

**M.SC SYLLABUS IN GEOGRAPHY**  
**CHOICE BASED CREDIT SYSTEM(CBCS)**

(EFFECTIVE FROM THE ACADEMIC SESSION 2017-18)



**DEPARTMENT OF GEOGRAPHY**  
**RAIGANJ UNIVERSITY**

**COLLEGE PARA, P.O, RAIGANJ**  
**DIST. UTTAR DINAJPUR**  
**PIN – 733 134**

**PROFORMA FOR THE SCHEME OF STUDY & EXAMINATION OF CHOICE  
BASED CREDIT SYSTEM, MASTER OF SCIENCE IN GEOGRAPHY**

**SEMESTER - I**

Code/Module	Title of the paper	Type	Duration of Examination (hour)	End-term Assessment	Internal Assessment	Total Marks	Credit
PGGEOCCT - 101	Geotectonic and Geomorphology	Theory	2	38	12	50	3+1= 4
PGGEOCCT- 102	Soil and Biogeography	Theory	2	38	12	50	3+1= 4
PGGEOCCT- 103	Economic Geography	Theory	2	38	12	50	3+1= 4
PGGEOCCT- 104	Settlement Geography	Theory	2	38	12	50	3+1= 4
PGGEOCCGP -105	General Practical	Practical	5	100	--	100	8
PGGEOIDC-1	-	Theory	3	75	75	100	6+2=8
			--	335	115	400	32

Notes: PG - Post Graduation; GEO - Geography; CC - Core Course; T - Theory; GP - General Practical; IDC - Inter-disciplinary Course

**SEMESTER - II**

Code/Module	Title of the paper	Type	Duration of Examination (hour)	End-term Assessment	Internal Assessment	Total Marks	Credit
PGGEOCCT- 201	Climatology	Theory	2	38	12	50	3+1= 4
PGGEOCCT - 202	Hydrology and Oceanography	Theory	2	38	12	50	3+1= 4
PGGEOCCT - 203	Social and Cultural Geography	Theory	2	38	12	50	3+1= 4
PGGEOCCT - 204	Remote Sensing and Geographical Information System	Theory	2	38	12	50	3+1= 4
PGGEOCCGP -205	General Practical	Practical	5	100	--	100	8
PGGEOIDC-2	--	Theory	3	75	75	100	6+2=8
			--	335	115	400	32

Notes: PG - Post Graduation; GEO - Geography; CC - Core Course; T - Theory; GP - General Practical; IDC - Inter-disciplinary Course.

### SEMESTER - III

Code/Module	Title of the paper	Type	Duration of Examination (hour)	End-term Assesment	Internal Assesment	Total Marks	Credit
PGGEOCCT-301	Tourism Geography	Theory	2	38	12	50	3+1= 4
PGGEOCCT-302	Regional Geography of India	Theory	2	38	12	50	3+1= 4
PGGEOCCT-303	Population Geography	Theory	2	38	12	50	3+1= 4
PGGEOCCT-304	Geographical Thought	Theory	2	38	12	50	3+1= 4
PGGEOCCCE-305	Seminar and Group Discussion	--	--		100	100	8
PGGEOCCGP-306	General Practical	Practical	5	100	--	100	8
Total			--	335	115	400	32

Notes: PG - Post Graduation; GEO - Geography; CC- Core Course; T - Theory; CE - Continuing Evaluation; GP - General Practical; IDC - Inter-disciplinary Course

### SEMESTER - IV

Code/Module	Title of the paper	Type	Duration of Examination (hour)	End-term Assesment	Internal Assesment	Total Marks	Credit
PGGEOCCT-401	Regional Planning and Development	Theory	2	38	12	50	3+1= 4
PGGEOCCT-402	Special Course*	Theory	2	38	12	50	3+1= 4
PGGEOCCT-403	Special Course*	Theory	2	38	12	50	3+1= 4
PGGEOCCT-404	Special Course*	Theory	2	38	12	50	3+1= 4
PGGEOCCT-405	Special Course Practical	Practical	3	50	--	50	4
PGGEOCCT-406	General Practical	Practical	3	50	--	50	4
PGGEOCCT-407	Special Course Project	--	--	100	--	100	8
Total			--	335	115	400	32

Notes: PG - Post Graduation; GEO - Geography; CC- Core Course; T - Theory; P - Practical; SPC - Special Course; GP - General Practical; PR - Project.

