

# Syllabus for MA/MSc Course in Geography & Environment Management

---

REVISED IN JUNE 2004 : TO BE EFFECTIVE FROM THE ACADEMIC SESSION 2004-2005



Department of Geography and Environment Management  
Vidyasagar University, West  
Medinipur, West Bengal  
PIN - 721 102

## DIVISION OF MARKS

Total Marks	: 1000
Part I Marks	: 500 (10 Modules of 50 marks each)
Part II Marks	: 500 (10 Modules of 50 marks each)
Theoretical Marks	: 700 (Part I: 400, Part II: 300)
Practical Marks	: 300 (Part I: 100, Part II: 200)

## STRUCTURE OF THE SYLLABUS

Part	Type	Paper / Module	Subject	Marks	Exam Time
I	THEORETICAL	I / M-1	Geo-tectonics & Geomorphology	50	4 hours
		I / M-2	GROUP A: Oceanography	25	
			GROUP B: Hydrology	25	
		II / M-3	Climatology	50	4 hours
		II / M-4	Environment Study	50	
		III / M-5	Settlement Study	50	4 hours
		III / M-6	Population Study	50	
		IV / M-7	Landuse Planning and Management	50	4 hours
	IV / M-8	Resource Use & Management	50		
	PRACTICAL	V / M-9	GROUP A: Ground Survey	25	4 hours
			GROUP B: Aerial Photo-Interpretation	25	
		V / M-10	Quantitative methods in Geography	50	4 hours
	II	THEORETICAL	VI / M-11	Geographical Thoughts	50
VI / M-12			Regional Development & Multilevel Planning	50	
VII / M-13			Global Environmental Issues - pollution and Hazards	50	4 hours
VII / M-14			Political and Economic Geography	50	
VIII/M-15			<i>Elective Special Paper*</i>	50	4 hours
VIII/M-16			<i>Elective Special Paper*</i>	50	
PRACTICAL		IX / M-17	<i>Elective Special Paper (Field study)*</i>	50	4 hours
		IX / M-18	Remote Sensing and Geographic Information System	50	4 hours
		X / M-19	Computer applications – Numerical data processing	50	4 hours
		X / M-20	GROUP A:: Methodology Environmental Research	25	4 hours
GROUP B:: Thematic Mapping of Environment	25				

\* The following subjects will be offered as elective special papers

- Advanced Agricultural Geography & Advanced Pedology
- Coastal Management
- Regional and Urban Planning
- Remote Sensing and Geographic Information System
- Rural Development

**Important Note:**

- ❖ Total intake capacity of the Department (Part-I) every year is 50 candidates at present
- ❖ The intake capacity of each special paper (Part-II) will be decided by the Departmental Committee before commencement of Part-II classes.

# PART I PAPERS

## **/// PAPER-I (EXAMINATION TIME: 4 HOURS)**

### **MODULE 1: GEO-TECTONICS & GEOMORPHOLOGY**

*Full Marks: 50. Number of lectures to be delivered for each module is 50. Pattern of setting questions: Four questions of 15 marks (Group-A) and four questions of 10 marks (Group-B) are to be set. Two questions of 15 marks each and two questions of 10 marks each are to be answered. Each question is to have at least two parts in Group-A. Right hand side parentheses indicate lecture hours.*

#### **Unit I (15)**

1. Modern theories of the origin of the earth.
2. Study of the interior of the earth and the earth's crust – Isostatic adjustments of the earth's crust
3. Plate Tectonics and Neo-tectonics.
4. Doctrine of Uniformitarianism.

#### **Unit II (10)**

1. Rock structure; Processes of weathering, mass-wasting and erosion and resultant landforms.
2. Slope development and slope facets; Relationship between longitudinal and transverse slope recession; Geomorphological processes upon slopes.
3. Concept of grade, profile of equilibrium and base level.

#### **Unit III (10)**

1. Evolution of landforms by the process – Fluvial, Glacial & Periglacial, Aeolian, Karst and Coastal.
2. Landforms developed by the interruptions of the Fluvial Cycle.

#### **Unit IV (15)**

1. Concept of cycle of erosion (W.M. Davis, W. Penck and L.C. King). Landforms associated with cycle of erosion.
2. Non-cyclic concept (Hack, Chorley and Schumm).
3. Applied geomorphology: Application of geomorphology in planning and development.

## **PAPER-I : MODULE 2**

*Full Marks: 50. Number of lectures to be delivered for each module is 50. Pattern of setting questions: Four questions of 15 marks (Group-A) and four questions of 10 marks (Group-B) are to be set. Two questions of 15 marks each and two questions of 10 marks each are to be answered. Each question is to have at least two parts in Group-A. Right hand side parentheses indicate lecture hours.*

### **GROUP A- OCEANOGRAPHY (25)**

#### **Unit I (15)**

1. Study of the continental and oceanic crusts – origin and permanency of the ocean basins.
2. Ocean waters – salinity and temperature and chemical compositions.
3. Air-sea interactions; Ocean circulations, dynamics of waves, tides and currents.
4. Marine ecosystem. Marine sediments – classification, distribution, texture and transport.

Unit II (10)

1. Onshore and Offshore oceanic regions
2. Geomorphology of coastal regions.
3. Coastal ecology – coastal dunes, mangroves and coral reefs.

**MODULE 2: GROUP B – HYDROLOGY (25)**

Unit I (15)

1. Hydrology – definition and relation with the environment.
2. Hydrological cycle, global and basin hydrology.
3. Estimation and measurement of hydrological parameters; softness and hardness, temperature, salinity, alkalinity, pH.
4. Study of trace elements and dissolved gases in water.
5. Unit hydrograph and its application.

Unit II (10)

1. Ground water studies – concept of aquifers, depletion and recharge.
2. Concept of watershed and major watersheds in India.
3. Wetland Ecosystems.
4. Major wetlands of India and West Bengal.

**/// PAPER-II : (EXAMINATION TIME: 4 HOURS)**

**MODULE-3: CLIMATOLOGY**

*Full Marks: 50. Number of lectures to be delivered for each module is 50. Pattern of setting questions: Four questions of 15 marks (Group-A) and four questions of 10 marks (Group-B) are to be set. Two questions of 15 marks each and two questions of 10 marks each are to be answered. Each question is to have at least two parts in Group-A. Right hand side parentheses indicate lecture hours.*

Unit I (40)

1. Introductory overview of climate (elements and factors)

– Climatology and Meteorology (15)

- a. Sun – Radiation distribution & balance, Cooling & warming of terrestrial / aquatic surface and atmosphere, Adiabatic heat transfer, Role in weather-making, Seasons
  - b. Atmosphere- composition, profile, its evolution through phases, greenhouse gases, probing the atmosphere, atmospheric stability, lifting processes
  - c. Water- Hydrologic cycle and role in weather-making, latent heat of vaporisation, Bowen ratio, humidity & saturation concept, poleward heat transport, Heat transport between hemispheres
2. Study of Agro-meteorological features – temporal variation of rainfall, temperature, humidity and wind, Methods of climatological measurements. Weather observatories various elements- Thermometers, Barometers, Psychrometers, rainfall measuring devices etc., Balloon-based measurements, Rocket-based measurements, Radiosonde, Pyranometer, Modern-day satellite based measurements. (10)

3. Modern Climatological Concepts: Mechanism of wind developments – surface wind & upper air circulations; Jet Streams; Planetary Circulations, mechanism of Monsoon; mechanism of cloud formation, types of precipitation, theories relating to Mechanism of precipitation. (10)

4. Dynamics of Air masses and fronts – Tropical and Extra-tropical Cyclones: scales, genesis and propagations. (5)

Unit II	(10)
1. Climatic classifications –Trewartha and Stamp.	(2)
2. Global climatic changes and Global warming	(4)
3. ENSO phenomena.	(4)

#### **MODULE-4: ENVIRONMENT STUDY**

*Full Marks: 50. Number of lectures to be delivered for each module is 50. Pattern of setting questions: Four questions of 15 marks (Group-A) and four questions of 10 marks (Group-B) are to be set. Two questions of 15 marks each and two questions of 10 marks each are to be answered. Each question is to have at least two parts in Group-A. Right hand side parentheses indicate lecture hours.*

Unit I	(20)
1. Definition environmental studies; Components of physical environment & their interrelations	
2. Concept of ecosystems: components and structure of ecosystem; Major ecosystems of the world.	
3. Environmental degradation and manifestations – land, water (surface & ground) and air.	
4. Concept of managed environmental systems: agricultural ecosystems, multipurpose river-valley projects and urban areas.	

Unit II	(15)
1. Importance of socio-cultural environment for human welfare.	
2. Components of socio-cultural environment.	
3. Relationship between physical and socio-cultural problems.	

Unit III	(15)
1. Environment-development debate; Environmental movements: Chipko, Silent valley & Narmada Bachao Andolan.	
2. Environmental ethics; Concept of Sustainable Development.	

#### ***/// PAPER-III (EXAMINATION TIME: 4 HOURS)***

#### **MODULE-5: SETTLEMENT STUDY**

*Full Marks: 50. Number of lectures to be delivered for each module is 50. Pattern of setting questions: Four questions of 15 marks (Group-A) and four questions of 10 marks (Group-B) are to be set. Two questions of 15 marks each and two questions of 10 marks each are to be answered. Each question is to have at least two parts in Group-A. Right hand side parentheses indicate lecture hours.*

Unit I	(15)
1. Theories of evolution of human settlement	
2. Size and distributions with theoretical models	
3. Settlement hierarchy: theories of Christaller and Losch; hierarchy of settlements in India, primacy of cities.	
Unit II	(15)
1. Evolution and growth of rural settlements	
2. Service centres and the nature of hierarchy.	
3. Spatial distribution and dispersion.	
4. House forms and types.	

### Unit III

(20)

1. Morphological structures of cities.
2. Functional classification of urban centres.
3. Social area analysis of urban centres.
4. Conurbation, urban agglomeration and rural-urban fringe.

### MODULE-6: POPULATION STUDY

*Full Marks: 50. Number of lectures to be delivered for each module is 50. Pattern of setting questions: Four questions of 15 marks (Group-A) and four questions of 10 marks (Group-B) are to be set. Two questions of 15 marks each and two questions of 10 marks each are to be answered. Each question is to have at least two parts in Group-A. Right hand side parentheses indicate lecture hours.*

#### Unit I

(26)

1. Population Geography as distinct from demography; scope and contents.
2. Sources of population data, their nature and quality.
3. Population characteristics and composition: age, sex, education, religion, castes and tribes, rural and urban, occupation, language (with spl. Ref. to India).
4. Theory of population dynamics – fertility, mortality, migration.
5. Factors determining population growth, distribution and density with spl. Ref. to India.
6. Migration : Types, patterns and streams of migration and controlling factors.

#### Unit II

(12)

1. Theories of population growth – classical and modern theories.
2. Demographic transition and the problems of developed and developing countries.
3. Nutrition, fertility, morbidity and mortality with special reference to India.

