosh, S. (1998): *Introduction to Settlement Geography*, Orient Longman Ltd., Calcutta: 158p.

Gore, Charles (1984). : *Region in question*, Routledge Publisher.

Hudson, F.S. (1970): *Geography of Settlements*, Macdonald and Evans Ltd., Plymouth:

Knox, P. (1982): *Urban Social Geography*, Longman Scientific and Technical, Harlow.

Pacione, M. (2007): *Urban Geography*, Routledge,

Ramachandran R. (1989): *Urbanisation and Urban Systems in India*, Oxford University Press, New Delhi.

Singh, R.L. (editor) (1971): *India: A Regional Geography*, National Geographical Society of India / UBS Pub. Distributors Ltd., New Delhi: 992p.

Singh, R.L. et. al. (ed) (1976): *Geographic Dimensions of Rural Settlements*, National Geographical Society of India, Varanasi.

Spate, O.H.K. and Learmonth, A. T.A. (1967): *India and Pakistan*, 3rd edition, Munshiram Monoharlal Pub. Pvt. Ltd., New Delhi: 877p.

Tewari, V. Weinston, J. and Prakash Rao, V.L.S. (1986): *Indian Cities: Ecological Perspectives*, Concept Pub. Co., New Delhi.

GEO303C.2: Contemporary Urban Issues

Ahuja,R (1999): *Social Problem in India*, Rawat, Jaypur
Carter, H. (1981): *Urban Geography*, 3rd edition Arnold-Heinemann, New Delhi: 434p.
Herbert, D. (1977): *Urban Geography- A social Perspectives*, David and charles, London
Herbert, D. and Johnston, R,J. (1979): *Geography and Urban Environment*, John wiley, New York
Kleniewski, N. (2005): *Cities and Society*, Blackwell,
Linder, C (2006): *Urban Space and Cityscapes*, Pergamon Press
Pacione, M. (2007): *Urban Geography*, Routledge,
Palen, J(1992): *The Urban World*, Mc Grow Hill, New York
Sovani, N.V. (1964): *The Analysis of Over Urbanization: Economic Development and Cultural Change*,
Macionis, J.J and Parrillo, V.N (2010): Cities and Urban life, Pearson Education, New Jersey

303D

GEO303D.1: Physical Basis of Remote Sensing

Campbell, J .B. (1996): *Introduction to Remote Sensing*, 2nd edition, Taylor & Francis, London; 622p.
Cracknelll, A.P., and L.W.B.Hayes, (1991): *Introduction to Remote Sensing*, Taylor and Francis, Washington, DC.
Curran, P.J. (1980*): Mulltispectral remote sensing of vegetation amount*, Progress in Physical Geography
Guha, P.K. (2003*): Remote Sensing for the Beginner*, Affiliated East-West Press Pvt. Ltd., New Delhi
Joseph, George, (2003): *Fundamental of Remote Sensing*, Orient Longman Pvt. Ltd.
Lillesand, T.M. and Kieffer, R.W. (2003): *Remote Sensing and Image Interpretation*, 5th Edition, Wiley, New York
Marcolongo, B. And Mantorani, F. (1997): *Remote Sensing Application in Earth Science*, Oxford and
Rajan, M.S. (1995): *Space Today*, 2nd edition, National Book Trust, New Delhi, 344p.
Sabins, F.F. (1997): *Remote Sensing: Principles and Applications*, 3rd edition, W.H. Freeman & Company, New York:

GEO303D.2: Photogrammetry, Aerial Photo and Satellite Systems

American Society of Photogrammetry (ASP), (1983): *Manual Of Remote Sensing*, second edition, ASP, Fallschurch, VA,
Chaisman, N. (1992): *Exploring Geographical Information Systems*, John Wiley and Sons Inc., New York: 198p.
Chrisman, N.R. (1997): *Exploring Geographic Information Systems*; John Wiley and Sons. (Inc).
John, R. J. (1998): *Introductory Digital Image Processing – A Remote Sensing Perspective*, Prentice Hall Series.
Lillesand, T.M. and Kieffer, R.W. (1979): *Remote Sensing and Image Interpretation*, 5th Edition, Wiley, New York
Martin, D. (1991): *Geographical Information Systems and their Socioeconomic Applications*. London, Routledge.
Robert A. Schowengerdt,(1997): *Techniques for Image Processing and Classification in Remote Sensing*, Academic Press.
Ulaby, F.T., Moore, R. K. and Fung, A.K. (1982): *Microwave Remote Sensing Active and Passive*, Volume II, Radar

C-GEO304 (*Elective/CBCS)*

C-GEO304.1: Emerging Issues and Policies on Environment

Maryk, Theodore (1996): *Major Environmental Issues Facing 21st Century*, Prentice Hall
Park, C. (1998): *The Environment: Principles and Applications*, Routledge, London:
Pickering, K. and Owen, L.A.(1997) : *An Introduction to Global Environmental Issues*, 2nd edition, Routledge, London.
Farmer, A. (1997): *Managing Environmental Pollution*, Routledge, London: 246p.
Roberts, N. (editor) (1994): *The Changing Global Environment*, 3rd edition, Blackwell Pub. Co., London: 531 p.

Kevin T. Pickering, Lewis A. (1997): *An Introduction to Global Environmental Issues* Rutledge, London
Edmond A. Mathez (2009): *Climate Change: The Science of Global Warming and Our Energy Future*, Columbia University Press,New York
Frances Drake, (2000): *Global Warming: The Science of Climate Change*:, Arnold Pub.
Harvey Danny(1999): *Global Warming*:, Pearson Education India
Mike Gonzalez, Marianella Yanes(2015): *The Last Drop-The Politics of Water*, Pluto Press,
Wendy Nelson Espeland (2015): *The Struggle for Water: Politics, Rationality, and Identity in the American Southeast*, University of Chicago Press
Paolo F. Ricci (auth.) (2006): *Environmental and Health Risk Assessment and Management: Principles and Practices*, Springer Netherlands
Marquita K. Hill (2010): *Understanding Environmental Pollution*, Cambridge University Press
Chris Barrow (2005): *Environmental Management and Development*. Routledge
Andrew E. Collins, Jones Samantha, Bernard Manyena, Janaka Jayawickrama, (2014): Hazards, *Risks, and Disasters in Society*, Elsevier
Fred Krüger, Greg Bankoff, Terry Cannon, Benedikt Orlowski, E. Lisa F. Schipper(2015): *Cultures and Disasters: Understanding Cultural Framings in Disaster Risk* Routledge
Peter Christoff, Robyn Eckersley: *Globalization and the Environment*, ,Rowman and Littlefield ,Newyork