**\* SPECIAL COURSE TO BE OFFERED: CARTOGRAPHY, URBAN GEOGRAPHY, POPULATION GEOGRAPHY, FLUVIAL GEOMORPHOLOGY**

**SEMESTER – I**  
**MODULE – PGGEOCCT-101**  
**GEOTECTONIC AND GEOMORPHOLOGY**

End-term Assessment - 38

Internal assessment - 12

Total - 50

**UNIT - I**

Objectives and History of Geomorphology: Methods of Geomorphic analysis - Concept of system and types, equilibrium, adjustment in nature; Geomorphological Mapping - schemes and basis of landform classification; Energy and Force in Geomorphology - behavior, strength and resistance of rocks, soil and water.

**UNIT - II**

Plate Tectonics and Geodynamics: Concept of plate tectonics and plate tectonics hypothesis, Vine- Mathew's hypothesis, Isostatic adjustment and geodynamics, palaeomagnetism, reconstruction of palaeomagnetism, reversal of polarity. Application of plate tectonics theory to - Continental drift, Mountain building, volcanicity, earthquakes and sea floor spreading.

**UNIT - III**

Hill Slope forms and Processes: processes for slope development; Slopes - evolution, forms, parallel retreat and slope replacement models.

**UNIT - IV**

Agent and Processes of Erosion: peneplain, pediplain, etchplain, exhumed erosion surface, panplain, wave-cut platform, glacial plain; Concepts of Sedimentation - Methods of observing sediment: Models of deposition, dating of sediments, case study - flood plains, alluvial fans, deltas, dunes.

**Recommended Books**

1. Ahnert, Frank, 1998: Introduction to Geomorphology, Arnold Publishers Ltd., London, UK, First Edition.
2. Alt, David, 1982: Physical Geology: Approach, Wardsworth Publishing Company, California, USA, First Edition.

3. Bartholomed, Rolland B. and Tillery, Bill W., 1984: Earth Science, D.C. Heath & Co., Lexinton, USA, First Edition.
4. Bradshaw, M.J., Abbott, A.J. and Gelsthorpe, A.P., 1978: The Earth's Changing surface, Hodder & Stoughton, London, UK, First Edition.
5. Butzer, Karl W., 1976: Geomorphology from the Earth, Harper and Row, Publishers, New York, USA, First Edition.
6. Chorely, R. J. & Kennedy, 1971; Physical Geography: A systems approach, Prentice Hall.
7. Chorley, Richard J., Schumm, Stanley, A. and Sugden, David E., 1985: Geomorphology, Methuen & Company, New York, USA, First Edition.
8. Cooke, R. U. and Doornkamp, J.C., 1997: Geomorphology in environmental management: A new Introduction, Oxford University Press, New York, Second Edition.
9. Davis, Stanley N., Reitan, Paul H. and Pestrong, Raymond, 1976: Geology: Our Physical Environment, McGraw-Hill Book Company, New York, USA, First Edition.
10. Derbyshire, E., Gregory, K. J. and Hails J. R., 1979: Geomorphological Processes: Studies in Physical Geography, Butterworths, London, UK, First Edition.
11. Embleton, Clifford and Thornes, John, (Ed.), 1980: Processes in Geomorphology, Arnold-Heinemann Publishers (India) Pvt. Ltd., New Delhi, First Indian Edition.
12. Flint, Richard Foster and Skinner, Brian J., 1977: Physical Geology, John Wiley & Sons, New York, USA, Second Edition.
13. Gabler, Robert E., Brazier, Sheila, Sagar, Robert J. and Wise, Daniel L., 1982: Essentials of Physical Geography, Saunders College publishing, New York, USA, Second Edition.
14. Garner, H.F., 1974: The origin of Landscapes: A Synthesis of Geomorphology, Oxford University Press, Inc., New York, USA, First Edition.
15. Gerrard, A. J., 1988: Rocks and Landforms, Unwin Hayman, London, UK, First Edition.
16. Gilluly, James, Waters, Arron C. and Woodford, A.O., 1968: Principles of Geology, W.H. Freeman and Company, London & Toppan Company, Ltd., Tokyo, Japan, Third Edition.
17. Holmes, Arthur, 1965: Principles of Physical Geology, First ELBS and Nelson Edition, London, UK, Second Edition.
18. Kale, Vishwas S. and Gupta, Avijit, 2001: Introduction to Geomorphology, Orient Longmen, Calcutta, First Edition.
19. King, Lester C., 1967: The morphology of the earth: A study and synthesis of world scenery, Oliver and Boyd, Edinburg, UK, Second Edition.
20. Larousse, 1961: Encyclopedia of the Earth, Prometheus Press, New York, USA, Batchworth Press, Ltd.
21. Rice, R. J., 1977: Fundamentals of Geomorphology, Longman Group Ltd., London, UK, First Edition.
22. Selby, M. J., 1993: Hillslope materials and processes, Oxford University Press, Oxford, Second Edition.