#### Unit III

(12)

1. India's population policies.
2. Problems of displaced population.
3. Human development index and its components: the Indian scenario.

### /// PAPER-IV (EXAMINATION TIME: 4 HOURS)

### MODULE-7: LANDUSE PLANNING AND MANAGEMENT

*Full Marks: 50. Number of lectures to be delivered for each module is 50. Pattern of setting questions: Four questions of 15 marks (Group-A) and four questions of 10 marks (Group-B) are to be set. Two questions of 15 marks each and two questions of 10 marks each are to be answered. Each question is to have at least two parts in Group-A. Right hand side parentheses indicate lecture hours.*

#### Unit I

(15)

1. Concept of Land and Land use: Factors governing land utilisation and causing changes in land use pattern; Importance of soil as determinant of land use.
2. Principles of Land use: (after Graham, Lewis, Stamp and others) – Basic principles of land use planning.
3. Land Reclamation: Land use and land in areas having Saline and Alkaline soils (case studies of Sundarban and East Kolkata); Acidic soils; Desert soils and Mountain soils with special reference to India

#### Unit II

(15)

1. Ownership, occupancy and government control on Landuse.
2. Landuse and govt. policy regarding wetland, urban land, industrial areas, mining and river valley planning; concept of wasteland and objectives of National Wasteland Development Board (NWDB)
3. Objectives, principles, types and methods of land use survey.

Unit III (20)

1. Environmental Impact of land use changes: Impact of changes in the urban and rural sectors with special reference to West Bengal.
2. Land use Planning Techniques and Methods; Land use Planning in the Urban and Rural sectors.
3. Land classification (USDA, UK, FAO and India).
4. Landuse planning in India: a historical overview.

**MODULE-8: RESOURCES USE AND MANAGEMENT**

*Full Marks: 50. Number of lectures to be delivered for each module is 50. Pattern of setting questions: Four questions of 15 marks (Group-A) and four questions of 10 marks (Group-B) are to be set. Two questions of 15 marks each and two questions of 10 marks each are to be answered. Each question is to have at least two parts in Group-A. Right hand side parentheses indicate lecture hours.*

Unit I (8)

1. Concept of resource as related to economic, technological and cultural development stages.
2. Classification of resources according to biogenesis, renewability, availability and distribution conditions. Distinction between diversity and disparity.

Unit II (12)

1. Pattern and use of major resources.
2. Land resources: use and misuse, protective measures to check soil erosion.
3. Water resources: domestic and industrial use, use in irrigation and water transport, hazards associated with unscientific use.
4. Marine resources: minerals, fishes, planktons etc., multilevel development, hazards from pollution.

Unit III (8)

1. Forest resources: patterns of existing use and misuse, regeneration through social forestry and joint forest management.
2. Agricultural resources: necessity for establishing parity to meet the nutritional requirements of the world population and supply raw materials for the industries, conventional and alternative methods of production.

Unit IV (12)

1. Mineral resources: techniques of maintaining the reserve level by scientific conservation and recycling processes.
2. Energy resources: disparities in production and consumption, necessity for increasing reliance from conventional to non-conventional sources.
3. Industrial resources: linkages with other resource bases, inter-regional transfer of technology, social adaptation of technology.

Unit V (10)

1. Human resource development and patterns of use. Disparities in development between the developed and developing countries. Disparities arising from internal and international policies.
2. Conservation and management needs: need for focusing the methods and measures of conservation for benefit of all, need for assuring economic, and social and environmental sustainability.



## **/// PAPER-V (PRACTICAL)**

### **Module-9: GROUND SURVEY AND AERIAL PHOTO INTERPRETATION**

*Full Marks: 50. At least even number of periods to be assigned (preferably in batches) for Group-A and Group-B. Examination Time: 4 hours. Pattern of setting questions: compulsory questions are to be set from Group-A (20 marks) and Group-B (20 marks). 10 marks are to be allocated for Evaluation of Practical Notebook (5 marks) and Viva-voce (5 marks). Right hand side parentheses indicate lecture / demonstration hours.*

#### **/// GROUP-A: GROUND SURVEY (20)**

1. Contour Survey on the basis of leveling by Dumpy Level and Prismatic Compass.
2. Traverse Survey by i) Plane Table (Intersection Method) and ii) Prismatic Compass.
3. Determination of height by Transit Theodolite (Base Inaccessible method).
4. Survey of roads in a study area by a GPS handset and preparation of a road map.

#### **/// GROUP-B: AERIAL PHOTO INTERPRETATION (20)**

1. Advantages of Aerial photographs over conventional on-the-ground observations, Types, scales and ground coverage, Basic Negative-to-Positive Photographic Sequence, Black & White Films, Colour Films
2. Aerial cameras, film exposures (numerical problems), stereoscopy, pseudoscopy, lens stereoscope, Mirror stereoscope, image parallax and determination of height.
3. Air Photo Interpretation; shape, size, pattern, tone, texture, shadows and site. Monoscopic and stereoscopic Interpretation of airphotos for geomorphic land use features

#### **PRACTICAL NOTEBOOK AND VIVA-VOCE (10)**

### **MODULE 10: QUANTITATIVE METHODS IN GEOGRAPHY**

*Full Marks: 50. At least even number of periods to be assigned (preferably in batches). Examination Time: 4 hours. Pattern of setting questions: Compulsory questions are to be set for 40 marks. 10 marks are to be allocated for Evaluation of Practical Notebook (5 marks) and Viva-voce (5 marks). Right hand side parentheses indicate lecture / demonstration hours.*

1. Sampling and summarising data; Sampling Methods, Estimate from Samples, Sample size. Frequency distribution, Lorenz Curve, Ternary Diagram, Weaver's Combination Index. **(15)**
2. Probability distributions: Probability, Law of Multiplication, probability distributions, binomial distributions, normal probability distribution, properties of normal curve. **(8)**
3. Bi-variate distribution and correlation: Scatter diagrams, Regression lines and residuals. Product moment correlation, Spearman's Rank Correlation and Correlation Matrix. **(7)**
4. Comparisons and Hypothesis Tests: a) Comparisons - the Nearest Neighbour Analysis, Shortest path analysis, b) Hypothesis Tests –  $\chi^2$  test, Student's t-test **(10)**

#### **PRACTICAL NOTEBOOK AND VIVA-VOCE (10)**

# PART II PAPERS

## **/// PAPER-VI (EXAMINATION TIME: 4 HOURS)**

### **MODULE-11: GEOGRAPHICAL THOUGHTS**

*Full Marks: 50. Number of lectures to be delivered for each module is 50. Pattern of setting questions: Four questions of 15 marks (Group-A) and four questions of 10 marks (Group-B) are to be set. Two questions of 15 marks each and two questions of 10 marks each are to be answered. Each question is to have at least two parts in Group-A. Right hand side parentheses indicate lecture hours.*

#### Unit I (5)

The Field of Geography; its place in the classification of sciences vis-à-vis other disciplines; geography as a social science, Physical and Human geography

#### Unit II (10)

Dualisms and dichotomies in geography; Determinism and Possibilism, Systematic (Nomothetic) & Regional (Ideographic) geography. Relationship between systematic sciences and regional geography, Environmental determinism, possibilism and ecological approach.

#### Unit III (25)

Laws theories and models; Encyclopaedism and to positivism, Development of Behavioural Geography, Development of Critical Social Geography – Radicalism, Welfare Geography and Gender issues, Post Modernism in Geography, Quantitative Revolution and Geographic Information System

#### Unit IV (10)

Concept of Space in geography – Material space and Social space

### **MODULE-12: REGIONAL DEVELOPMENT & MULTILEVEL PLANNING**

*Full Marks: 50. Number of lectures to be delivered for each module is 50. Pattern of setting questions: Four questions of 15 marks (Group-A) and four questions of 10 marks (Group-B) are to be set. Two questions of 15 marks each and two questions of 10 marks each are to be answered. Each question is to have at least two parts in Group-A. Right hand side parentheses indicate lecture hours.*

#### Unit I (30)

1. Definition & typology - formal-functional, nodal, uniform, single purpose, special purpose & composite regions and hierarchy of regions.
2. Historical review of regional approach in geography – different countries.
3. Formal Regions: physiographic, agro-climatic and cultural. (spl. ref to India) – Functional Regions in India: city region, industrial region, and administrative regions – Special Purpose Regions: river valley, micro-watershed, metropolitan – Problem Regions: hilly regions, coastal regions, tribal, drought-prone & flood-affected regions.
4. Regional development strategies: centralized & decentralized, multi-level planning (rural/urban) peoples participation (Panchayati Raj institutions).

Unit II (20)

1. Structure of underdevelopment – colonial and post-colonial India.
2. Delineation of planning region in the national context, indicators of development and their data sources, measuring levels for regional development & disparities.
3. Regional disparities in India: demographic and economic disparities.
4. Assessment of Regional Development Policies in India – problems and prospects.

## **/// PAPER-VIII**

### **MODULE-13: GLOBAL ENVIRONMENTAL ISSUES - POLLUTION AND HAZARDS**

*Full Marks: 50. Number of lectures to be delivered for each module is 50. Pattern of setting questions: Four questions of 15 marks (Group-A) and four questions of 10 marks (Group-B) are to be set. Two questions of 15 marks each and two questions of 10 marks each are to be answered. Each question is to have at least two parts in Group-A. Right hand side parentheses indicate lecture hours.*

Unit I (22)

1. Population growth Technology and Environment.
2. Rapid urbanisation-global economic pressures-scarcity of natural resources – Global resources crisis.
3. Hazard in the environment: Concept of Hazard, Vulnerability and Disaster
4. Dimensions of disaster, risk assessment and causes, effects and loss sharing adjustments of typical hazards:
  - a. Tectonic hazards - Earthquake
  - b. Geomorphological hazards – Landslides and River bank erosion
  - c. Hydrological hazards – Flood and Drought
  - d. Bio-physical hazards - Epidemics
  - e. Technological hazards – Industrial accidents and nuclear radiation leakage
  - f. Social hazards – Poverty & Crime

Unit II (10)

1. Global concerns: Global warming and its various implications, Acid rain and Ozone depletion
2. Non-degradable waste and its disposal.
3. Pollution: Air, water, land, noise.
4. Soil degradation: Erosion, Salinisation, Alkalinisation, Desertification and Deforestation, Quarrying & Mining

Unit III (8)

1. Pollution control strategies.
2. Recycling, renewable energy uses.
3. Conservation of Biodiversity with special reference to India (problems of agricultural development and regeneration of forest and maintenance of Biodiversity –Wild, Aquatic & Agriculture

Unit IV (10)

1. Environmental Policy
2. Legislation on Water, Air, Noise, Environmental Protection Act with special reference to Legislation in India.
3. Environmental Impact Assessment (EIA).
4. Environmental Management Planning (EMP).