C-GEO304.2: Environmental Hazards and Disaster Management

Alexander, D. (1993): *Natural Disasters*, Research Press, New Delhi: 619p.
Baarrsches, W.H. (1996): *Eco-facts and Eco-fiction: Understanding the Environmental Debate*, Routledge, London.
Chapman, D. (1994): *Natural Hazards*, Oxford University Press, Melbourne: 174p.
Dasgupta, P. and Mller, K.G. (1997): *The Environment and Emerging Development Issues*, Volumes I and 2, Clarendon
Elsom, D.M. (1992): *Atmospheric Pollution: A Global Problem*, 2nd edition, Blackwell Pub. Co., London: 422p.
Farmer, A. (1997): *Managing Environmental Pollution*, Routledge, London: 246p.
Hyndman, Donald and Hyndman, David. (2008): *Natural Hazards and Disasters*; Cengage Learning.
Keller, Edward A. and Blodgett,Robert H. (2007): *Natural Hazards: Earth's Processes As Hazards, Disasters and Catastrophes*; Pearson Prentice Hall.
Middleton N. (1995): *The Global Casino: An .Introduction to Environmental Issues*, John Wiley and Sons.
New Park, C. 1998: *The Environment: Principles and Applications*, Routledge, London:York: 332p.
Pickering, K. and Owen, L.A. (1997): *An Introduction to Global Environmental Issues*, 2nd edition, Routledge, London:
Roberts, N. (editor) (1994): *The Changing Global Environment*, 3rd edition, Blackwell Pub. Co., London: 531 p.
Smith, Keith and Petley, David N. (2009): *Environmental Hazards: Assessing Risk And Reducing Disaster*; Taylor & Francis.
Valancy, F. and Bronstein, D.A. (1995): *Environmental and Social .Impact Assessment*, John Wiley and Sons inc., New York: 325p.
Vogler, J. (1995): *The Global Commons: A Regime Analysis*, John Wiley and Sons Ltd., Chichester: 233p.

GEO395.1: Application of Remote Sensing In Geography

Allison, L.J., Schnapf, A.(1983): *Meteorological satellites*: In Colwell, R.N.(ed.) Manual of Remote Sensing (2nd edn).
Avery,T.E.,and G.L.Berlin, (1992): *Fundamental of remote sensing and air photo interpretation*,5th ed, Macmillan, New York,
Billingsley, F.C. (1983): *Data Processing and Reprocessing*: In Colwell, R.N.(ed.) Manual of Remote Sensing (2nd edn).
Bukata,R.P., et al., (1995): *Optical Properties And Remote Sensing Of Inland And Coastal Waters*, CRC press, New York,
Campbell, J .B. (1996): *Introduction to Remote Sensing*, 2nd edition, Taylor & Francis, London: 622p.
Canada Center for Remote Sensing, *Remote Sensing Tutorial*

Cracknelll, A.P., and L.W.B.Hayes, (1991): *Introduction to Remote Sensing*, Taylor and Francis, Washington.
Curran, P.J. (1980): *Mlltispectral remote sensing of vegetation amount*, Progress in Physical Geography
Curran, P.J. (1988): Principles of Remote Sensing, ELBS Edn. Longman Group UK Ltd.
Guha, P.K. (2003): *Remote Sensing for the Beginner*, Affiliated East-West Press Pvt. Ltd., New Delhi
Joseph, George, (2003): *Fundamental of Remote Sensing*, University Press (India) Pvt. Ltd, Orient Longman Pvt. Ltd., Hyderabad, India
Lillesand, T.M. and Kieffer, R.W., 2003. Remote Sensing and Image Interpretation, 5th Edition. Wiley, NY.
Marcolongo, B. And Mantorani, F. (1997): *Photogeology: Remote Sensing Application in Earth Science*, Oxford and IBH Pub. Pvt. Ltd., New Delhi: 195p.
Rajan, M.S. (1995): *Space today*, 2nd edition, National Book Trust, New Delhi, 344p.
Sabins, F.F., (1997): *Remote Sensing: Principles and Applications*, 3rd edition, W.H. Freeman & Company, New York: 494p.

GEO395.2: Research Methodology

Compton,R.R.(1985): *Geology in the Field*, John Wiley and Sons.
Gardiner,V. and Dacombe,R.(1983):*Geomorphological Field Mannual*,George Allen and Unwin, London
Ghosh,B.N.(1982): *Scientific Methods and Social Research* ,Starling Publishers Private Ltd. New Delhi.
Goudie, A.(1981): *Geomorphological Techniques*, George Allen and Unwin, London
Kothari,R.C(2004):*Research Methodology*,New Age International Publishers, New Delhi.
Mishra,H.N(1998): *Research Methodology in Geography*, Rawat Publication.
Ramachandran,P.(1971):*Training in Research Methodology in Social Sciences in India*, ICSSR, New Delhi
Shama,B.A.V. et al (1983): *Research Methods in Social Sciences*, Chaitanya Publishing House, Allahabad.
Sjoberg g. and Nett (2002*): Methodology of Social Research*, Rawat Publication
Wang, X and Vonhofe, R.A (200&): *Research Method in Urban and Regional Planning*, Springer
Young,P.V.(1960): *Scientific Social Surveys and Research;* 3rd Ed ,Prentice Hall, New York
Bordens, K,S and Abbott, B.B (2011): Research Design and Methods, Tata McGraw Hill Edition, New Delhi

GEO396.1: Field Works

Compton,R.R.(1985): *Geology in the Field*,John Wiley and Sons.
Gardiner,V. and Dacombe,R.(1983): *Geomorphological Field Manual*, George Allen and Unwin, London
Goudie, A.(1981): *Geomorphological Techniques*, George Allen and Unwin, London
Kothari,R.C(2004):*Research Methodology*,New Age International Publishers, New Delhi.
Mahmood, A (1977): *Statistical methods in Geographical studies*, Rajesh Pub. New Delhi
Mathur,S.M (2001): *Guide to Field Geology*, Prentice Hall, India
Mishra,H.N (1998): *Research Methodology in Geography*,Rawat Publication.
National Family Health Survey (NFHS-3) 2005-2006, Vol-I and II International Institute for population Science,Mumbai
Pal, S.K. (1999): *Statistics for Geoscientists*, Concept publishing Company, New Delhi: 423p.
Ramachandran, P.(1971):*Training in Research Methodology in Social Sciences in India*, ICSSR, New Delhi
Shama,B.A.V. et al (1983): *Research Methods in Social Sciences*, Chaitanya Publishing House, Allahabad

GEO396.2: Field Report

Goudie, A.(1981): *Geomorphological Techniques*, George Allen and Unwin, London
Mathur,S.M(2001): *Guide to Field Geology*, Prentice Hall, India
National Family Health Survey (NFHS-3) 2005-2006, Vol- I and II International Institute for population Science,Mumbai
Pal, S.K. (1999): *Statistics for Geoscientists*, Concept publishing Company, New Delhi: 423p.
Ramachandran, P.(1971):*Training in Research Methodology in Social Sciences in India*, ICSSR, New Delhi
Shama,B.A.V. et al (1983): *Research Methods in Social Sciences*, Chaitanya Publishing House, Allahabad.