23. Small, R. J., 1978: The study of Landforms: A Textbook of Geomorphology, Cambridge University Press, Cambridge, UK, Second Edition.
24. Strahler, Arthur N., 1960: Physical Geography, John Wiley & Sons, Inc., New York, USA, Second Edition.
25. Strahler, Arthur N., 1963: The Earth Sciences, Harper's Geoscience Series, Harper & Row Publishers, New York, USA, First Edition
26. Trinkler, K. J., 1989: History of Geomorphology: From Hutton to Hack, Unwin Hayman, Winchester, USA, First Edition.
27. Worcester, Philip G., 1948: A Textbook of Geomorphology, D. Von Nostrand Co., Inc., New York, USA, Second Edition.

**SEMESTER – I**  
**MODULE – PGGEOCCT-102**  
**SOIL AND BIO GEOGRAPHY**

End-term Assessment – 38

Internal assessment – 12

Total – 50

**UNIT I**

Biogeography: Definition scope and significance of biogeography; Elements of biogeography with special reference to India; environment, habitat, plant-animal association; zoo geography of India; World distribution of forests and major plants communities. Biogeographical Regions: phytogeographical and zoogeographical regions of the world. Distribution of major animal communities. Conservation of forests, wildlife sanctuaries and parks.

**UNIT II**

Ecosystem: Basic ecological principles; Geo-biochemical cycles: carbon, oxygen, nitrogen and phosphorus cycles. Biome and biomass; Biodiversity - concept, recent trends and future possibilities; Biodiversity - Causes of depletion, effect of climate change on biological diversity. Conservation of biodiversity. Anthropogenic effects on animals. - Impact of pre-agricultural man, impact of domestication, Impact of industrialization and urbanization.

**UNIT III**

**Soil Geography:** Definition, components of soils; Origin and formation of soils- weathering process, Soil forming factors; soil forming process, soil profile development under different climatic conditions; Physical properties of soils;

#### UNIT IV

Soil Classification and Significance: Genetic classification of soil. Factors of soil erosion. Soil conservation measures. **Soil degradation** and Wasteland - Definition of soil **degradation and its causes**; Soil reclamation and management.

#### Recommended Books

1. Allee, W.C. & Schmidt, K.P., Ecological Animal Geography, New York.
2. Bennett, H. H. : Soil Conservation.
3. Bibby, J.S. and Machney, D. : Land Use Capability Classification; Soil Survey; England and Wales, Harpenden, U.K. Technical Monograph No. 1.
4. Bridges, E. M. (1986): Principles and Applications of Soil Geography, Halsted Press.
5. Bunting, B. T. (1976). The Geography of soils, Hutchinson, London
6. Brikeland, P. W. (1984). Soils and geomorphology, Oxford University Press
7. Brown, J. H., & A. C. Gibson, Biogeography, St. Louis, Mosby, 1983.
8. Brown, J.H. and Lomolino, M.V., Biogeography, Second Edition, Sinauer Associates, Inc. Sunderland, Massachusetts, 1998.
9. Cox, C.B., Moore, P.D., Biogeography, An Ecological and Evolutionary Approach, 5th ed., Blackwell Science, Cambridge, 1993
10. Cloudsley-Thompson, J.L., Terrestrial Environment, London.
11. Daji, J. A. (1970): A textbook of soil science, Asia Pub. House
12. Darlington, P., Zoogeography, New York.
13. FAO (1974) : Approaches to land classification, Soil Bulletin No. 22.
14. FAO (1976) : A framework of Land Evaluation, Soil Bulletin No. 3.
15. FAO (1978) : UNESCO/UNEP - Assessment of Soil loss by water erosion.
16. Foth, Henry D. and Schafer, John W. : Soil Geography and Land Use, John Wiley & sons, New York, First Edition, 1980.
17. Gerrard, A.J. : Soil and Landform.
18. Hole, Francis D. and Campbell, James B. : Soil landscape analysis, Routledge & Kegan Paul, First Edition, 1985.
19. Hudson, N.W.: Soil Conservation.
20. Huggett, R.J., Fundamentals of Biogeography, Routledge, U.S.A, 1998.
21. Jones, R.L., Biogeography: Structure, Process Pattern and Change within a Biosphere.
22. Klingbiel, A.A. and Montgomery, P. 1961: Land capability classification : Soil conservation Series, USDA, Agricultural Handbook No, 210.
23. MacDonald, Glen, Biogeography: Introduction to Space, Time and Life, John Wiley, New York, 2002.
24. Mathur, M.S., Essentials of Biogeography, Jaipur.
25. Miller, R. W. and Donahue, R. L. (1990): Soils, Prentice-Hall of India