## MODULE-14: Political and Economic Geography

*Full Marks: 50. Number of lectures to be delivered for each module is 50. Pattern of setting questions: Four questions of 15 marks (Group-A) and four questions of 10 marks (Group-B) are to be set. Two questions of 15 marks each and two questions of 10 marks each are to be answered. Each question is to have at least two parts in Group-A. Right hand side parentheses indicate lecture hours.*

### Unit-I (20)

1. Geographical perspective on formation of state, nation and nation-state, core and peripheral areas, capitals, frontiers and boundaries, border lands and buffer zones, buffer states, land locked nation
2. Geostrategic views- Heartland and Rimland theories
3. Politics of world resources with special reference to energy resources, economic, political, military blocks; political geography of foreign trade.

### Unit-II (6)

1. Partition of India and its implication
2. Reorganization of Indian states since independence.
3. International and interstate water dispute in Indian subcontinent.

### Unit-III (15)

1. Economic geography in the era of globalisation- agriculture, industry and trade.
2. Ranking of world economies
3. Significance of trade in regional and national economy; balance of payment and international trade - GATT, WTO and Intellectual Property Right; Impact of privatisation and liberalisation.

### Unit-IV (9)

1. Concept of distance, accessibility and connectivity: Inter-regional and Intra-regional.
2. Modes of transportation and transport costs: comparative cost advantages.
3. Impact of Information Technology on trade.

## **/// PAPER-VIII SPECIAL PAPER THEORY : (ANY ONE)**

- 1) Advanced Agricultural Geography and Advanced Pedology, 2) Coastal Management, 3) Regional and Urban Planning, 4) Remote Sensing & GIS, and 5) Rural Development

### **Option-1 Advanced Agricultural Geography and Advanced Pedology**

## **MODULE-15**

*Full Marks: 50. Number of lectures to be delivered for each module is 50. Pattern of setting questions: Four questions of 15 marks (Group-A) and four questions of 10 marks (Group-B) are to be set. Two questions of 15 marks each and two questions of 10 marks each are to be answered. Each question is to have at least two parts in Group-A. Right hand side parentheses indicate lecture hours.*

### **Advanced Agricultural Geography (50)**

#### **UNIT:I AGRICULTURE IN INDIA (15)**

1. Landuse pattern and regional pattern of productivity in India.

2. Green revolution, shifting cultivation, wasteland development, fodder culture and white revolution—their impact and consequences.
3. Indian agricultural policies, management and planning.

**UNIT:II DETERMINANTS AND PRINCIPLES OF AGRICULTURAL LANDUSE (15)**

1. Determinants of agricultural landuse: Physical, economic, social and technological.
2. Cropping pattern, crop concentration, degree of commercialisation, diversification and specialisation, efficiency and productivity, crop-combination region and agricultural development.
3. Agricultural development: Pattern in developed and developing countries.

**UNIT:III EMERGING ISSUES (20)**

1. Food security: Monitoring performance of major crops of India for forecasting production – Acreage & Yield estimation by Remote Sensing
2. Environmental impact of irrigation, fertilisers, pesticides, and technological know-how.
3. Employment in agricultural sector: land-less labours, workers, children, occupational health and agricultural activity.
4. Precision Farming – Use of modern technology: Remote Sensing, GIS & GPS

**MODULE-16**

*Full Marks: 50. Number of lectures to be delivered for each module is 50. Pattern of setting questions: Four questions of 15 marks (Group-A) and four questions of 10 marks (Group-B) are to be set. Two questions of 15 marks each and two questions of 10 marks each are to be answered. Each question is to have at least two parts in Group-A. Right hand side parentheses indicate lecture hours.*

**ADVANCED PEDOLOGY (50)**

**UNIT:I CONSTITUENTS AND PROPERTIES OF SOIL INFLUENCING PLANT GROWTH (20)**

1. Soil reactions: Soil acidity, alkalinity, salinity and their effects on plant growth.
2. Soil plasma: Organic and Inorganic origin, constitution, properties and types of soil clay. Classification of clay minerals.
3. Soil nutrients: Macro- and micro-nutrients, nutrient transformation and fixation in soil. Principle of base exchange and its relation with fertility.
4. Soil fertility and productivity: Roles of irrigation, inorganic fertilizers, organic manures, including other bio-fertilisers in augmenting soil fertility. Nitrification and denitrification.

**UNIT:II SOIL GENESIS, SURVEY, CLASSIFICATION AND MANAGEMENT (10)**

1. Processes of soil formation and soil development: Physical, Chemical, Flora, Fauna, Climate, Relief, Time.
2. Pedogenic processes - Theories on formation of major soils of the world: podsolisation, laterisation, lessivage, calcification, gleisation etc.. Sub-types of major zonal soils.
3. Soil degradation: factors, processes, and resultant forms in different parts of India.

1. Classification of soil: Soil Taxonomy
2. Generation of derivatives: Land capability, land irrigability, soil irrigability, soil suitability, hydrological grouping of soils
3. Role of Remote Sensing in soil mapping – Prospects & limitations
4. Integrated soil and water management – concept of sustainable development

### **Option-2 Coastal Management**

#### **MODULE-15**

*Full Marks: 50. Number of lectures to be delivered for each module is 50. Pattern of setting questions: Four questions of 15 marks (Group-A) and four questions of 10 marks (Group-B) are to be set. Two questions of 15 marks each and two questions of 10 marks each are to be answered. Each question is to have at least two parts in Group-A. Right hand side parentheses indicate lecture hours.*

#### **Coastal Management: Physical Aspects [50 marks]**

Definition of coastal zone and related nomenclature.

Coastal processes: Wave, tide and wind. Coastal currents and cells.

Coastal morphodynamics: Micro, macro and biogenic forms. Systems of change in coasts: cyclical and progressive. Classification of coasts based on processes and sediment characteristics.

Coastal biogeography with special reference to sea weeds, mangroves, dune vegetation and corals. Their ecological and economic significance.

Natural coastal hazards and their management: Sea level rise, erosion, sedimentation and tropical cyclones.

Techniques of monitoring changes in coastal processes and landforms.

#### **MODULE-16**

*Full Marks: 50. Number of lectures to be delivered for each module is 50. Pattern of setting questions: Four questions of 15 marks (Group-A) and four questions of 10 marks (Group-B) are to be set. Two questions of 15 marks each and two questions of 10 marks each are to be answered. Each question is to have at least two parts in Group-A. Right hand side parentheses indicate lecture hours.*

#### **Coastal Management: Human Aspects [50 marks]**

Coastal regulations with special reference to India.

Human utilisation of coasts, environmental impacts and management: Navigation, mining, fishing and fish-processing, off-shore oil exploitation, reclamation and tourism.

Coastal engineering and its impacts: Ports and harbours, measures for prevention of erosion and sedimentation.

Coastal pollution: Sources, impacts and management.

Integrated Coastal Management: Concepts, techniques and applications.

West Bengal coast: Major environmental issues, problems and their management

Application of Remote Sensing with special reference to Fishery

Monitoring Surface waters in Coastal Regulatory Zone (CRZ)

Study of Suspended mineral in water

Study of Chlorophyll in water

Measurement of Sea Surface Temperature (SST)

## Option-3 Regional and Urban Planning

### MODULE-15

*Full Marks: 50. Number of lectures to be delivered for each module is 50. Pattern of setting questions: Four questions of 15 marks (Group-A) and four questions of 10 marks (Group-B) are to be set. Two questions of 15 marks each and two questions of 10 marks each are to be answered. Each question is to have at least two parts in Group-A. Right hand side parentheses indicate lecture hours.*

#### REGIONAL DEVELOPMENT

(50)

1. Concept of growth, development, poverty and underdevelopment
2. Regional development perspectives: Colonial period (Dependency theories)
3. Growth Pole theories and the developing world
4. Agropolitan Development, Basic Needs Approach
5. Regional Planning Strategies: regional plans of developed & developing countries. Regional plans in India with examples.
6. Regional Environmental Issues.

### MODULE-16

*Full Marks: 50. Number of lectures to be delivered for each module is 50. Pattern of setting questions: Four questions of 15 marks (Group-A) and four questions of 10 marks (Group-B) are to be set. Two questions of 15 marks each and two questions of 10 marks each are to be answered. Each question is to have at least two parts in Group-A. Right hand side parentheses indicate lecture hours.*

#### URBAN GEOGRAPHY

(50)

1. Concepts and definitions: urban, urbanization and urbanism,
2. Origin & growth of urban settlements; bases & process of urbanisation
3. Major influences in urban planning: ancient, oriental, European, American.
4. Urbanization in India: a historical perspective
5. Features of metropolitan development (with special reference to India)
6. Urban Economy: basic, non-basic functions, changing urban functions; role of informal sector
7. Issues of urban environment: poverty, crime, infrastructure, sprawl, renewal, pollution & health.
8. Urban Environmental Problems in West Bengal
9. Brief introduction of Remote Sensing applications on Urban landscape

## Option-4 Remote Sensing (RS) & Geographic Information System(GIS)

### MODULE-15

*Full Marks: 50. Number of lectures to be delivered for each module is 50. Pattern of setting questions: Four questions of 15 marks (Group-A) and four questions of 10 marks (Group-B) are to be set. Two questions of 15 marks each and two questions of 10 marks each are to be answered. Each question is to have at least two parts in Group-A. Right hand side parentheses indicate lecture hours.*

#### BASIC CONCEPTS

(50)

#### Physics of Remote Sensing

(10)

Fundamental laws governing the science - Sources of Energy, Electromagnetic Radiation, Radiation laws, (Wavelength-frequency-energy relationship of EMR, Stefan-Boltzman law, Wien's law, Kirchhoff's law etc., numerical problems), Definitions, Requirements, Stages, Black body and Real body, Radiant temperature & Kinetic temperature, Atmospheric interaction.

### **Satellite Platforms and Sensors**

(15)

Basics – Kepler's laws, Major-Semimajor axis & Eccentricity, Velocity, Period (Numerical problems), Historical development, Launch Vehicle, Indian scenario, Types of platform for civilian applications, Advantages and Disadvantages, Characteristics of various satellite platforms Physical principles and characteristics of major sensors, Resolution, Data storage, dissemination & Processing, Ideal Remote Sensing system & Real Remote Sensing System.

### **Aerial Photography & Photogrammetry**

(10)

Historical development, Definitions of key terminology, Types of aerial photographs, Geometry of Single Aerial Photographs, Scale, Lens distortions, Relief distortion and Tilt distortions, Rectification, Ortho Rectification, Film density & Characteristic curve, Colour Infrared films, Film resolution, Filters, Stereo Photogrammetry – **Various photogrammetric activities**, Conditions for Stereovision, Photographic overlap, Image Parallax, Flight Planning.