Semester- IV (300 Marks)

THEORETICAL COURSES (200 Marks)

PAPER – GEO 401: GEOGRAPHICAL PHILOSOPHY

Full Marks: 50 Credit: 4

GEO 401.1: SCHOOLS IN GEOGRAPHICAL THOUGHT

Course Outcome:

The course incorporated the fundamental concepts of geographical thought. It includes the premier concepts of geography at the time of its emergence to the past century (20th century). Upon completion of this course, the students would have a comprehensive idea of the fundamental nature of Geography and how it evolves with time.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. The Field of Geography, Place of Geography in classification of knowledge and other disciplines, Geography as a social science, Physical and Human Geography. Linkages among the sub-disciplines of physical and human geography.
2. Development of Geography in 19th Century: Contribution of German, French, British and American schools of thought.
3. Conceptual and methodological development in 20th Century: changing paradigms, evolution of man-nature relation.
4. Typology of models and uses: structure component and characters.
5. Dualism and dichotomies in Geography: Determinism and Possibilism, Systematic and Regional, Aerial differentiation and Spatial organization.

GEO 401.2: CONTEMPORARY DISCOURSES IN GEOGRAPHY

Course Outcome:

Students will learn about the philosophical background that guides the approaches and ways of thinking to design teaching-learning and research under different discourses of Geography. It aims to achieve a clear insight into theoretical foundation of the subject that is articulated among different courses and guides to design objectives and methodological framework of geographical enquiry. This understanding helps the learners to locate themselves in the wide and dynamic philosophical domain of the discipline and help them to concentrate towards developing geography as a science of holistic synthesis.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4***

marks *(without division), will be set for answering any two.* ***Group- C*** *(Short Answer Type): Four questions, each of* ***2 marks*** *(without division), will be set for answering any two.*

1. Pragmatism, Positivism and Quantitative revolution in geography
2. Development of critical social theories: Humanistic geography, Behaviouralism, Radicalism, Welfare geography, Feminist geography
3. Structuralism and Post-structuralism, Modernism and Postmodernism.
4. Concept of space: absolute, relative, material and social space, concept of 3rd space in geography, temporal geography, time-space prism
5. Recent trends in geography.

PAPER - GEO 402: POLITICAL GEOGRAPHY AND GLOBALIZATON

Full Marks: 50 Credit: 4

GEO 402.1: POLITICAL GEOGRAPHY

Course Outcome:

Students will develop their understanding on politics of space and spatial patterns of political and economic power distribution. This course will enable the of Government in India based on the principle of regional disparities in India. They will also know about the nature of conflict at national and global level centered on water and power resources. They will develop their interest in analyzing factors and local as well as global implications of economic and political agglomerations in the form of economic and political blocs.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
Pattern of setting questions: ***Group- A*** *(Long Answer Type): Two questions, each of* ***8 marks*** *(without division), will be set for answering any one.* ***Group- B*** *(Semi-long Answer Type): Four questions, each of* ***4 marks*** *(without division), will be set for answering any two.* ***Group- C*** *(Short Answer Type): Four questions, each of* ***2 marks*** *(without division), will be set for answering any two.*

1. Politics and Geography: Politics of Space, Scope of electoral geography, Global strategic views- Heartland and Rimland theories and their significance in present international politics.
2. Geopolitical significance of core-periphery theory; Nationalism and Regionalism.
3. Geography and federalism; Reorganization of Indian states since independence, Partition of India and its consequences
4. International and interstate water disputes in India.
5. Political and economic blocs; Geopolitics in the context of globalization, colonialism and post colonialism.

GEO 402.2: GEOGRAPHY OF GLOBALIZATION

Course Outcome:

Course objectives and expected outcome: This course is focused on the fundamental concepts of globalization and its overall impacts on agriculture, industry, trade and culture. It also focused on the issues and challenges of globalization faced by the

countries across the world. The students get a leading idea about the globalization and its consequences upon completion of this course.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Transformed Geography: Concept of Liberalization, Privatization and Globalization (LPG), beginning of the globalization, globalization to glocalilisation.
2. Globalization and Economic Geography: Impact of globalization on agriculture, industry and trade.
3. World economic order: Economic booms and crisis.
4. Globalization and cultural changes: Globalization and cultural transformations.
5. Future of globalization and global challenges: Issues and recent trends.

PAPER – GEO 403: SOCIETY AND REGIONAL PLANNING

Full Marks: 50 Credit: 4

GEO 403.1: SOCIAL AND CULTURAL GEOGRAPHY

Course Outcome:

The paper is based on the nature, scope and content of social and cultural Geography. The paper will examine the role of social divisions such as class, 'race'/ethnicity, gender and sexuality in shaping the social geographies of regions. Emphasis is given on cross-disciplinary, critical engagement with current events. On completion of the course, students are able to Understand the nature, scope, and concept, relationship between culture and social environment, and right of information act, the cultural complex and traits of culture and its concepts, evolution to civilization and cultural system according to religion, language and geography, and global cultural changes.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Nature, scope and content of social Geography; Ethnicity, tribe, dialect, language, caste and religion.
2. Social structure and processes, social exclusion, geographies of social well-being with special reference to India.
3. Cultural Geography: Definition, scope and nature. Race, religion, language as cultural attributes with special reference to India, North-South, social -cultural divide.
4. World cultural Realms, Morphology of cultural landscape (Carl O Sauer) and cultural diversity. Cities as melting pot of culture. Traditional folk culture- crisis and transformation

5. Cultural processes: Diffusion, acculturation, assimilation and cultural pluralism

GEO 403.2: REGIONAL PLANNING

Course Outcome:

The learners will be able to know the process of planning in India, its role and various strategy for the development of our country. The students will understand how they can participate in the planning and development of the nation. This knowledge is very effective for the government also for smooth conduction of the development planning.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Concept of planning: Levels of planning: Types of planning
2. Basic principles and methodology of regional planning
3. Regional planning strategies: Centralized, decentralized and multilevel planning for rural and urban areas, people's participation in planning- Panchayati Raj Institution.
4. Regional disparities: Concept, Types; Demographic, social and economic disparities in India.
5. Planning of problem regions: Tribal, coastal, drought prone area, flood prone area.

PAPER – GEO 404: SPECIAL PAPERS

Full Marks: 50 Credit: 4

404A: ADVANCED GEOMORPHOLOGY

GEO 404A.1: ADVANCED GEOMORPHIC TECHNIQUES

Course Outcome:

Students will learn about the empirical methods to estimate various geomorphic attributes by using field instruments or through models run by sophisticated software. This will offer them training on data generation, computation and analysis. This course aims to enable learners deal with real world problems using advanced technology recently available to the department from DST-FIST programme, Department of Science and Technology, Govt. of India.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Modeling concepts and approaches in geomorphology; Data sources and Freeware models; Dating procedures and uses.
2. Estimating flow velocities, discharge and stage.; Estimation of stream hydraulic parameters (Critical flow, Froude number, Reynolds number). Inundation estimates.
3. Manning equation: Required data, data measurements, and limitations; Tractive force and stream power estimation.
4. Sediment transport and sediment discharge estimates: Bed load and suspended load
5. Watershed delineation, preparation of DEM; micro-landscape analysis (landscape unit map) using GIS (Case study on a badland area)

GEO 404A.2: APPLIED GEOMORPHOLOGY

Course Outcome:

Students will learn how to apply theoretical knowledge of geomorphology in wide range of engineering and management problems ranging from drainage basin management to hazard management. They are trained to apply geomorphic understanding on water management, landuse planning, sewage and solid waste management. They are also trained on their contribution in EIA and EMP. This course aims in revival of the applied value of the discipline.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Applied Geomorphology in River Basin Management (Case study on Shilabati/ Kangsabati/ Subarnarekha Basin)
2. Applied Geomorphology in Hazard Management: Flood, Coastal and River Bank Erosion, Soil Piping, Soil Erosion (Case study on Shilaboti flood/ Old Digha Erosion/ Bhagirathi erosion, Western Ghat)
3. Geomorphology in dam site selection and impact assessment: (Case Study on Farakka)
4. Geomorphology in urban management: Landuse planning, Sewage treatment, Storm-water management, Ground water recharge and discharge (Case study on Kolkata)
5. Geomorphology in EIA and EMP (Case study on Nayachar/ Singur/Salboni)

404B: COASTAL MANAGEMENT

GEO 404B.1: COASTAL ECOLOGY AND HAZARDS

Course Outcome:

Students will understand the ecological importance of coast as an important habitat between terrestrial and marine system. They will also develop their deep insight into the significance and techniques of coastal study in the context of increasing hazards forced

by global climatic change. They will be exposed to the information on the future scope of coastal studies in India.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Study and management of- Sea weeds; seaweed ecosystem, artificial seaweeds.
2. Dune vegetation: Dune initiating and dune building types, adaptation and reproduction, plant-animal interaction in sand dune. Mangroves: physical environment and ecology.
3. Coastal hazards and their management: Sea level change- long and short term changes, regional and global effects on shore; Coastal erosion- causes and effects; Storm hazard- role in sediment transfer, effects on open and estuarine coast, management of storm hazard.
4. Techniques of monitoring coastal processes and land forms.
5. Coastal studies in India: Monitoring and research.

GEO 404B.2: COASTAL ISSUES AND MANAGEMENT

Course Outcome:

Students will understand about the complexities of emerging coastal issues and their better management techniques. They will get employment opportunities as research scientist in the various institutes like INCOIS, MOEF, DST, NIO, NCSCM, Dept. of Earth Sciences and TOURISIM Department etc.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Coral bleaching: Impact of Global warming, coastal eutrophication and habitat conservation (Coastal lagoons, other coastal wetlands)
2. Coastal tourism and environment conflicts (Beaches and barrier coasts, mangrove dominated coasts, coral coasts, environmental regulations).
3. Application of remote sensing and GIS techniques in coastal management (Geomorphological mapping, coastal cell circulation systems, environmental zoning approach, identification and diversity of coastal habitats)
4. Managing coastal change: Assessment of coastal vulnerability, ecosystem valuation of coast, integrated coastal zone management, coastal regulations); Coastal engineering: Developments in hard structure designs, developments in soft structure designs, new dredging techniques and procedures.
5. Coastal urbanization and population pressures, Coastal resource management.

404C: URBAN GEOGRAPHY AND REGIONAL PLANNING

GEO 404C.1: THEORETICAL BASES OF REGIONAL PLANNING

Course Outcome:

This paper will provide knowledge on spatial analysis of functions of urban areas. Social and economic characteristics of cities and suburbs will be discussed under this paper. Urban land use and its impact on environment and ecology will be addressed. This paper will introduce students to the basics of urban geography, such as definition of cities, central place theory, National urban systems, and traditional models of urban spatial structure. More importantly, students will be exposed to contemporary urban topics such as global cities, urban sprawling, urban green space, urban ecology and footprints etc. Emphasis will be placed on the urban experience of developing countries, especially India.The students will be able to assemble knowledge of urbanism and urbanization as historic, geographic, social, and cultural processes, historical development, contemporary condition, and environmental impact of cities and urban related issues growing from exposure to the disciplines of Geography and Planning

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. History of regional planning in India, theories of regional planning. Concept of balanced and unbalanced growth
2. Regional development perspectives: Colonial period (Dependency theories- Friedman, Andre Gander Frank, David Slater)
3. Growth Pole theories and the developing world by Perroux, Myrdal, Hirschman, and Boudiville.
4. Agropolitan Development, Basic need approach (E.A.J Johnson, Dennis Rondinelli-USAID)
5. Regional Environmental issues in Purba and Paschim Medinipur Districts- Flood, Drought, coastal erosion, Salinization, Deprivation and related social conflicts, conflict in forest society interface.

GEO 404C.2: PLANNING FOR URBAN DEVELOPMENT

Course Outcome:

Students will understand the urban planning process in various issues like sanitation, transport, housing, water supply etc and various policies of the govt. The knowledge about the remote sensing and GIS is also important for urban planning. The students will be able to participate in various works relating to urban planning.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Concept of developed and underdeveloped economy, Intra- and Inter-regional planning. Policies of Urban planning and development.
2. Urban infrastructure planning: Sanitation and Water supply systems, Waste Water disposal systems, Solid waste collection and disposal.
3. Urban traffic and transportation planning.
4. Planning for Urban housing: concepts of land use and land valuation, Needs and types of housing; Housing Policy and programmes in India; Real estate development.
5. Application of Remote Sensing and GIS in urban planning and management.

404D: REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM

GEO 404D.1: ADVANCED REMOTE SENSING

Course Outcome:

This core content of this course is focused on some advanced ideas of microwave and hyperspectral remote sensing including image-based statistics for digital image processing. The course is also focused on some of the advanced ideas of GIS including remote sensing and GIS integration. It includes the application of GIS and remote sensing in various purposes. Upon completion of this course, students would be benefited from these advanced level of applications, and allow them to pursue their future career in GI Science.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Thermal Remote Sensing: Concept, Sensors and Utility.
2. Microwave Remote Sensing:Concept, Comparison with optical system, advantages and disadvantages, spatial resolution, Real and Synthetic Aperture Radar, Passive Microwave Remote Sensing, Lidar.
3. Hyperspectral Remote Sensing: Concept, Sensors and utility.
4. Visual Image Processing& Digital image interpretation: Elements of Visual image interpretation, generation of thematic maps, information extraction.
5. Digital Image Processing: Pre-processing, Image Registration, Image geometric operations, Enhancement, Spatial filtering, Transformation, classification, data compression, spectral pattern recognition, output generation.

GEO 404D.2: ADVANCED GIS AND APPLICATIONS OF REMOTE SENSING

Course Outcome:

This core content of this course is focused on some advanced ideas of microwave and hyperspectral remote sensing including image-based statistics for digital image processing. The course is also focused on some of the advanced ideas of GIS including remote sensing and GIS integration. It includes the application of GIS and remote sensing

in various purposes. Upon completion of this course, students would be benefited from these advanced levels of applications allow them to pursue their future career in GI Science.