26. Morgan, R.P.C. : Soil erosion and conservation.
27. Newbigin, M.I., Plant and Animal Geography, London.
28. Odum, Eugene P., Fundamentals of Ecology, Philadelphia.
29. Pitty, A. F. (1978): Geography and soil properties. University Press.
30. Robinson, H., Biogeography, The English Language Book Society and Macdonald and Evans, London, 1982
31. Olson, Gerald W., : Field Guide to Soils and the Environment : Applications of soil surveys, Chapman and hall, New York, USA, First Edition, 1984.
32. Olson, Gerald W., : Soils and the Environment : A guide to soil surveys and their applications, Chapman and Hall, new York, USA, Firs Edition, 1981.
33. Simmon, I.G., Biogeography: Natural and Cultural, Longman, London 1974.
34. Stamp, L. Dudley. : The land of Britain: its use and misuse, Longmans, Green and Co. Ltd., in conjunction with Geographical Publications Ltd., London, Third Edition, 1962.
35. Watts, David, Principles of Biogeography, London.

**SEMESTER – I**  
**MODULE – PGGEOCCT-103**  
**ECONOMIC GEOGRAPHY**

End-term Assessment – 38  
Internal assessment – 12  
Total – 50

**UNIT I**

Economic Geography: Scope content and importance of Economic Geography; approaches to the study of Economic Geography; relation of Economic Geography with other branches of geography; Economic sectors - primary, secondary and tertiary; types of economies.

**UNIT II**

Von Thunen’s model and selected agricultural concepts: Von Thunen’s model of agricultural land use and its modifications; Selected agricultural concepts: crop concentration, crop diversification, crop combination, agricultural productivity and efficiency.

**Unit III**

Theories of industrial location: Alfred Weber, TordPalander, August Losch, Walter Isard and Rawstron’s principles. Methods of measuring the spatial distribution of manufacturing; location quotient and co-efficient of Geographical association.



## Unit IV

Transport and Network: Modes of transport; Transport Network - elements, connectivity and accessibility; traffic flow; role of transport in economic development; morphology and periodicity of market, role of market in economic development.

### Suggested Readings

1. Alexander, J.W., Economic Geography
2. Brian, J.L., Berry et al., The Geography of Economic Systems.
3. Barlow, M.H. & R.G. Newton., Patterns and Processes in Man's Economic Environment.
4. Chisholm, M., Geography and Economics.
5. Jones, C.F., Economic Geography.
6. Grigg, D.B., Agricultural Systems of the World: An Evolutionary.
7. Loyd, P. & P. Dickens., Location in Space; A Theoretical Approach to Eco. Geo.
8. Hartshon, T.A., Economic Geography. Husain, Majid : Agricultural Geography, Inter-India Publications, Delhi, 1979.
9. Husain, Majid: Economic Geography
10. Llyod P. L. & Dicken P. - Location in Space: A theoretical approach to economic Geography.
11. Losch , A., The Economics of Location, University Press, Yale, New Haven, 1954.
12. Miller, E. & E. Willard., A Geography of Manufacturing.
13. Mc. Carty, H. & J.B.Lindberg., A preface to Economic Geography.
14. Singh J. and Dhillion. S. S. Agriculture Geography, McGraw Hill, India, New Delhi 1984.
15. Smith, D. M. : Industrial Location, John Wiley & Sons, N.Y., 1971.
16. Strahler, A.N. & A. Strahler., Geography and Man's Environment.
17. Symons. L.: Agricultural Geography, Bell and Sons, London, 1972.
18. Symons. L.: Agricultural Geography, Bell and Sons, London, 1972.
19. Thoman, R.S. & E.C. Conkling., The Geography of Economic Activity.
20. Thoman, R., " Economic Geography" in International Encyclopaedia of S.Science
21. Von Royen, W., Fundamentals of Economic Geography.
22. Wheeler, J. O. et. al.: Economic geography, John Wiley, New York, 1995.
23. William Von Royen, et. al., Fundamentals of Economic Geography.
24. Zimmerman, E.W., World Resources and Industries.