### **4. Satellite Systems**

(15)

Whiskbroom Systems: LANDSAT series

Pushbroom Systems: SPOT, IRS series

Microwave Systems: ERS, RADARSAT

Coarse resolution / Meteorological Satellite System: NOAA, INSAT

Very high resolution Remote Sensing Systems: Earlybird and Quickbird, IKONOS, Orbview-3, 4.

## **MODULE-16**

*Full Marks: 50. Number of lectures to be delivered for each module is 50. Pattern of setting questions: Four questions of 15 marks (Group-A) and four questions of 10 marks (Group-B) are to be set. Two questions of 15 marks each and two questions of 10 marks each are to be answered. Each question is to have at least two parts in Group-A. Right hand side parentheses indicate lecture hours.*

### **Advanced techniques & applications**

(50)

#### **1. A brief introduction to Thermal Remote Sensing**

(3)

***Fundamentals of Thermal Remote Sensing: Sensing Radiant Temperature, Black body Radiation, Radiation from real materials, sensors, utility***

#### **2. Microwave Remote sensing / Laser**

(5)

Concept, Advantages and Disadvantages vis-à-vis Optical systems, Spatial resolutions, Real aperture and Synthetic aperture Radar, stereoscopy, parallax, passive systems, Lidar

#### **3. A brief introduction to Hyperspectral Remote Sensing**

(2)

Concept, sensors, utility

#### **4. Digital Image Processing**

(10)

Preprocessing / Georeferencing, Data enhancement, Density slicing, Data compression, Spectral pattern recognition (Supervised, Unsupervised, NDVI etc.), Filtering, Output generation



## **5. Geographic Information System**

**(10)**

Basic Concepts: An overview of the development of the GIS field, Data Sources, Data capture (Manual and automatic digitization of analog data), vector and raster structures, Hardware configuration and software requirements, DBMS, Data Storage, Data analysis (overlay, buffering etc), Data output, Query of a GIS

Introduction to ARC/INFO GIS software – a leading commercial software  
Integration of GIS and Remote Sensing with a couple of case studies

## **6. Basic Theory of GPS Surveying**

**(5)**

Conceptual framework, Space segment, Ground segment, Control segment, Satellite Triangulation, US Dept. of Defense policy, DGPS, Uses

## **7. Applications of Remote Sensing**

**(15)**

Comparative assessment of SOI toposheet, Aerial photograph and Satellite data for representation of geographical data.

Remote Sensing in Landuse /land cover applications

Remote Sensing in Soil & Agricultural Applications

Remote Sensing in Geomorphic Mapping

Remote Sensing in watershed management

## **Option-5 Rural Development**

### **MODULE-15**

*Full Marks: 50. Number of lectures to be delivered for each module is 50. Pattern of setting questions: Four questions of 15 marks (Group-A) and four questions of 10 marks (Group-B) are to be set. Two questions of 15 marks each and two questions of 10 marks each are to be answered. Each question is to have at least two parts in Group-A. Right hand side parentheses indicate lecture hours.*

### **Identification and Characteristics of Rural Environment**

**(50)**

1. Theoretical framework of rural development and geographical perspective: Rural economy under different production systems – experiences of developed and developing world with examples.
2. Dimensions of rural economy; Non-urban landuse – agriculture and complementary uses of land; animal husbandry, dairying, poultry, fishing, forestry, market gardening and agro-based industries; Problems of development related to labour, capital, market, scale and infrastructure.
3. Rural labour force with special reference to gender, migration and socio-cultural dimensions.
4. Analysis of rural settlement: Cause and effect associations, distribution of rural settlement with special reference to size and spacing.; Rural service centres – Nature and hierarchy of nodal settlement of market centres and growth centres – Central Place Theory – Concept of rural urban continuum.

## MODULE-16

*Full Marks: 50. Number of lectures to be delivered for each module is 50. Pattern of setting questions: Four questions of 15 marks (Group-A) and four questions of 10 marks (Group-B) are to be set. Two questions of 15 marks each and two questions of 10 marks each are to be answered. Each question is to have at least two parts in Group-A. Right hand side parentheses indicate lecture hours.*

### Evolution of Rural Development in India

(50)

1. Evolution of rural development concept in India; R.D. during plan periods – Objectives and approaches.
2. Land reform in India – Abolition of Jamindari system, Land Ceiling Act and emerging production relations.
3. Concept of Panchayati Raj – Role of Panchayati Raj in rural development and planning.
4. Objectives and strategies of planning at district, block and village levels; people's participation in rural development and planning; centrally sponsored programmes of rural development: Area approach, Target Group approach and Target Sector approach.
5. Models of rural development: experience of Punjab, Kerala, West Bengal and Bihar.

## **/ PAPER-IX – PRACTICAL**

### MODULE-17 (SPECIAL PAPER FIELD - PRACTICAL) :

#### Field Report on Special Paper

(Report preparation: 25 Marks, Viva-voce: 25 Marks; Total: 50 marks)

*Full Marks: 50. At least even number of periods to be assigned (preferably in batches). Examination Time: 4 hours. Pattern of setting questions: Optional ( if any, compulsory questions are to be set).*

#### Option-1: Advanced Agricultural Geography & Advanced Pedology (Field Report on a specific project selected from the themes mentioned below)

1. Monitoring performance of major crops of a block in a particular season for forecasting production – Crop Acreage & Production estimation (CAPE) by Remote Sensing using SAC (Space Application Centre, ISRO, Ahmedabad) methodology
2. Analysis of crop suitability in the study area based on the soil category, climate and the available resources / technological inputs using GIS
3. Mapping of seasonal / round the year crop distribution of a specific study area with the help of toposheet, satellite FCC and field traverse.
4. Mapping of soil categories from FCC by visual interpretation and finalization of categories by field traversing and profile sample studies.

#### Option-2: Coastal Management (Field Report on Non-riverine Coastal Environments)

1. Mapping of the forms of coastline changes (non-riverine).
2. Demographic changes along with the coasts based on Census data.
3. Analysis of one specific problem based on field observation and primary survey with a prepared questionnaire.

**Option-3: Regional and Urban Planning (Field Report on a specific problem of an urban area, e.g. Small town or a few wards of a big city, based mainly on primary data)**

1. Identification of Study area and problem.
2. Data base, preparation of questionnaire, field survey, analyses of the survey data and mapping

**Option-4: Remote Sensing & GIS (Field Report on a specific project selected from the themes mentioned below)**

**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**

Soils Mapping, Crop mapping /Crop stress determination

**3. Remote Sensing in Land and Water Management**

Land use /Land cover planning, Land resources management

Water Resources: Surface water-ground water, water deciphering, quality inventory and monitoring, quantity 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 Forest Management**

Forest density mapping, Forest type mapping

**5. Remote Sensing in Urban and Rural Development**

Mapping of human habitation, type

**6. Remote Sensing in Coastal Management**

Coastal land use, spatial and temporal changes, SST, Phytoplankton assessment, Sediment assessment

**Option-5: Rural Development (Field Report on a specific problem of a defined rural area, e.g. Micro-Watershed / Block Level / Mouza Level, based mainly on primary data)**

1. Identification of Study area and problem.
2. Data base, field observation and survey (with a prepared questionnaire), analyses of the survey data and mapping

**MODULE-18**

*Full Marks: 50. At least even number of periods to be assigned (preferably in batches). Examination Time: 4 hours. Pattern of setting questions: Compulsory questions are to be set for 40 marks. 10 marks are to be allocated for Evaluation of Practical Notebook (5 marks) and Viva-voce (5 marks). Right hand side parentheses indicate lecture hours.*

**Group-A: Remote Sensing (RS)**

**(25)**

1. Historical development of Remote Sensing as a technology, relevance of Remote Sensing in Geography, Concepts and basic requirements
2. Satellite remote sensing: Platforms & Sensors, orbital characteristics, Whiskbroom scanners, Pushbroom scanners, and data products.

3. Image Processing: visual and digital; Significance of secondary / in-situ data, Ground Truth Verification. Preprocessing / Rectification and restoration; data enhancement, Spectral pattern recognition, microwave sensing: SLAR Imageries, elements of passive microwave sensing.
4. Remote Sensing applications and mapping in India – Case studies (e.g., Landuse planning, forest management, wasteland management etc.)

**Group-B: Geographical Information System (GIS) (15)**

1. Concept of GIS, maps & spatial information, dynamics and selection of spatial information, concept of spatial and non-spatial data, computer environment for GIS (hardware & software requirement)
2. Spatial data: raster-vector structure- conversion & comparison
3. Elements of GIS: data capture, verification & processing, storage & maintenance, data manipulation, analysis, overlay analysis.
4. Integration of GIS, remote sensing and GPS data.
5. Application: use of satellite imagery and other categories of maps for GIS (e.g., Landuse planning, forest management, wasteland management etc.)

**PRACTICAL NOTEBOOK AND VIVA-VOCE (10)**

**/// PAPER-X - PRACTICAL**

**MODULE-19**

*Full Marks: 50. At least even number of periods to be assigned (preferably in batches). Examination Time: 4 hours. Pattern of setting questions: Compulsory questions are to be set for 40 marks. 10 marks are to be allocated for Evaluation of Practical Notebook (5 marks) and Viva-voce (5 marks). Right hand side parentheses indicate lecture hours.*

**COMPUTER APPLICATIONS – NUMERICAL DATA PROCESSING (50)**

- 1.0 COMPUTATION, SORTING AND FORMATTING OF SPREADSHEETS (15)
  - 1.1 Derivation of rank, mean, median and mode.
  - 1.2 Computation of standard deviation, sample variation and moving average.
  - 1.3 Derivation of correlation, covariance and regression.
  - 1.4 Use of <if-then> function. F-test, t-test and z-test.
- 2.0 PREPARATION OF ANNOTATED DIAGRAMS (10)
  - 2.1 Simple and compound bar and line graphs.
  - 2.2 Pie and doughnut diagrams.
  - 2.3 Scatter diagrams.
  - 2.4 Histograms.
- 3.0 PREPARATION OF ANNOTATED GRAPHIC FILES (15)
  - 3.1 Cleaning and editing of scanned files.
  - 3.2 Creation of layers.
  - 3.3 Digitisation of scanned files.
  - 3.4 Annotation of scanned and digitised files.

**4.0 PRACTICAL NOTEBOOK AND VIVA-VOCE (10)**

## **MODULE-20**

*Full Marks: 50. At least even number of periods to be assigned (preferably in batches). Examination Time: 4 hours. Pattern of setting questions: Compulsory questions are to be set for 40 marks. 10 marks are to be allocated for Evaluation of Practical Notebook (5 marks) and Viva-voce (5 marks). Right hand side parentheses indicate lecture hours.*

### **Methodology Environmental Research & Thematic Mapping of Environments**

**(50)**

#### **Group-A - Methodology of Environmental Research**

**(20)**

1. Research Paradigms
2. Identification of Research Problems and specification of the Objectives of the Study.
3. Development of theoretical background – literature survey.
4. Methods of data collection: Questionnaire and schedule.
5. Report writing.
6. Methods of writing Notes, References, Bibliography.
7. Examples on some problems of environmental research using tools of Remote Sensing and GIS

#### **Group-B: Thematic Mapping of Environments**

##### **Physical:**

**(14)**

Mapping on themes covering physical attributes: Relief, Morphometry (Relative Relief, Dissection Index, Ruggedness Index, Drainage Density, and Hypsometry), Climatology, Flora and Fauna.