Full Marks- 25 (End term Examination- 20 and Internal Assessment- 5)
*Pattern of setting questions: **Group- A** (Long Answer Type): Two questions, each of **8 marks** (without division), will be set for answering any one. **Group- B** (Semi-long Answer Type): Four questions, each of **4 marks** (without division), will be set for answering any two. **Group- C** (Short Answer Type): Four questions, each of **2 marks** (without division), will be set for answering any two.*

1. Advanced GIS: Spatial data model, Data entry, data analysis, Data models. Data sources, Data captures, attribute data management and Meta data concept.
2. Data Infrastructure: Spatial Data Infrastructure: NSDI.
3. Modern trend in GIS: Local to Global concept in GIS, Integration of GIS and Multimedia, 3D GIS and Web GIS, Real time GIS, Mobile GIS, Collaborative GIS, concept and application of GPS and GNSS.
4. Integration of Remote sensing and GIS: Concept and importance of Remote Sensing and GIS integration in Geographical studies.
5. Applications of Remote Sensing and GIS: Landuse/land covers mapping, soil and agricultural mapping, geomorphological mapping, watershed mapping.

PRACTICAL COURSES (100 Marks)

PAPER – GEO 495: GEODESY AND GIS

Full Marks: 50 Credit: 4

Course Outcome:

The course is designed for providing the fundamental ideas of Geodesy and map projection. It includes some advance projective transformation from 3D to 2D surface. The course also includes the fundamentals of GI science and its application. The students get an exposure to the theoretical and practical understanding upon completion of this course.

GEO 495.1: MAP TRANSFORMATION AND GEODESY

Full Marks- 25
*Pattern of Setting Questions: **Three** compulsory questions bearing marks **7, 7 and 6** respectively, will be set covering the whole unit. **5** marks will be allotted for Laboratory Note Book and Viva-voce.*

1. Map transformation: Scale factor; distortion types; systems of map projections; principles of choosing map projection; importance of map projection in GIS.
2. Principle, construction, properties and uses of following map projections:

   a) Conformal Projections- Mercator's Projection; Transverse Mercator Projection and Lambert's Conformal Conic (LCC) Projection.
3. Principle, construction, properties and uses of following map projections

   b) Equal Area Projection- Mollweide's Projection.

c) Conical Projection- Simple Conical Projection with Two Standard Parallels.

4. Geodesy: Scope and application; concept of Geoid, reference ellipsoid and spheroid- WGS 84, Everest Spheroid.
5. Coordinate Systems: Cartesian, Rectangular, Spherical, Curvilinear, Spherical, UTM Grid System.

GEO 495. 2: GEOGRAPHIC INFORMATION SYSTEM

Full Marks- 25
*Pattern of Setting Questions: **Three** compulsory questions bearing marks **7, 7 and 6** respectively, will be set covering the whole unit. **5** marks will be allotted for Laboratory Note Book and Viva-voce.*

1. Basic Concepts and components in GIS: An overview of the development of the GIS fields, Data Sources; Data acquisition methods
2. Data structure: Vector and Raster data structures, data storage.
3. Modern trends in GIS: 3D GIS and Web GIS, Real time GIS, Mobile GIS and application of GIS
4. Basics of GPS Surveying: Conceptual Framework, Space Segment, Ground Segment, Control Segment, Satellite Triangulation, Pseudo Random Code. DGPS and GNSS
5. GPS-aided traversing; Manual and Computer plotting for preparation of maps.

PAPER - GEO 496: SPATIAL ANALYSIS AND PROTOTYPE RESEARCH

Full Marks: 50 Credit: 4

GEO 496. 1: SPATIAL ANALYSIS IN GEOGRAPHY

Course Outcome:

The focus of this course is to give a comprehensive understanding of the spatial organization through mathematical and statistical analysis. Upon completion of this course, the students get an inclusive knowledge and skills to perform spatial analysis at different spatial scale.

Full Marks- 25
*Pattern of Setting Questions: **Three** compulsory questions bearing marks **7, 7 and 6** respectively, will be set covering the whole unit. **5** marks will be allotted for Laboratory Note Book and Viva-voce.*

1. Transport network analysis: Centrality Indices, Shortest path analysis(Transport and allocation problems), Detour and spread.
2. Distance Matrix (Aggregate Travel Distance).
3. Point spatial distribution analysis: Uniformity, randomness and compactness.
4. Analysis of Directional Data; Rose diagram, Dominant Direction, Mean direction.
5. Analysis of Shape: Measures based on axial ratios, perimeters to areas, areas to axial length.

GEO 496. 2: RESEARCH EXERCISE IN GEOGRAPHY

Full Marks- 25 (Evaluation of written report-10 and Viva-voce based on Power point presentation- 15)

Field work on a specific environmental issue and generation of report (within about 50 A4 size pages including 15-20 maps/diagrams/field photographs).

SUGGESTED REFERENCES

GEO401.1: Schools in Geographical Thought

Adhikari, S. (1992): *Geographical Thought*, Chaitanya Pub. House, Allahabad: 272p.

Chorley, R.J. and Hagget, P. (editors) (1965): *Frontiers in Geographical Teaching*, OUP, Oxford: 231p.Delhi: 195p.

Dikshit, R.D. (edt.) (1994): *The Art and Science of Geography: Selected Readings*, Prentice Hall India Ltd., New

Dunbar, G.S. (edt.) (1991): *Modern Geography: An Encyclopaedic Survey*, St. James Press, Chicago: 219p.

Gregory D. and Walford, R. (editors) (1988): *Horizons in Human Geography*, Macmillan, London: 390p.

Hussain, M. (1995): *Evolution of Geographical thought*, 3rd edition, Rawat Pub. Co., New Delhi: 432p.

Messy, D. and Allen, J. (editors) (1984): *Geography Matters: A Reader*, Cambridge University Press, Cambridge: 204p.

Stoddart, D.R. (1986): *On Geography and its History*, Basil Blackwell, Oxford: 236p.

GEO401.2: Contemporary Discourses in Geography

Adhikari, S. (1992): *Geographical Thought*, Chaitanya Pub. House, Allahabad: 272p.

Bird .J.(1989): *Changing Worlds of Geography: A Critical Guide to Concepts and Methods*, Oxford University Press

Chorley, R.J. and Hagget, P. (editors) (1965): *Frontiers in Geographical Teaching*, OUP, Oxford: 231p.Delhi

Dikshit, R.D. (editor) (1994): *The Art and Science of Geography: Selected Readings*, Prentice Hall India Ltd., New Delhi.

Dunbar, G.S. (editor) (1991): *Modern Geography: An Encyclopedi Survey*, St. James Press, Chicago: 219p.

Gregory D. and Walford, R. (editors) (1988): *Horizons in Human Geography*, Macmillan, London: 390p.

Hussain, M. (1995): *Evolution of Geographical thought*, 3rd edition, Rawat Pub. Co., New Delhi: 432p.

Johnston, R..J (1997): *Geography and Geographer: Anglo American Human Geography*, Arnold pub.

Johnston, R. J. (ed.) (2006): *Dictionary of Human Geography*, Blackwell.

Messy, D. and Allen, J. (editors) (1984): *Geography Matters: A Reader*, Cambridge University Press, Cambridge: 204p.