**SEMESTER – I**  
**MODULE – PGGEOCCT-104**  
**SETTLEMENT GEOGRAPHY**

End-term Assessment – 38

Internal assessment – 12

Total – 50

**UNIT I**

Settlement Geography: Definition, scope and approaches to study the Settlement Geography; Archeological finds and settlements - Mesopotamia, the Nile valley, the Indus valley; Place names versus settlements; The rural urban continuum.

**UNIT II**

Origin, distribution and functional classification of settlements: Origin and distribution pattern of rural settlements and urban centers (with special reference to India); Functional Classification of rural and urban centers (with special reference to India).

**UNIT III**

Settlement Structure: Models explaining morphological pattern of rural settlements (with special reference to India), Models and theories explaining morphological pattern of urban centers, shape analysis of rural settlements and urban centers.

**UNIT IV**

Settlement Hierarchy: Central place theory - theory of Walter Christaller and its application; theory of August Losch and its application; measurements of centrality, hierarchy of settlements in India.

**Suggested Readings**

1. Ambrose, Peter, 1970: Concepts in Geography, Vol.-I, Settlement Pattern, Longman.
2. Baskin, C., (Translator) 1996: Central Places in Southern Germany, Prentice-Hall Inc. Englewood Cliffs New Jersey, Originally written by C.W. Christaller in German with title DioZentralenOrleSuddeutsch land in 1933.
3. Haggett, Peter, Andrew D. Cliff and Allen Frey (Ed.) 1979: Locational Models Arnold Heinemann.
4. Hudson, F. S. (1976) Geography of Settlements, Macdonald, London.
5. King, Leslie, J., 1986: Central Place Theory, Saga Publications, New Delhi.
6. Mayer, M. Harold and Clyde F. Kohn (Ed.) 1967 Readings in urban Geography, Central Book Depot, Allahabad.

7. Mitra, Asok, Mukherjee S and Bose, R., 1980: Indian Cities Abhinav Publications, New Delhi.
8. Nangia, Sudesh, 1976: Delhi Metropolitan Region, K.B. Publications, New Delhi.
9. Prakasa, Rao, V. L. S., 1992: Urbanisation in India: Spatial Dimensions, Concept Publishing Co., New Delhi.
10. Ramachandran, R., 1992: Urbanisation and Urban Systems in India, Oxford University Press, New Delhi.
11. Singh, R. L. and Kashi Nath Singh (Ed.) 1975: Readings in Rural Settlement Geography, National Geographical Society of India, Varanasi.
12. Ucko, M. J., Ruth Tringham and G. W. Dimbleby (editors) 1972: Man, Settlement and Urbanism, Duckworth.
13. United Nations Centre for Human Settlements (HABITAT) 1996: An Urbanising World, Global Report on Human Settlements, Oxford University Press for HABITAT.

**SEMESTER – I**  
**MODULE – PGGEOCCGP-105**  
**GENERAL PRACTICAL**

End-term Assessment - 100

**UNIT I**

**Study of Topographical Maps** 25

- Morphometric analysis of drainage basin: Stream ordering (Horton and Strahler), Drainage density and texture in different ecological set up
- Basin circulatory and elongation
- Altimetric curve, hypsometric curve
- Ruggedness index, dissection index
- Nearest neighbour analysis of settlements (based on topographical maps)
- Quantitative relation between settlement and different relief aspects by linear regression analysis

**UNIT II**

**Weather Instruments** 25

- Pluviometric chart
- Thermo-hydrograph
- Barometric chart

## UNIT IV

### Thematic Mapping

50

- Methods of measuring - crop combination, agricultural efficiency, location quotient and co-efficient of Geographical association
- Time Series analysis for measuring trend of land value /land use by the method of Semi averages and Least Squares - Straight line and Parabola of the second degree
- a) Measurement of breaking points and detour index. b) Spatial Distribution of Population Mapping and Population Potential
- Lorenz Curve, Ginni's coefficient of localisation (already in UG course) and Centographic measures