##### **Cultural:**

**(6)**

Mapping on themes covering cultural attributes: settlement, road network, embankments, tanks etc.

#### **PRACTICAL NOTEBOOK AND VIVA-VOCE**

**(10)**

# REFERENCES (under preparation, yet to be finalized)

## PART I

### **/// PAPER-I : GEOTECTONICS, GEOMORPHOLOGY, HYDROLOGY AND OCEANOGRAPHY**

- Bloom, Arther L., 2003. *Geomorphology – A systematic analysis of Late Cenozoic Landforms*, 3<sup>rd</sup> Edn. 482p.
- Chorley, R., Schumm, S. and Sugden, D.E. 1994. *Geomorphology*, Methuen, London: 605p. [Sections 1, 2, 3]
- Cook and Doorncamp. 1988. *Geomorphology in Environment Management*, London: [Topic 1.4]
- Faniran, A. and Jeje, L.K. 1983. *Humid Tropical Geomorphology*, Longman, London: 340p. [Topic 2.3, 2.4]
- Garrison, T. 1993. *Oceanography: An Invitation to Marine Science*, Wadsworth Pub. Co., Belmont: 540 p. [Topics 4.1, 4.2, 4.3]
- Johnson, H.D. and Baldwin, C.T. 1996. 'Shallow clastic seas.' In Reading H.G. (editor): *Sedimentary Environments: Processes, Facies and Stratigraphy*, 3rd edition, Blackwell Science Ltd. Oxford: pp 232–280. [Topic 2.3]
- Kale, V.S. and Gupta, A. 2001. *Introduction to Geomorphology*, Orient Longman Ltd., Hyderabad: 274p. [Topics ]
- Keary, P. and Vine, M. 1997. *Global Tectonics*, 2nd edition, Blackwell Scientific Publications, Oxford: 302p.
- Knighton, D. 1998 : *Fluvial Forms and Processes: A New Perspective*, Arnold, London: 385p. [Topic 2.1; Section 4]
- Lal, D. S., 2003. *Oceanography*, 3<sup>rd</sup> Edn. 288p.
- Mitchell, C.W 1991. *Terrain Evaluation*, 2nd edition, Longman Scientific & Technical, Harlow: 441p. [Topics 1.3, 3.3]
- Morisawa, M. (editor) 1994. *Geomorphology and Natural Hazards*, Elsevier, Amsterdam: 355p. [Topic 1.4]
- Morisawa, M. 1985. *Rivers*, Longman, London: 222p. [Topic 2.1, Section 4]
- Ollier, C.D. 1981: *Tectonic Geomorphology*, Longman Scientific & Technical, London: [Topic: 3.2]
- Murthy, K.S. 1998. *Watershed Management in India*, 3rd edition, Wiely Eastern Ltd. / New Age International Ltd., New Delhi: 198p. [Topic 3.4]
- Newson, M. 1992. *Land Water and Development, River Basin Systems and their Sustainable Management*, Routledge, London: 350p. [Topic 3.4]
- Pethick, J. 1984. *An Introduction to Coastal Geomorphology*, Edward Arnold, London: 259 p. [Topics 2.3, 4.4]
- Petts, G. and Foster, I. 1985. *Rivers and Landscapes*, Edward Arnold, London, 274p. [Section 4]
- Petts, G.E. and Amoros, C. (editors) 1996. *Fluvial Hydrosystems*, Chapman and Hall, London: 322p. [Topics 4.3, 4.4]
- Rice, R.J. 1988. *Fundamentals of Geomorphology*, 2nd edition, Longman Scientific and Technical, London: 420p. [Sections 1~4]
- Selby, M.J. 1985. *An Introduction to Geomorphology*, Clarendon, Oxford: 607p. [Sections 1,2, 3]
- Sharma, H.S. 1987. *Tropical Geomorphology : A Morphogenetic Study of Rajasthan*, South Asia Books, Jaipur: 124p. [Topic 5.4]
- Starkel, L. and Basu, S. 2000 *Rains, Landslides and Floods in the Darjeeling Himalaya*, Indian National Science academy, New Delhi: 168p. [Topic 5.2].
- Summerfield, M.A. (Editor) 1991. *Global Geomorphology : An Introduction to the Study of Landforms*, John Wiley and Sons Ltd., New York: 560p. [Sections 1~4]
- Thornbury, W.D. 1969. *Principles of Geomorphology*, Wiley Eastern Limited, New Delhi: 594 p. [Topics 2.4, 3.2, 4.3]
- Tinkler, 1985. *A Short History of Geomorphology*, Croom Helm Ltd., Beckenham: 315p. [Topic 1.1, 1.2]
- Valdiya, K.S. 1998. *Dynamic Himalaya*, University Press (India) Ltd., Hyderabad: 178p. [Topic 5.2].
- Wilson, J.P. and Gallant, J.C. (editors) 2000. *Terrain Analysis : Principles and Applications*, John Wiley and Sons Ltd. New York: 479p. [Topic 3.3]
- Wirthmann, A. 2000. *Geomorphology of the Tropics*, Translated by Busche, D. Springer-Verlag, Berlin: 225p. [Topic 2.2]

### **/// PAPER-II : CLIMATOLOGY & ENVIRONMENT STUDY**

#### **Climatology**

- Anthes, R. 1997: *Meteorology*, 7th edition, Prentice-Hall Inc., Upper Saddle River: 214p.
- Barry, R.G. and Chorley, R.T. 1992: *Atmosphere, Weather and Climate*, 6th edition, Routledge, London: 392p.
- Brigg, G.R. 1996 : *The Ocean and Climate*, Cambridge University Press, Cambridge: 266p.
- Coch, N.K. 1995 : *Geohazards: Natural and Human*, Prentice Hall, Englewood Cliffs: 481 p.
- 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.
- Elsom, D.M. 1992 : *Atmospheric Pollution: A Global Problem*, 2nd edition, Blackwell Pub. Co., London: 422p.
- 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 Inc., Upper Saddle River: 434p.

- 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.
- Pant, G.B. and Kumar, R.K. 1997: *Climates of South Asia*, John Wiley and Sons Ltd., Chichester: 320p.
- Smith, K. 1996 : *Environmental Hazards: Assessing Risk and Reducing Disaster*, 2nd edition, Routledge, London; 389p.
- Taylor, J.A. (editor) 1974 : *Climatic Resources and Economic Activity*, David & Charles, London: 264p.

## **Environment Study**

- Adams, W.M. 1995 : *Green Development: Environmental Sustainability in the Third World*, Routledge, London: pp 1-8,87-139.
- Alexander, D. 1993: *Natural Disasters*, Research Press, New Delhi: 619p.
- Allaby, M. 1996 : *Basics of Environmental Science*, Routledge, London: 297p.
- Baarsches, W.H. 1996 : *Eco-facts and Eco-fiction: Understanding the Environmental Debate*, Routledge, London: 264p.
- Chapman, D. 1994: *Natural Hazards*, Oxford University Press, Melbourne: 174p.
- Chapman J.L. and Reiss, M.J. 1993: *Ecology: Principles and Applications*, Cambridge University Press, Cambridge: 294p.
- Dasgupta, P. and Miller, K.G. 1997 : *The Environment and Emerging Development Issues*, Volumes I and 2, Clarendon Press, Oxford: 593p.
- Elsom, D.M. 1992 : *Atmospheric Pollution: A Global Problem*, 2nd edition, Blackwell Pub. Co., London: 422p.
- Falconer, R.A. and Goodwin, P. (editor) 1994 : *Wetland Management*, Thomas Telford, London: 289p.
- Farmer, A. 1997 : *Managing Environmental Pollution*, Routledge, London: 246p.
- Gilpin, A. 1996 : *Dictionary of Environment and Sustainable Development*, John Wiley and Sons Ltd., Chichester: 147p.
- Marsh, W.M. and Grossa, J.M. 1996: *Environmental Geography: Science, Landuse and Earth Systems*, John Wiley and Sons Inc., New York: 416p.
- Masters, G .M. 1991 : *Introduction to Environmental Engineering and Sciences*, Prentice Hall India Ltd. New Delhi: 460p.
- Middleton N. 1995 : *The Global Casino: An Introduction to Environmental Issues*, John Wiley and Sons Inc., New York: 332p.
- 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.
- Singh, R.B. and Misra, S. 1996 : *Environmental Laws in India: Issues and Responses*, Rawat Pub., New Delhi: 303p.
- 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. 55
- Wall, D. 1994 : *Green History: A Reader in Environmental literature*, Philosophy and Politics, Routledge, London: 273p.
- Whyte, ill. 1995 : *Climate Change and Human Society*, Arnold, London: 217p.
- Woodward, F.I. 1992 : *Global Climatic Change: The Ecological Consequences*, Academic Press, London: 337p.
- Hardoy, J .E Mittin, D. & Satterthwaite, D. 1992 : *Environment Problems in the World Cities*, Earthscan Pub. Ltd. London:

## **/// PAPER-III : SETTLEMENT STUDY & POPULATION STUDY**

- Ahmad, A. 1993 : *Social Structure and Regional Development*, Rawat Pub. Co., New Delhi: pp 1-16,17-77, 129-157.
- Blunden, J., Haggett, P., Harnnett, C. and Sarre, P. ( 1985): *The Fundamentals of Human Geography*, Harper and Row, New York: pp 7-17,27-33.
- Carter, J. And Jones, T. 1989 : *Social Geography: An Introduction to Contemporary Issues*, Edward Arnold, London: 259p.
- De Blij H.J. 1995 : *The Earth: An Introduction to its Physical and Human Geography*, John Wiley and Sons Inc., New York: 468p.
- De Blij H.J. 1996: *Human Geography: Culture, Society and Space*, John Wiley and Sons Inc., New York: 531 p.
- Dickinson, R.E. 1968 : *City and Region: A Geographical Interpretation*, Routledge and Kegan Paul Ltd. London.
- Ghosh, S. 1998: *Introduction to Settlement Geography*, Orient Longman Ltd., Calcutta: 158p.
- Hardoy, J .E., Mittin, D. & Satterthwaite, D. 1992 : *Environment Problems in the World Cities*, Earthscan Pub. Ltd. London.
- Hudson, F.S. 1970: *Geography of Settlements*, Macdonald and Evans Ltd., Plymouth: 3-12,61-70, 79-101, 141-145,217-230.
- Hussain, M. 1994: *Human Geography*, Rawat Pub. Co., New Delhi: 485p.
- Mandal, R.B. 1988 : *Systems of Rural Settlements in Developing Counties*, Concept Pub. Co., New Delhi.
- 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.
- Ramachandran R. 1989 : *Urbanisation arid Urban Systems in India*, Oxford University Press, New Delhi.
- Singh, R.L. et. al. (ed) 1976: *Geographic Dimensions of Rural Settlements*, National Geographical Society of India, Varanasi.
- Singh, R. Y. ( 1994 ) : *Geography of Settlements*, Rawat Pub. Co., New Delhi: 335p.
- Tewari, V. Weinston, J. and Prakash Rao, V.L.S. 1986 : *Indian Cities: Ecological Perspectives*, Concept Pub. Co., New Delhi. pp 1-2, 85, 221-273.