Stoddart, D.R. (1986): *On Geography and its History*, Basil Blackwell, Oxford: 236p.

GEO402.1: Political Geography

Adhirari, S. (2004): *Political Geography*, Rawat Pub. Jaipur.

Alexander, L.M.(1963): *The World Political Pattern*, Rand Mcnally, Chicago.

Alland, A. (1972*): The Human Imperatives*, Atheneum, New York.

Bergman, E. (1975): *Modern Political Geography*, WMC Brown Co. Pub. Iowa.

Dikshit R. D. (1975): *Political Geography, - A contemporary perspective*, Tata McGraw Hill Pub. Company, New Delhi

Dwivedi, R.L.(1990): *Fundamental of political Geography*, Chaitanya publising House, Allahabad.

Goblet, Y.M. (1955): *Political Geography and the World Map*, George Philip and sons Ltd.

Hartshorne,T.A and Alexander ,J.W. (1988): *Economic Geography* (3rd Edition), Prentice Hall of India Pvt. Ltd.

Jackson, WAD (1964): *Politics and Geographic Relationship*, PrenticeHall.

Taylor, P.J.(1985): *Political Geography, World Economy, Nation, State & Locality*, Longman, Landon.

Weigest, H. (1957): *Principles of Political Geography*, Appleton century, Crasts Inc. New york.

GEO402.2: Geography of Globalization

Appaduria, A. (2001): *Globalization*, Duke University Press
Cofman, E and Youngs, G (1996): *Globalization: Theory and Practice*, Continum International Publishing Group.
Dasgupta, Biplab (2005): *Globalization- India's Adjustment Experience*; SAGE, New Delhi.
Haggett, P. (2001): *Geography: A Global synthesis*, Prentice Hall
Mackinnon, D. and Cumbess, A. (2007): *An Introduction to Economic Geography: Globalization, Uneven development and ……*, Prentice Hall
Mc Cann(Eds)(2004):*From Local to the Global*, Rawat Publishers
Tomlinson, J (1999): *Globalization and Culture*, Cambridge Polity presss
Vertova, G. (2006): *The changing economic geography of Globalization*, Routledge
W.Murray (2006): *Geographies of Development*, Routhledge Publication
Youngs, G. (2001): *Globalization, Communication and Technology*, Cambridge.
Goldin, I and Reinert, K (2012) : Globalization for Development, Oxford University Press, New York
Potter, R.B and Binns, Tony (Eds) (2001); Globalization and Development, Pearson Education Limited, Harlow

GEO403.1: Social and Cultural Geography

Bist,B.S.and Panth,V.K(1998): *Backward Communities in India*, Rawat Pub.
Harvey,G.(2006): *Readings in Indigenous Religion* ,Rawat Pub.
Hichcock,S.(2006): *Geography of Religion*, Rawat Pub.
Knox,Paul.L.(1975): *Social Wellbeing: Human Spatial Perspectives*, Oxford University Press.
Mahanti.M (ed)(1994): *Class, Caste and Gender- Tribal Issues in India*, Sage Pub.
Sahu, C.(2006): *Encyclopedia of Indian tribes*
Tiwari, S.K.(1998): *Antiquity of Indian Tribes*.ISBN-81-7625-016-3.
Smith, S.J and Pain,R (Eds) (2010): Social Geographies, Sage, Los Angles
Perry, A.J and Perry, E.K (2010) : Contemporary Society: An Introduction to Social Science, Pearson Education, Noida, India
Guha-Banerje, S. (2001): *Space, society and geography*, Rawat Publication, Jaipur.
Norton, W (2006): *Cultural Geography: Environments, Landscape, Identities and Inequities*, Oxford University Press, Oxford.
Carter, J. And Jones, T. (1989):*S ocial Geography: An Introduction to Contemporary Issues* , Edward Arnold, London
De Blij H.J. (1996): *Human Geography: Culture, Society and Space*, John Wiley and Sons Inc., New York: 531 p.
Norton, W (2006): *Cultural Geography: Environments, Landscape, Identities and Inequities*, Oxford University Press, Oxford.
Mitchell, D. (2000): *Cultural Geography: A Critical Introduction*, Wiley
Mike,C. (2000): *Cultural Geography*, Routledge, London
Hussain, M. (2005): *Cultural Geography*, Anmol Publication, New Delhi
Alison,B et.al (2003): *Cultural Geography in practice*, Arnold, New Delhi
Singh, G.N and Nath, Kashi (2004): *Cultural Geography-Form and Process*, Concept Publication, New Delhi
Jackson, A.K and et.al (2005): *Cultural Geography: A critical dictionary of key concepts*, Tauris, London

GEO403.2: Regional Planning

Bhat, L.S. (1973): *Regional Planning in India*, Statistical Pub. Society.
Chand, M. and Puri, V.K. (1988): *Regional Planning in India*, Vikas, New Delhi
Chandana, R.C. (2000): *Regional Planning and Development*, Kalyani Publishers
Glasson, J. (1974): *An Introduction to Regional Planning*, Hutchinson, London
Greed, C (2000): *Introducing Planning*, Athlone Press, London
Hall, P. (174): *Urban and Regional Planning*, Penguin, London
Mishra, R.P. (1969): *Regional Planning, Concept, Techniques, Policies*, The University of Mysore Press.
Mitra, A. (1971): *Levels of Regional Development India*, Census of India

Roy,G.L and Mondal, S. (1993): *Gram Panchayat Organization: Effective Management for Rural Development*
Sanyal, B. M (2001): *Decentralized Planning- Themes and Issues*, Concept.
Tim, Hall (2006): *Urban Geography*, Routledge.

GEO404A.1: Advanced Geomorphic Techniques

Anderson Robert S. and Anderson Suzanne P., 2010 Geomorphology (1st Edition, Kindle Edition) by , Cambridge University Press.
Anderson, M.G. (1988) Modelling Geomorphological Systems, John Wiley & Sons, New York
Chorley R.J. (Ed.) (1972) Spatial Analysis in Geomorphology., Methuen & Co., London.
Coates, D.R. and Vitek, J.D. (1980) (eds), Thresholds in Geomorphology, George Allen & Unwin, London.
Goudie, A.G. et al. (1990) (eds) Geomorphological Techniques, Unwin, Hyman, London.
Knighton, D. (1990) Fluvial Forms and Processes, Hodder Education, UK.
Maiti, R.K. (2016) Modern Approaches to Fluvial Geomorphology, Primus Books.
Maity S.K. and Maiti, R.K. (2018) Sedimentation in the Rupnarayan River, Vol 1, Hydrodynamic Processes under Tidal System, Springer.
Maity S.K. and Maiti, R.K. (2018) Sedimentation in the Rupnarayan River, Vol 2, Estuarine Environment of Deposition, Springer.
Morisawa, M. (1985) Rivers, Longman, London.
Selby, R.C. (1976), An Introduction to Sedimentology, Academic Press, London.