### Laboratory Note Book and Viva-Voce

### Suggested Readings

1. Command of the Defence Council: Textbook of Topographic Surveying, Ministry of Defence, London, Fourth Edition, 1965
2. Cromley, Robert G., 1997: Digital Cartography, Prentice Hall, Englewood Cliffs, New Jersey, First Edition
3. Ebdon, David: Statistics in Geography: A Practical Approach, Basil Blackwell Publisher, Oxford, England, 1983
4. Frank, Harry & Steven C. Althoen, 1994: Statistics: Concepts and Applications, Cambridge University Press, Cambridge, UK, Cambridge low price edition, 1997.
5. Misra, R.P.: Fundamentals of Cartography, Concept Publishing Company, New Delhi, Revised & Enlarged Edition, 1989
6. Rabinson, Arthur H., Morison, Joel L., Muehrcke, Philip C., Kimerling,
7. A. Jon and Guptill, Stephen C.: Elements of Cartography, John Wiley & Sons, Inc., N.Y., Sixth Edition, 1995
8. Raisz Erwin.: Principles of Cartography, International Student Edition, McGraw-Hill Book Co. Inc., Tokyo, Japan, First Edition 1962
9. Raisz, Erwin.: General Cartography, McGraw Hill Book Co., New York, 1938
10. Sarkar, Ashis: Practical Geography - A Systematic Approach, Orient Longman, Cal First Edition, 1991
11. Sarkar, Ashis and Roy, P., 1983: Some selected Map Projection for India - their relative efficiencies, Geographical Review of India, Kolkata, Vol. 43, No. 2
12. Singh, R. L.: Elements of Practical Geography, Kalyani Publishers, New Delhi, First Ed., 1979
13. Stout, K.J. and Blunt, L., 1994: Three-Dimensional Surface Topography, Penton Press, London, First Edition

14. Tobler, W. R.: Automation and Cartography, in Geographical Review of India, Calcutta, Vol. 49, No. 4

**SEMESTER – I**  
**MODULE – PGGEOIDC-1**  
**Interdisciplinary Course -1**  
**(for other streams)**

**ENVIRONMENTAL GEOGRAPHY AND DISASTER MANAGEMENT**

End term: 75 (6 credit)  
Internal assessment: 25 (2 credit)  
Total:100 (8 credit)

**UNIT I**

Environmental Geography: Meaning and scope of Environmental Geography; Relations of Environmental Geography with other sciences; meaning, component and types of environment, approaches to the study of man-environment relationships.

**UNIT II**

Ecosystems: meaning, types and components of ecosystem; function of ecosystem, trophic levels, food chain and food webs; Ecological pyramid and flow of energy; **Bio-geo-chemical Cycles, Nitrogen cycle, Carbon cycle and Hydrological cycle.**

**UNIT III**

Environmental Degradation and Pollution: concept and types of environmental degradation; causes of environmental degradation; sources and types of pollution; Air Pollution - adverse effect of air pollution on weather and climate; ozone depletion, green house effects, effects on human health water pollution - surface and ground water pollution, adverse effects on human health.

**UNIT IV**

Environmental Planning and Management: Environmental management - methods and approaches; ecological basis of environmental management - ecological principles; environmental impact assessment (EIA).

**UNIT V**

Disaster: meaning and concept; hazards, risk and vulnerability. Disaster – classification of disasters; Natural disaster – earthquake, floods, drought and global warming: causes, consequences and mitigation; Manmade disasters, their types – technological and industrial disasters. Social disasters: causes, consequences and mitigation.

## Unit VI

Disaster management: relief and response; reconstruction and rehabilitation; Disaster management: prevention, preparedness and mitigation. Importance of information in disaster management, significance of remote sensing and GIS; Mitigation and management - role of Government, NGOs; Plans and policies and laws.

## Suggested Readings

1. Chandna, R.C., 1998, Environmental Awareness, Kalyani Publishers, New Delhi.
2. Gaur, S., and Chandrashekhar, T., 2006, Global Environmental Crisis, Book Enclave, Jaipur.
3. Government of India. (1997) Vulnerability Atlas of India. New Delhi, Building Materials & Technology Promotion Council, Ministry of Urban Development, Government of India.
4. Gupta, P.D., 2003, Environmental Issues for the 21st Century, Mittal Publications, New Delhi.
5. Kapur, A. (2010) Vulnerable India: A Geographical Study of Disasters, Sage Pub. , New Delhi.
6. Modh, S. (2010) Managing Natural Disaster: Hydrological, Marine and Geological Disasters, Macmillan, Delhi.
7. Morris, D., Freeland, J., Hinchliff, S., Smith, S. (ed.), 2003, Changing Environments, Pd. John Wiley and Sons Ltd., The Open University, U.K.
8. Park, C.C., 1980, Ecology and Environmental Management, Butterworths, London.
9. Radha, S., and Sankhyan, A.S., (ed.), 2004, Environmental Challenges of the 21st Century, Deep Publications, New Delhi.
10. Rasure, K.A., 2007, Environment and Sustainable Development, Serials Publications, New Delhi.
11. Saxena, H.M., 2006, Environmental Studies, Rawat Publications, Jaipur.
12. Sinha, A. (2001). Disaster Management: Lessons Drawn and Strategies for Future, New United Press, New Delhi.
13. Singh Jagbir (2007) "Disaster Management Future Challenges and Oppurtunities", 2007. Publisher- I.K. International Pvt. Ltd. S-25, Green Park Extension, Uphaar Cinema Market, New Delhi, India.
14. Singh, R.B. (2005) Risk Assessment and Vulnerability Analysis, IGNOU, New Delhi.
15. Singh, R. B. (ed.), (2006) Natural Hazards and Disaster Management: Vulnerability and Mitigation, Rawat Publications, New Delhi.
16. Singh, S., 1991, Environmental Geography, Prayag Publication, Allahabad.