## **/// PAPER IV: LANDUSE PLANNING AND MANAGEMENT, RESOURCE USE & MANAGEMENT**

### **Landuse Planning and Management**

- Chitambar, J.B. 1993: *Introductory Rural Sociology*, Wiley Eastern, New Delhi: pp 129-285.
- Goomen, M.A. and Datta, A. 1995 : *Panchayats and their Finance*, Rawat Pub. Co., New Delhi: 76p.
- Institute of Social Sciences 1994: *Decentralised Planning and Panchayati Raj*, Rawat Pub. Co., New Delhi: 64p.
- Mandal, R..B. 1988 : *Systems of Rural Settlements in Developing Counties*, Concept Pub. Co., New Delhi: 103
- Matthews G. (editor) 1995 : *Status of Panchayati Raj*: 1994, Institute of Social Sciences / Rawat Pub. Co., New Delhi: 232p.
- Matthews a. 1994: *Panchayati Raj: From Legislation to Movements*, Rawat Pub. Co., New Delhi: 130p.
- Misra, H.M. (ed) 1987 : *Contributions to Indian Geography*, Volume 9: Rural Geography, Heritage Pub., New Delhi.
- 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.
- Singh, R.L. (editor) 1971 : *India: A Regional Geography*, National Geographical Society of India / UBS Pub. Distributors Ltd., New Delhi: 992p.
- Spate, O.H.K. and Learmonth, A. T.A. 1967 : *India and Pakistan*, 3rd edition, Munshiram Monoharlal Pub. Pvt. Ltd., New Delhi: 877p.

### **Resource Use & Management**

- Brereton, E. 1992 : *Resource Use and Management*, Cambridge University Press, Cambridge: 118p.
- Elliotte, j. A. 1994 : *An Introduction to Sustainable Development: The Developing World*, Routledge, London: 121 p.
- Mitchell, B. 1997 : *Resources and Environment Management*, Addison Wesley Lon~an Ltd., Harlow: 298p.
- Pickering, K. and Owen, L.A. 1997 : *An Introduction to Global Environmental Issues*, 2nd edition, Routledge, London: 345p.
- Johnston, R.J., Taylor, P.J. and Watts, M.J. (editors) : 1995: *Geographies of Global Change: Remapping the World in the Late Twentieth Century*, Blackwell, Oxford: 440p.
- United Nations Populations Fund 1997 : *India Towards Population and Development Goals*, Oxford University Press, New Delhi: 194p.
- Unwin, T. (editor) 1994: *Atlas of World Development*, John Wiley and Sons Ltd., Chichester: 364p.
- World Bank 1996: *From Plan to Market: World Development Report 1996*, Oxford University Press, Oxford: 241 p.
- World Resources Institute 1998: *World Resources 1998-99: A Guide to the Global Environment*, Oxford University Press, Oxford: 369p

## **/// PAPER-V : (PRACTICAL PAPER)**

### **GROUND SURVEY AND AERIAL PHOTO-INTERPRETATION; QUANTITATIVE METHODS IN GEOGRAPHY**

- Allison, L.J., Schnapf, A.(1983) Meteorological satellites: In Colwell, R.N.(ed.) *Manual of Remote Sensing* (2nd edn). American Society of Photogrammetry, Falls Church, Virginia, pp.651-79
- A.S.P. (1981) *Manual of Photogrammetry* (4th edn). American Society of Photogrammetry, Falls Church, Virginia.
- Alvi, Z. 1995 : *Statistical Geography: Methods and Applications*, Rawat Pub. New Delhi: 194p.
- Beaumont, J.R. and Williams, S.W. 1983 : *Project Work in the Geography Curriculum*, Croom Helm, London: 332p.
- 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, Virginia, pp.231-91
- Curran, P.J. (1988) *Principles of Remote Sensing*, ELBS Edn. Longman Group UK Ltd.
- Elfic, M.H., Fryer, J.G. Brinkner, R.C. and Wolf, P.R. 1994: *Elementary Surveying*, 8th edition, Harper Collins Publishers, London: 510 p.
- Guha, P.K. (2003) *Remote Sensing for the Beginner*, Affiliated East-West Press Pvt. Ltd., New Delhi
- Houghton, J.T., Cook, A.H. and Charnock, H.(1983) *The study of Land surface from satellites*. The Royal Society of London (first published in *Philosophical Transactions of the Royal Society*, Series A, 309, pp. 241-464)
- Hussain, S.K. and Nagaraj, M.S. 1992 : *Text Book of Surveying*, S. Chand & Co. Ltd., New Delhi:



- Kanetkar, T.P. and Kulkarni, S. V. 1988 : *Surveying and Levelling*, Part I, Pune Vidyarthi Griha Prakashan, Pune: 608p.
- Kellaway, G.P. 1979 : *Map Projections*, 1st Indian edition, B.I. Publication, Delhi.
- Kochher, C.L. 1993 : *A Text Book of Surveying*, S.K. Kataria & Sons, Delhi:
- Lillesand, T.M. and Kiefer, R. W. 2003 : *Remote Sensing and Image Interpretation*, 5th edition, John Wiley and Sons, New York:
- Marcolongo, B. And Mantorani, F. 1997 : *Photogeology: Remote Sensing Application in Earth Science*, Oxford and IBH Pub. Pvt. Ltd., New Delhi: 195p.
- Monkhouse F.J. and Wilkinson, H.R. 1971. : *Maps and Diagrams: Their Compilation and Construction*, B.I. Publications Private Limited, New Delhi: 527p.
- Pal, S.K. 1999 : *Statistics for Geoscientists*, Concept publishing Company, New Delhi: 423p.
- Parsons, T. and Knight, P.1995 : *How To Do .Your Dissertation in Geography and Allied Disciplines*. Chapman and Hall, London. 151 p.
- 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:
- Sheffield, C. (1983) *Man on Earth*, Sidgwick and Jackson, London
- Shepherd, F.A. 1983 : *Engineering Surveying*, Edward Arnold, London:
- Slater, P.N. (1983) *Photographic systems for remote sensing*
- Silk, J. 1979 : *Statistical techniques in Geography*, George Allen and Unwin, London: 276p:
- Singh, N. Surveying, Tata McGraw-Hill Publishing Company Ltd., New Delhi:
- Singh, R.L. and Singh, R.P.B. 1991 : *Elements of Practical Geography*, Kalyani Pub. New Delhi: 421p.
- Steers, J.A. 1965 : *An Introduction to Map Projections*, 14th ion, University of London Press, London:
- Venkatramaiah, C. 1996 : *A Textbook of Surveying*, Universities Press / Orient Longman Ltd., Hyderabad: 76p.
- Walford, P.,1995: *Geographical Data Analysis*, John Wiley and Sons Inc., New York: 446p.

## PART II

### /// PAPER-VI : GEOGRAPHICAL THOUGHTS; REGIONAL DEVELOPMENT & MULTILEVEL PLANNING

#### GEOGRAPHICAL THOUGHTS

- Adhikari, S. 1992 : *Geographical Thought*, Chaitanya Pub. House, Allahabad: 272p.
- Binege, W. 1962 : *Theoretical Geography*, Glenerp, London: 897p.
- Chorley, R.J. and Hagget, P. (editors) 1965 : *Frontiers in Geographical Teaching*, OUP, Oxford: 231p.
- Dikshit, R.D. (editor) 1994 : *The Art and Science of Geography: Selected Readings*, Prentice Hall India Ltd., New Delhi: 195p.
- Dunbar, G.S. (editor) 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.

#### REGIONAL DEVELOPMENT & MULTILEVEL PLANNING

- Chitambar, J.B. 1993: *Introductory Rural Sociology*, Wiley Eastern, New Delhi: pp 129-285.
- Goomen, M.A. and Datta, A. 1995 : *Panchayats and their Finance*, Rawat Pub. Co., New Delhi: 76p.
- Institute of Social Sciences 1994: *Decentralised Planning and Panchayati Raj*, Rawat Pub. Co., New Delhi: 64p.
- Mandal, R..B. 1988 : *Systems of Rural Settlements in Developing Counties*, Concept Pub. Co., New Delhi: 103
- Matthews G. (editor) 1995 : *Status of Panchayati Raj*: 1994, Institute of Social Sciences / Rawat Pub. Co., New Delhi: 232p.
- Matthews a. 1994: *Panchayati Raj: From Legislation to Movements*, Rawat Pub. Co., New Delhi: 130p.
- Misra, H.M. (ed) 1987 : *Contributions to Indian Geography*, Volume 9: Rural Geography, Heritage Pub., New Delhi.
- 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.
- Singh, R.L. (editor) 1971 : *India: A Regional Geography*, National Geographical Society of India / UBS Pub. Distributors Ltd., New Delhi: 992p.
- Spate, O.H.K. and Learmonth, A. T.A. 1967 : *India and Pakistan*, 3rd edition, Munshiram Monoharlal Pub. Pvt. Ltd., New Delhi:

## **PAPER-VII : GLOBAL ENVIRONMENTAL ISSUES - POLLUTION AND HAZARDS; POLITICAL AND ECONOMIC GEOGRAPHY**

### **Global Environmental Issues - pollution and Hazards**

- Adams, W.M. 1995 : *Green Development: Environmental Sustainability in the Third World*, Routledge, London: pp 1-8,87-139.
- Alexander, D. 1993: *Natural Disasters*, Research Press, New Delhi: 619p.
- Allaby, M. 1996 : *Basics of Environmental Science*, Routledge, London: 297p.
- Baarsches, W.H. 1996 : *Eco-facts and Eco-fiction: Understanding the Environmental Debate*, Routledge, London: 264p.
- Blaikie, P., Cannon, To Davis, I. and Wisener, 1994: *At Risk: Natural Hazards, People's Vulnerability and Disasters*, Routledge, London: 320p.
- Bryant, E.A. 1991 : *Natural Hazards*, Cambridge University Press, Cambridge: 294p.
- Canter, L. W. 1996 : *Environmental Impact Assessment*, 2nd edition, McGraw Hill, New York: 660p.
- Chapman, D. 1994: *Natural Hazards*, Oxford University Press, Melbourne: 174p.
- Chapman J.L. and Reiss, M.J. 1993: *Ecology: Principles and Applications*, Cambridge University Press, Cambridge: 294p.
- Chhatwal, G.R., Mensa, M.C., Satke, M., Katyal, T., Katyal, Mo, and Nagahiro, T. 1989 : *Environmental Noise Pollution and its Control*, Anmol Pub. Pvt. Ltd., New Delhi: 301p.
- CoIlS, J. 1997: *Air Pollution: An Introduction*, E & FN Spon / Chapman and Hall, London: 314p.
- Dasgupta, P. and Mller, K.G. 1997 : *The Environment and Emerging Development Issues*, Volumes I and 2, Clarendon Press, Oxford: 593p.
- Elsom, D.M. 1992 : *Atmospheric Pollution: A Global Problem*, 2nd edition, Blackwell Pub. Co., London: 422p.
- Falconer, R.A. and Goodwin, P. (editor) 1994 : *Wet and Management*, Thomas Telford, London: 289p.
- Farmer, A. 1997 : *Managing Environmental Pollution*, Routledge, London: 246p.
- Gilpin, A. 1996 : *Dictionary of Environment and Sustainable Development*, John Wiley and Sons Ltd., Chichester: 147p.
- Gilpin, A. 1997 : *Environmental Impact Assessment: Culling Edge for the Twenty-first Century*, Cambridge University Press, Cambridge: 181p.
- Goel, P.K. 1997: *Water Pollution: Causes, Effects and Controls*, New Age International (P) Ltd. Pub. New Delhi: 169p.
- Goudie, A. 1986: *The Human Impact on the Natural Environment*, 2nd edition, Blackwell Pub. Co., London: 337p.
- Marsh, W.M. and Grossa, J.M. 1996: *Environmental Geography: Science, Landuse and Earth Systems*, John Wiley and Sons Inc., New York: 416p.
- Masters, G .M. 1991 : *Introduction to Environmental Engineering and Sciences*, Prentice Hall India Ltd. New Delhi: 460p.
- Middleton N. 1995 : *The Global Casino: An Introduction to Environmental Issues*, John Wiley and Sons Inc., New York: 332p.
- 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.
- Singh, R.B. and Misra, S. 1996 : *Environmental Laws in India: Issues and Responses*, Rawat Pub., New Delhi: 303p.
- 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. 55
- Wall, D. 1994 : *Green History: A Reader in Environmental literature*, Philosophy and Politics, Routledge, London: 273p.
- Wathern, P. (editor) 1988 : *Environmental Impact Assessment: Theory and Practice*, Routledge, London: 332p.
- Whyte, ill. 1995 : *Climate Change and Human Society*, Arnold, London: 217p.
- Woodward, F.I. 1992 : *Global Climatic Change: The Ecological Consequences*, Academic Press, London: 337p.
- Hardoy, J .E Mittin, D. & Satterthwaite, D. 1992 : *Environment Problems in the World Cities*, Earthscan Pub. Ltd. London:

### **Political and Economic Geography**

- Hartshorn and Alexander, 1988: *Economic Geography*, 3rd edition, Prentice- Hall India Ltd., New Delhi
- Leong, G.C. and Morgan, G.C. 1982, *Human and Economic Geography*, 2nd edition, Oxford University Press, Oxford: 662p.
- Mamoria, C.B. 1996 : *Economic and Commercial Geography of India*, Revised edition, Shivalal Aggarwala and Co., Agra: 566p.
- Guha, J .L. and Chattoraj, P.R. 1998 : *A New Approach to Economic Geography: A Study of Resources*, 15<sup>th</sup> edition, World Press, Calcutta: 849p.
- Shanna, T. C. and Coutinho, O. 1998 : *Economic and Commercial Geography of India*, 3rd edition, Vikash Pub. House Pvt. Ltd., New Delhi. 392p.

## /// PAPER-VIII, IX : MODULES – 15, 16, 17 (ELECTIVE SPECIAL PAPERS)

### Option-1: Advanced Agricultural Geography and Advanced Pedology

#### Advanced Agricultural Geography

- Briggs, D. 1985: *Agriculture and Environment*, Longman, London: pp 1- 40, 143-306.
- Husain, M. 1996 : *Systematic Agricultural Geography*, Rawat Pub. New Delhi: 430p. ,
- Joy, T.V. 1990: *Agricultural Ecology*, Longman, London: pp 1-243,244- 261.
- McLaren, R.G. and Cameron, K.C. 1996 : *Soil Science, Sustainable Production and Environmental Protection*, 2nd edition, Oxford University Press, Auckland: 304p.
- Singh, J. and Dhillon, S.S. 1984: *Agricultural Geography*, 2nd edition, Tata McGraw-Hill, New Delhi, 443p.
- Mitchell, C. W. 1991: *Terrain Evaluation: An Introductory Handbook to the History Principles and Methods of Practical Terrain Analysis*, 2nd edition, Longman Science & Technical, London: 441 p.
- Wigley, G. 1981: *Tropical Agriculture: The Development of Production*, 4th edition, Arnold, London: 96p.

#### Advanced Pedology

- A.G. Pimente, J. D. (editor) 1993 : *World Soil Erosion and Conservation*, Cambridge University Press, Cambridge: 349p.
- Biswas, T.D. and Mukherjee, S.K. 1987 : *Textbook of Soil Science*, Tata-McGraw-Hill, 314p.
- Brady, N.C. and Weil, R.R. 1996 : *The Nature and Properties of Soil*, 11th edition, Longman, London: 740p.
- Coleman, D.C. and Crosby, J. 1996 : *Fundamentals of Soil Ecology*, Academic Press, San Diego: 203p.
- Ellis, S. and Mellor, R. 1995 : *Soils and Environment*, Routledge, London: 364p.
- Floth, H.D. 1990 : *Fundamentals of Soil Science*, 8th edition, John Wiley and Sons, New York: 360p.
- Mitchell, C. W. 1991 : *Terrain Evaluation: An Introductory Handbook to the History, Principles and Methods of Practical Terrain Analysis*, 2nd edition, Longman Science & Technical, London: 441 p.
- Morgan, R.P.C. 1995 : *Soil Erosion and Conservation*, 2nd edition, Longman, London: 198p.
- Schwab, G.O., Fangmeir, D.D. and Elliot, W.J. 1996 : *Soil and Water Management Systems*, 4th edition, John Wiley and Sons Inc., New York: 371p. I
- 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.

### Option-2: Coastal Management

- Bird, E.C.F. 2000. *An Introduction to Coastal Geomorphology*, John Wiley and Sons Ltd, New York: 340 p. [Topics 2.3, 4.4]
- Carter, R.W.G. 1988. *Coastal Environments: An Introduction to the Physical, Ecological and Cultural Systems of Coastlines*, Academic Press, London: 617p. [Topic 2.3]
- Chow, V.T, Maidment, D.R. and Mays, L.W. 1988. *Applied Hydrology*, McGraw-Hill, New York: 572 p. [Topic 3.2]
- Garrison, T. 1993. *Oceanography: An Invitation to Marine Science*, Wadsworth Pub. Co., Belmont: 540 p. [Topics 4.1, 4.2, 4.3]
- Johnson, H.D. and Baldwin, C.T. 1996. 'Shallow clastic seas.' In Reading H.G. (editor): *Sedimentary Environments: Processes, Facies and Stratigraphy*, 3rd edition, Blackwell Science Ltd. Oxford: pp 232–280. [Topic 2.3]
- Knighton, D. 1998 : *Fluvial Forms and Processes: A New Perspective*, Arnold, London: 385p. [Topics 2.1, 2.2]
- Morisawa, M. 1985. *Rivers*, Longman, London: 222p. [Topics 2.1, 2.2, 3.1]
- Murthy, K.S. 1998. *Watershed Management in India*, 3rd edition, Wiley Eastern Ltd. / New Age International Ltd., New Delhi: 198p. [Topic 3.4]
- Newson, M. 1992. *Land Water and Development, River Basin Systems and their Sustainable Management*, Routledge, London: 350p. [Topic 3.4]
- Pethick, J. 1984. *An Introduction to Coastal Geomorphology*, Edward Arnold, London: 259 p. [Topics 2.3, 4.4]
- Petts, G.E. and Amoros, C. (editors) 1996. *Fluvial Hydrosystems*, Chapman and Hall, London: 322p. [Topics 1.2, 2.2]
- Pirazzoli, P.A. 1996. *Sea Level Changes: The Last 20,000 Years*, Routledge, London: 224p. [Topic: 4.4]
- Price, M. 1996. *Introducing Groundwater*, 2nd edition, Chapman & Hall, London: 224p. [Topic 3.2]
- Seibold, E. and Berger, W.H. 1996. *The Sea Floor: An Introduction to Marine Geology*, 3rd edition, Springer-Verlag, Berlin: 354p. [Topic 4.1]
- Wilby, R. 1996. *Contemporary Hydrology*, Wiley, Chichester: 250p. [Topic 3.2]

### Option-3: Regional and Urban Planning

- Carter, H. 1981 : *Urban Geography*, 3rd 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 Kegan Paul Ltd. London.
- Ghosh, S. 1998: *Introduction to Settlement Geography*, Orient Longman Ltd., Calcutta: 158p.
- Hardoy, J. E., Mittin, D. & Satterthwaite, D. 1992 : *Environmental Problems in the World Cities*, Earthscan Pub. Ltd. London.
- Hudson, F.S. 1970: *Geography of Settlements*, Macdonald and Evans Ltd., Plymouth: 3-12,61-70, 79-101, 141-145,217-230.
- Knox, P. 1982: *Urban Social Geography*, Longman Scientific and Technical, Harlow.
- Mandal, R.B. 1988 : *Systems of Rural Settlements in Developing Countries*, Concept Pub. Co., New Delhi.
- 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.
- Ramachandran R. 1989 : *Urbanisation and Urban Systems in India*, Oxford University Press, New Delhi.
- Singh, R.L. et. al. (ed) 1976: *Geographic Dimensions of Rural Settlements*, National Geographical Society of India, Varanasi.
- Singh, R.L. (editor) 1971 : *India: A Regional Geography*, National Geographical Society of India / UBS Pub. Distributors Ltd., New Delhi: 992p.
- Singh, R. Y. ( 1994) : *Geography of Settlements*, Rawat Pub. Co., New Delhi: 335p.
- 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. pp 1-2, 85, 221-273.