GEO404A.2: Applied Geomorphology

Anderson Robert S. and Anderson Suzanne P., 2010 Geomorphology (1st Edition, Kindle Edition) by , Cambridge University Press.
Anderson, M.G. (1988) Modelling Geomorphological Systems, John Wiley & Sons, New York
Brierley, G.J. & Fryirs, K.A. (2005): Geomorphology and River Management, Blackwell Publishing, Oxford, UK.
Chorley R.J. (Ed.) (1972) Spatial Analysis in Geomorphology., Methuen & Co., London.
Chorley R.J. (Ed.) (1972) Spatial Analysis in Geomorphology., Methuen & Co., London.
Coates, D.R. and Vitek, J.D. (1980) (eds), Thresholds in Geomorphology, George Allen & Unwin, London.
Cook, R.U. & Doornkamp, J.C. (1974): Geomorphology in Environmental Management, an Introduction. Clarendon Press. Oxford. .
Goudie, A.G. et al. (1990) (eds) Geomorphological Techniques, Unwin, Hyman, London.
Hart, M.G. (1986): Geomorphology Pure and Applied, George Allen and Unwin, London.
Knighton, D. (1990) Fluvial Forms and Processes, Hodder Education, UK.
Lee, N. and George, C. (eds.)(2000), Environmental assessment in developing and transitional countries. John Wiley & Sons Ltd.
Maiti, R.K. (2016) Modern Approaches to Fluvial Geomorphology, Primus Books.
Maity S.K. and Maiti, R.K. (2018) Sedimentation in the Rupnarayan River, Vol 1, Hydrodynamic Processes under Tidal System, Springer.
Maity S.K. and Maiti, R.K. (2018) Sedimentation in the Rupnarayan River, Vol 2, Estuarine Environment of Deposition, Springer.
Morisawa, M. (1985) Rivers, Longman, London.
Paul A. () Coastal Geomorphology---------- acb Publication, Kolkata.
Selby, R.C. (1976), An Introduction to Sedimentology, Academic Press, London.
Shit, P.K. and Maiti, R.K. (2012), Rill Gully Erosion in Badland Topography – Field Measurement and Monitoring (A case study on western part of West Bengal, India), LAMBERT Academic Publication, Germany
Shit, P.K. and Maiti, R.K. (2013), Management techniques of Rill-Gully Erossion in Badland Topography (Experimental Research at Laboratory, Plot and Catchments Scale), LAMBERT Academic Publication, Germany

GEO404B.1: Coastal Ecology and Hazards

Bird, E.C.F. (2000): *An Introduction to Coastal Geomorphology*, John Wiley and Sons Ltd. New York: 340 P.

Carter, R.W.G (1988): *Coastal Environments: An Introduction to the Physical, Ecological and Cultural Systems of Coastlines*, Academic Press, London

Inman, D.L. (1960): *Shore Processes, Encyclopedia of Science & Technology*, Mc Graw Hill, New York.

Komar, P.D. (1996): *Beach Processes and Sedimentation*, Prentice Hall.

Laussn, E and Lato, I.(ed): *Chemistry and Biochemistry of estuaries*, Wiley, New York.

Paul, A.K. (2002): *Coastal Geomorphology and Environment*, ACB Publication.

GEO404B.2: Coastal Issues and Management

Allen, J.R.L (1970): *Physical Processes of Sedimentation*, Jorge Allen & Unwin, London

Bird, E.C.F. (1985): *Coastline Changes*, Wiley.

Carter, R.W.G (1988): *Coastal Environments: An Introduction to the Physical, Ecological and Cultural Systems of Coastlines*, Academic Press, London

Dayer K.R. (1979): *Estuary Hydrography, and sedimentation, Cambridge Univ. Press, Cambridge*.

Devis R.A. (ed) (1978): *Coastal Sedimentary Environment*, Springer Verlag, New York.

Fitzerled and Davis Jr. (2002): *Beaches and Coasts*.

Harikawa , K. (1978): *Coastal Engineering*, Univ of Tokyo Press, Tokyo.

Hsasleff, S.K. (2000): *Coastal Systems*, Routledge.

Inman, D.l. (1960): *Shore Processes, Encyclopedia of Science & Technology*, Mc Graw Hill, New York.

Ivan, V. (2006): *Global Coastal Change*, Blackwell.

Kay,R. and Alden, J.(1999): *Coastal Planning and Management*, E and FN Spon, London

Komar, P.D. (1996): *Beach Processes and Sedimentation*. Prentice Hall.

Laussn, E and Lato, I.(ed): *Chemistry and Biochemistry of estuaries*, Uniley, New York.

Paul, A.K. (2002): *Coastal Geomorphology and Environment*, ACB Publication.

Paul, A.K. (2005): *Tsunami- An Assessment of Disaster in Indian Ocean Nations*, ACB Publication.

Pethick, J.(2000): *An Introduction to coastal Geomorphology*, Arnold, London.

Schwartz, M.L (2005): *Encyclopedia of Coastal Science*, Springer.

Stanley, D.J. and Suist D.J.P.(ed)(1976): *Marine Sediment Transport and environmental management*, Wiley, New York.

Woodroffe, C. D. (2002): *The Coast- Form, Process and Development*, Cambridge University Press.

GEO404C.1: Theoretical Bases of Regional Planning

Bhat, L.S. (1973): *Regional Planning in India*, Statistical Pub. Society.

Chand, M. and Puri, V.K. (1988): *Regional Planning in India*, Vikas, New Delhi

Chandana, R.C. (2000): *Regional Planning and Development*, Kalyani Publishers

Glasson, J. (1974): *An Introduction to Regional Planning*, Hutchinson, London

Greed, C (2000): *Introducing Planning*, Athlone Press, London

Hall, P. (174): *Urban and Regional Planning*, Penguin, London

Mishra, R.P. (1969): *Regional Planning, Concept, Techniques, Policies,* The University of Mysore Press.

Mitra, A. (1971): *Levels of Regional Development India*, Census of India

Roy,G.L and Mondal, S. (1993): *Gram Panchayat Organization: Effective Management for Rural Development*

Sanyal, B. M (2001): *Decentralized Planning- Themes and Issues*, Concept.

Tim, Hall (2006): *Urban Geography*, Routledge.

GEO404C.2: Planning For Urban Development

Bhat, L.S. (1973): *Regional Planning in India*, Statistical Pub. Society.

Chand, M. and Puri, V.K. (1988): *Regional Planning in India*, Vikas, New Delhi

Glasson, J. (1974): *An Introduction to Regional Planning*, Hutchinson, London

Hall, P. (174): *Urban and Regional Planning*, Penguin, London

Mishra, R.P. (1969): *Regional Planning, Concept, Techniques, Policies,* The University of Mysore Press.

Mitra, A. (1971): *Levels of Regional Development India*, Census of India.

Tim, Hall (2006): *Urban Geography*, Routledge.