17. Stoltman, J.P. et al. (2004) International Perspectives on Natural Disasters, Kluwer Academic Publications. Dordrecht.
18. Strahler, A.N., and Strahler, A.M., 1997, Geography and Man's Environment, John Wiley and Sons, New York.
19. Taj, B., Murphy, P. and Rana, P.S., 2007, Environmental Impact Assessment, An Indo - Australian Perspective, Bookwell New Delhi.
20. Verma, S. B. and Shiva, K.S.,(ed.), 2005, Environmental Protection and Development, Deep Publications, New Delhi.

**Notes:**

1. Question paper shall be divided into Group A and Group B. Group A shall consist of long answer type questions and Group B brief answer type questions.
2. In Group A, there shall be two questions each carrying 10 marks from each unit. Out of two, examinees are to answer one question from each unit. Thus, six units shall carry  $6 \times 10 = 60$  marks of long answer type questions.
3. Group B shall consist of five questions each of 3 marks covering any five units. Thus, total marks for Group B shall be  $3 \times 5 = 15$
4. For internal assessment, total marks are 25.

**SEMESTER – II**  
**MODULE – PGGEOCCT-201**  
**CLIMATOLOGY**

End-term Assessment - 38  
Internal assessment - 12  
Total - 50

**UNIT I**

Climatology: Nature and scope of climatology and its relationship with meteorology; Insolation and heat budget; Green house effect; Atmospheric motion: forces controlling motion of air; general circulation in the atmosphere; local winds; jet stream; Atmospheric moisture: humidity, evaporation, condensation; processes of precipitation formation and types of precipitation; Acid rain: causes and impact.

**UNIT II**

Ocean atmospheric interaction: El Nino, Southern oscillation (ENSO) and La Nina. Atmospheric disturbances: Cyclones - tropical and extra-tropical; Thunderstorms - origin, characteristics, classification and distribution; Western disturbances.

### UNIT III

Climatic changes: Evidences, possible causes and impact; Global warming: environmental impacts and society's response.

### UNIT IV

Applied climatology: Methods of data collection; Weather forecasting - historical perspectives and modern development. Hydro-meteorology: concept and applications. Agro-meteorology: concept and applications. Climate and settlement - urban heat island.

#### Suggested Readings

1. Barry, R. G. and Chorley, R. G., *Atmosphere, Weather and Climate*, Methuen & Co., London, 1968.
2. Byers, H. R., *General meteorology*, McGraw Hill Book Co., New York, 1959.
3. Craig, R. A., *The Upper Atmosphere - Meteorology and Physics*, Academic Press, New York, 1965.
4. Critchfield, H. J., *General Climatology*, Prentice Hall of India Pvt. Ltd., New Delhi, 1975.
5. Crowe, P. R., *Concepts in Climatology*, Longmans, London, 1971.
6. Das, P. K., *The Monsoons*, N.B.T., New Delhi, 1970.
7. Flohn, H. (Ed.), *General Climatology*, Elsevier, Amsterdam, 1969.
8. Haurwitz, B. and Austin, J. M., *Climatology*, McGraw Hill Book Co., New York, 1944.
9. I.M.D., *Monsoons of the World*, I.M.D., New Delhi, 1960.
10. Kendrew, W. G., *Climatology*, Oxford University Press, 1957.
11. Landsberg, H., *Physical Climatology*, Gray Printing Inc. Du. Bois, Paris, 1958.
12. Mason, B. J., *Clouds, Rain and Rain making*, Cambridge University Press, Cambridge, 1962.
13. Mason, B. J., *The Physics of Clouds*, Oxford University Press, New York, 1970.
14. Petterssen, Sverre, *Introduction to Meteorology*, McGraw Hill Book Co., New York, 1958.
15. Rasool, S. I. (Ed.), *Chemistry of the Lower Atmosphere*, Plenum Press, New York, 1975.
16. Ratcliffe, J. A., (Ed.), *Physics of the Atmosphere*, Academic Press, New York & London, 1960.
17. Riehl, H., *Jet Streams of the Atmosphere*, Colorado University, Colorado, 1969.
18. Saha, P. K., *El-Nino - La Nina/ENSO and its Impact on Global Climate in 'Contemporary Dimensions in Geography'*, University of Burdwan, Burdwan, 2000.
19. Saha, P. K., *Nature and Natural Processes in 'Environment'*, Calcutta University, Calcutta, 2000.
20. Saha, P. K., & Bhattacharyya, P. K., *Adhunik Jalavayu Vidya (Modern Climatology)*, West Bengal State Book Board, Calcutta, 1999.
21. Trewartha, G. T., *An Introduction to climate*, McGraw Hill Kogakusha, Ltd., Tokyo, 1968.