## Option-4: Remote Sensing & GIS

- American society of photogrammetry (ASP), Manual of remote sensing, second edition, ASP, Falls church,VA,1983
- American society of photogrammetry (ASP), Multilingual dictionary of remote sensing and photogrammetry, ASP, Falls church,VA,1983
- American society for photogrammetry and remote sensing, glossary of mapping science, ASPRS,Bethesda, MD,1994
- American society of photogrammetry and remote sensing, remote sensing for the earth science, manual of remote sensing,3<sup>rd</sup> ed.,vol.3,woe;u,New York,1999
- American society for photogrammetry and remote sensing, remote sensing core curriculum, on the internet at <http://www.asprs.org>.
- Allison, L.J., Schnapf, A.(1983) Meteorological satellites: In Colwell, R.N.(ed.) Manual of Remote Sensing (2nd edn). American Society of Photogrammetry, Falls Church, Virginia, pp.651-79
- A.S.P. (1981) Manual of Photogrammetry (4th edn). American Society of Photogrammetry, Falls Church, Virginia.
- Avery,T.E.,and G.L.Berlin, Fundamental of remote sensing and airphoto interpretation,5<sup>th</sup> ed, Macmillan, New York,1992
- Barrett,E.C., and L.F.Curtis, Introduction to environmental remote sensing, 3<sup>rd</sup> ed, Chapman and Hall, New York,1992
- Billingsley, F.C. (1983) Data processing and reprocessing: In Colwell, R.N.(ed.) Manual of Remote Sensing (2nd edn). American Society of Photogrammetry, Falls Church, Virginia, pp. 719-92.
- Bukata,R.P., et al., Optical properties and remote sensing of Inland and coastal waters, CRC press, New York,1995
- Burrough, P.A.,Principles of geographical information system for land resources assessment, 2<sup>nd</sup> ed., Oxford University press, New York,1998
- Campbell, J .B. 1996 : *Introduction to Remote Sensing*, 2nd edition, Taylor & Francis, London: 622p.
- Canada Center for Remote Sensing, Remote Sensing Tutorial
- 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.
- Chrisman, N.R. (1997) Exploring Geographic Information Systems. John Wiley andSons.
- Cracknell, A.P., and L.W.B.Hayes, Introduction to remote sensing, Taylor and Francis, Washington, DC,1991
- DeMers, M.N.,Fundamentals of geographic information system, Wiley, New York, 1997
- Curran, P.J. (1988) Principles of Remote Sensing, ELBS Edn. Longman Group UK Ltd.
- Curran, P.J. (1980) Multispectral remote sensing of vegetation amount, Progress in Physical Geography, 4:315
- David J Maguire, Michael F Goodchaid and David W Rahind., 1991, Geographical Information System, Ed.
- Ian Masser & Michael Blakemore., 1991, Handling Geographical Information : Methodology and Potential Applications, Ed.
- Foresman,T.W.(ed)History of GIS, Prentice-Hall, Upper saddle river, NJ,1998
- Gerstl, S.A., 1990. Physics concept of optical radar reflectance signatures. A summary review, International journal of remote sensing, vol 11,no 7
- Guha, P.K. (2003) Remote Sensing for the Beginner, Affiliated East-West Press Pvt. Ltd., New Delhi
- Gunter Sieber, - Satellite Geodesy
- Houghton, J.T., Cook, A.H. and Charnock, H.(1983) The study of Land surface from satellites. The Royal Society of London (first published in Philosophical Transactions of the Royal Society, Series A, 309, pp. 241-464)
- <http://tsc.wes.army.mil/gps/whatisgps.htm>
- Humhold.W.E., 1991. An introduction to urban geographic information system, Oxford University press, New York
- Huxhold, W.E. (1991) *An Introduction to Urban Information Systems*. New York, OUP.
- Japan Association of Remote Sensing, Fundamentals of Remote Sensing
- John, R. J., Introductory Digital Image Processing – A Remote Sensing Perspective, Prentice Hall Series
- Jensen, J.R., 2000. Remote sensing of the environment: An earth resource perspective, Prentice Hall, Upper saddle river, NJ,
- Joseph, George, (2003), Fundamental of Remote Sensing, University Press (India) Pvt. Ltd, Orient Longman Pte. Ltd., Hyderabad,

India

- Laurini, R. and Thompson, D. (1992) *Fundamentals of Spatial Information Systems*. London, Academy Press.
- Lillesand, T.M. and Kieffer, R.W., 2003. *Remote Sensing and Image Interpretation*, 5<sup>th</sup> Edition., Wiley, New York
- Maguire, D.J., Goodchild, M.F. and Rhind, D.W. (eds.) (1991) *Geographical Information Systems: Principles and Applications*. Avon, Longman Scientific and Technical.
- 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.
- Peuquet, D.J. and Marble, D.F. (eds.) (1990) *Introductory Readings in Geographic Information Systems*. London, Taylor and Francis.
- Rajan, M.S. 1995 : *Space Today*, 2nd edition, National Book Trust, New Delhi, 344p.
- Rao, U .R. 1996 : *Space Technology for Sustainable Development*, Tata McGraw-Hill, New Delhi: 564p.
- Robert A. Schowengerdt, *Techniques for Image Processing and Classification in Remote Sensing*, (Academic Press, Inc).
- Sabins, F.F., 1997 : *Remote Sensing: Principles and Applications*, 3rd edition, W.H. Freeman & Company, New York: 494p.
- Sheffield, C. (1983) *Man on Earth*, Sidgwick and Jackson, London
- Slater, P.N. (1983) *Photographic systems for remote sensing*
- Singapore Science Center, *Principles of Remote Sensing*
- Star, J. and Estes, J. (1990) *Geographical Information Systems: An Introduction*. Englewoods Cliffs, New Jersey, Prentice Hall.
- Townshend, J.R.G. (1981) *Image analysis and interpretation for land resources survey*
- Townshend, J.R.G. (ed.) *Terrain Analysis and Remote Sensing*, Allen & Unwin, London; Boston, pp. 59-108
- Ulaby, F.T., Moore, R.K. and Fung, A.K. (1981) *Microwave Remote Sensing, Active and Passive, Volume I, Fundamentals and Radiometry*. Addison-Wesley, Reading, Massachusetts; London.
- Ulaby, F.T., Moore, R.K. and Fung, A.K. (1982) *Microwave Remote Sensing Active and Passive, Volume II, Radar Remote Sensing and Surface Scattering and Emission Theory*. Addison-Wesley, Reading, Massachusetts; London.
- [www.trimble.com/index.htm](http://www.trimble.com/index.htm)

### Option-5: Rural Development

- 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.
- Chitambar, J.B. 1993: *Introductory Rural Sociology*, Wiley Eastern, New Delhi: pp 129-285.
- Goomen, M.A. and Datta, A. 1995 : *Panchayats and their Finance*, Rawat Pub. Co., New Delhi: 76p.
- Institute of Social Sciences 1994: *Decentralised Planning and Panchayati Raj*, Rawat Pub. Co., New Delhi: 64p.
- Mandal, R..B. 1988 : *Systems of Rural Settlements in Developing Counties*, Concept Pub. Co., New Delhi: 103
- Matthews G. (editor) 1995 : *Status of Panchayati Raj*: 1994, Institute of Social Sciences / Rawat Pub. Co., New Delhi: 232p.
- Matthews a. 1994: *Panchayati Raj: From Legislation to Movements*, Rawat Pub. Co., New Delhi: 130p.
- Misra, H.M. (ed) 1987 : *Contributions to Indian Geography*, Volume 9: Rural Geography, Heritage Pub., New Delhi.
- Singh, R.L. (editor) 1971 : *India: A Regional Geography*, National Geographical Society of India / UBS Pub. Distributors Ltd., New Delhi: 992p.
- Spate, O.H.K. and Learmonth, A. T.A. 1967 : *India and Pakistan*, 3rd edition, Munshiram Monoharlal Pub. Pvt. Ltd., New Delhi: 877p.

### /// PAPER- IX : MODULES – 18 REMOTE SENSING & GIS

- American society of photogrammetry (ASP), *Manual of remote sensing*, second edition, ASP, Falls church,VA,1983
- Burrough, P.A., *Principles of geographical information system for land resources assessment*, 2<sup>nd</sup> ed., Oxford University press, New York,1998
- Campbell, J .B. 1996 : *Introduction to Remote Sensing*, 2nd edition, Taylor & Francis, London: 622p.
- Canada Center for Remote Sensing, *Remote Sensing Tutorial*
- 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.
- Chrisman, N.R. (1997) *Exploring Geographic Information Systems*. John Wiley and Sons.
- Cracknell, A.P., and L.W.B.Hayes, *Introduction to remote sensing*, Taylor and Francis, Washington, DC,1991
- DeMers, M.N., *Fundamentals of geographic information system*, Wiley, New York, 1997
- Curran, P.J. (1988) *Principles of Remote Sensing*, ELBS Edn. Longman Group UK Ltd.
- Ian Masser & Michael Blakemore., 1991, *Handling Geographical Information : Methodology and Potential Applications*, Ed.
- Gerstl, S.A., 1990. *Physics concept of optical radar reflectance signatures. A summary review*, International journal of remote sensing, vol 11,no 7
- Guha, P.K. (2003) *Remote Sensing for the Beginner*, Affiliated East-West Press Pvt. Ltd., New Delhi
- Japan Association of Remote Sensing, *Fundamentals of Remote Sensing*

John, R. J., Introductory Digital Image Processing – A Remote Sensing Perspective, Prentice Hall Series  
Jensen, J.R., 2000. Remote sensing of the environment: An earth resource perspective, Prentice Hall, Upper saddle river, NJ,  
Joseph, George, (2003), Fundamental of Remote Sensing, University Press (India) Pvt. Ltd, Orient Longman Pte. Ltd., Hyderabad, India  
Lillesand, T.M. and Kieffer, R.W., 2003. Remote Sensing and Image Interpretation, 5<sup>th</sup> Edition., Wiley, New York  
Martin, D. (1991) *Geographical Information Systems and their Socioeconomic Applications*. London, Routledge.  
Rajan, M.S. 1995 : *Space Today*, 2nd edition, National Book Trust, New Delhi, 344p.  
Rao, U .R. 1996 : *Space Technology for Sustainable Development*, Tata McGraw-Hill, New Delhi: 564p.  
Robert A. Schowengerdt, Techniques for Image Processing and Classification in Remote Sensing, (Academic Press, Inc).  
Sabins, F.F., 1997 : *Remote Sensing: Principles and Applications*, 3rd edition, W.H. Freeman & Company, New York: 494p.  
Ulaby, F.T., Moore, R.K. and Fung, A.K. (1982) *Microwave Remote Sensing Active and Passive, Volume II, Radar Remote Sensing and Surface Scattering and Emission Theory*. Addison-Wesley, Reading, Massachusetts; London.

## **/// PAPER-X : COMPUTER APPLICATIONS – NUMERICAL DATA PROCESSING & METHODOLOGY ENVIRONMENTAL RESEARCH & THEMATIC MAPPING OF ENVIRONMENTS**

Alvi, Z. 1995 : *Statistical Geography: Methods and Applications*, Rawat Pub. New Delhi: 194p.  
Pal, S.K. 1999 : *Statistics for Geoscientists*, Concept publishing Company, New Delhi: 423p.  
Silk, J. 1979 : *Statistical techniques in Geography*, George Allen and Unwin, London: 276p:  
Walford, P.,1995: *Geographical Data Analysis*, John Wiley and Sons Inc., New York: 446p.