Faira Arthur B. Gallion (2003).The Urban pattern: City planning and Design, CBS Publication
Rao,P. (2009). Urban Planning: Theory and Practice, CBS Publication
Hiraskar,G.K. (2012). Fundamentals of Town Planning. Dhanpat Rai Publication
Das Amiya Kumar (2007). Urban Planning in India. Rawat
Catanese (2014). Urban Planning. McGrow Hill
KulshresthaS.K. (2012). Urban and regional Planning in India: A handbook for Professional Practice. Sage Publication
Jane Jacob (1992). The Death and Life of Great American Cities. Vintage Publication

GEO404D.1: Advanced Remote Sensing

Campbell, J .B. (1996): *Introduction to Remote Sensing*, 2nd edition, Taylor & Francis, London: 622p.
Cracknelll, A.P. and Hayes, L.W.B. (1991): *Introduction to Remote Sensing*, Taylor and Francis, Washington.
Curran, P.J. (1980): *Multispectral Remote Sensing of Vegetation Amount*, Progress in Physical Geography
Curran, P.J. (1988): *Principles of Remote Sensing*, ELBS Edn. Longman Group Ltd. UK
Guha, P.K. (2003*): Remote Sensing for the Beginne*r, Affiliated East-West Press Pvt. Ltd., New Delhi
Joseph,, George (2003*): Fundamental of Remote Sensing*, University Press (India) Pvt. Ltd,
Lillesand, T.M. and Kieffer, R.W. (2003): *Remote Sensing and Image Interpretation*, 5th Edition., Wiley, NY.
Marcolongo, B. and Mantorani, F. (1997): *Photogeology: Remote Sensing Application in Earth Science*, Oxford
Rajan, M.S. (1995): *Space today*, 2nd edition, National Book Trust, New Delhi, 344p.
Sabins, F.F. (1997): *Remote Sensing: Principles and Applications*, 3rd edition, W.H. Freeman & Company, New York:

GEO404D.2: Advanced GIS and Application of Remote Sensing

A.S.P. (1981): *Manual of Photogrammetry*; (4th edn). American Society of Photogrammetry, Falls Church, Virginia.
American society for Photogrammetry and Remote Sensing, Glossary of mapping science, ASPRS,Bethesda, MD,1994
Castleman, K.R. (1979*): Digital Image Processing*. Prentice Hall Inc, New Jersey.
Chaisman, N. 1992: *Exploring Geographical Information Systems*, John Wiley and Sons Inc., New York: 198p.
Foresman,T.W.(ed) (1998*): History of GIS*, Prentice-Hall, Upper saddle river, NJ,
Martin, D. (1991): *Geographical Information Systems and their Socioeconomic Applications*. London, Routledge.
Masser, Ian and Blakemore, Michael (1991): *Handling Geographical Information: Methodology and Potential Application*, 3rd ed., Longman Scientific and Technical.
Robert A. Schowengerdt,(1997): *Techniques for Image Processing and Classification in Remote Sensing*, Academic Press.
Ulaby, F.T., Moore, R,K. and Fung, A.K. (1982): *Microwave Remote Sensing Active and Passive*, Volume II, Radar

GEO495.1: Spatial Analysis in Geography

Clark, C.D. and Wilson, C.(1994): *Spatial Analysis of Lineaments: Computer and Geosciences*, V.20.No. 7/8,p. 1237-1258.
Cliff, A.D. and J.K.Ord (1981): Spatial Processes: Models and Applications. London, Pion Ltd.
Getis, A. and B. Boots (1978): Models of Spatial Processes: An Approach to the study of Point, Line and Area Patterns. Cambridge, Cambridge University Press.
John, J.C.(2002):*Statistics and data nalysis in Geology*, Singapore, JohnWiley & Sons(Asia).
Watson, D.F. (1992): *Contouring: A Guide to the Analysis and Display of Spatial Data*, Oxford, Pergamon Press.
Watson, G.S. (1970): *Orientation Statistics in the Earth Sciences*, Bull.Geol. Inst.Uppsala, V.2. No. 9, p.73-89.
Watson, G.S. (1983): *Statistics on Spheres*, New York, John Wiley & Sons

GEO495.2: Research Exercise in Geography

Alvi. Z. (1995*): Statistical Geography: Methods and Applications*, Rawat Publication, New Delhi
Compton,R.R.(1985): *Geology in the Field*, John Wiley and Sons.
Gardiner,V. and Dacombe,R.(1983):*Geomorphological Field Mannual*,George Allen and Unwin, London
Ghosh,B.N.(1982): *Scientific Methods and Social Research* ,Starling Publishers Private Ltd. New Delhi.
Goudie, A. (1981): *Geomorphological Techniques*, George Allen and Unwin, London
John, C. D. (2002): *Statistics and Data Analysis in Geology*; John Wiley & Sons.
Kothari,R.C(2004):*Research Methodology*,New Age International Publishers, New Delhi.
Mahmood, A (1977): *Statistical methods in Geographical studies*, Rajesh Pub. New Delhi
Mishra,H.N(1998): *Research Methodology in Geography*,Rawat Publication.
Pal, S.K. (1999): *Statistics for Geoscientists*, Concept publishing Company, New Delhi: 423p.
Ramachandran,P.(1971):*Training in Research Methodology in Social Sciences in India*, ICSSR, New Delhi
Shama,B.A.V. et al (1983): *Research Methods in Social Sciences*, Chaitanya Publishing House, Allahabad.
Sjoberg g. and Nett (2002): Methodology of Social Research, Rawat Publication
Wang, X and Vonhofe, R.a (2007): *Research Method in Urban and Regional Planning*, Springer
Young,P.V.(1960): *Scientific Social Surveys and Research* 3rd Ed ,Prentice Hall, New York.

GEO496.1: Map Transformation and Geodesy

Kraak, M.J. and Ormeling, F. (2004): *Cartography- Visualization of Geospatial Data*; Pearson Education, Singapore.
Maling, D.H. (1973*): Co-ordinate systems on Map Projection*; George Philip and Sons Ltd, London
Raisz, E. (1962): *Principles of cartography*; Mc Graw Hill, NY.
Richards, P. and Adler, R.K. (1974): *Map Projections*, North Holland Publishing Company, New Delhi.
Robinson, A.H., Sale, R.D., Morrison, J. (1984): *Elements of Cartography*, Wiley, New York:
Roy, P. (1988): *An Analytical Study of Map Projections*, Volume 1, Kolkata.
Sarkar, A. (1997): *Practical Geography: A Systematic Approach*, Orient Longman Ltd., Hyderabad:
Steers, J.A. (1965): *An Introduction to Map Projections*, 14th ion, University of London Press, London:

GEO496.2: Geographic Information System

Foresman,T.W.(ed) (1998*): History of GIS*, Prentice-Hall, Upper saddle river, NJ,
Marcolongo, B. And Mantorani, F. (1997): *Photogeology: Remote Sensing Application in Earth Science*, Oxford and IBH Pub. Pvt. Ltd., New Delhi: 195p.
Martin, D. (1991): *Geographical Information Systems and their Socioeconomic Applications*. London, Routledge.
Masser, Ian and Blakemore, Michael (1991): *Handling Geographical Information: Methodology and Potential Application*, 3rd ed., Longman Scientific and Technical.
Robert A. Schowengerdt,(1997): *Techniques for Image Processing and Classification in Remote Sensing*, Academic Press.