**SEMESTER – II**  
**MODULE – PGGEOCCT-202**  
**HYDROLOGY AND OCEANOGRAPHY**

End-term Assessment – 38

Internal assessment – 12

Total – 50

### **UNIT I**

Hydrological cycle and surface hydrology: Hydrology -definition, hydrological cycle, characteristics, significance and interpretation;Surface hydrology - runoff characteristics, runoff cycle; Conceptual and empirical relationship between rainfall and runoff;Drainage basin hydrology - components, interface and flood analysis;Stream flow measurement - techniques and their application.

### **UNIT II**

Sub-surface hydrology and basin management: Basic concept -aquifer and their characteristics,hydraulic conductivity, specific yield and watershed leakage.Components - Definition and characteristics of precipitation, evaporation, evapo-transpiration, infiltration, rainfall recharge. Principles of integrated basin management-concept of micro watershed planning, water management in tropical cities and rainwater harvesting.

### **UNIT III**

Ocean Morphology: Fundamental - origin, characteristics and classification of the major structure and morphological features of the ocean with particular reference to Plate Techniques Bottom configuration - Pacific, Atlantic and Indian Ocean.Ocean sediments: Origin, classification and movement coral reefs and atolls; evolution.

### **UNIT IV**

Chemical Oceanography: Composition of sea water, classification of elements based on their distribution, **chemical exchanges across interfaces and residence times in sea water**; Biological Oceanography: Classification of the marine environment and marine organisms; Physio- chemical factors affecting marine life, adaptation and biological processes; Primary and secondary production; factors controlling phytoplankton and zooplankton abundance and diversity.

### **Suggested Readings**

1. Brooks, K.N., Ffolliott, P.F., Gregersen, H.M and DeBano, F.B. (2003): *Hydrology and the Management of Watersheds* , 3rd edition, WileyBlackwell,Chichester.
2. Brutsaert, W. (2005): *Hydrology: An Introduction* , Cambridge University Press, Cambridge.
3. Carter, R.W.G. (1988) :*C oastal Environments: An Introduction to the Physical, Ecological and Cultural Systems of Coastlines* , Academic Press, London.
4. Chow, V.T. (1988) :*Applied Hydrology* , McGrawHill Education, New York.
5. Dingman, S.L. (2002): *Physical Hydrology* , 2nd edition, Prentice Hall, Englewood Cliffs.
6. Ganeri, A. (1994): *The Ocean Atlas* , Dorling Kindersley, London.
7. Garrison, T.S. (2007): *O ceanography: An Invitation to Marine Science* , 6th edition, Brooks Cole, Chicago.
8. Keary, P. and Vine, F.J. (1996): *G lobal Tectonics* , 2nd edition, Blackwell Scientific Publications, Oxford.
9. Keith, D. and Mays, L.W. (2004): *Groundwater Hydrology* , 3rd edition, Wiley, Chichester, KinkadeLevario,
10. H. (2007): *D esign for Water: Rainwater Harvesting, Stormwater Catchment, and Alternate Water Reuse* , New Society Publishers, Gabriola Island (Canada).
11. Leier, M. (2001): *World Atlas of the Oceans: More than 300 Maps and Charts of the Ocean Floor* , Firefly Books, London.
12. Pinet, P.R.(2006) *Invitation to Oceanography* , 4th edition, Jones & Bartlett Pub. New York.
13. Pirazzoli, P.A. (1996): *Sea Level Changes: The Last 20000 Years* . Wiley, New York.
14. Pugh, D. (2004): *C hanging Sea Levels. Effects of Tides, Weather and Climate* , Cambridge University Press, Cambridge.
15. Thurman, H.V. and Trujillo, A.P. (2003): *I ntroductoryOceanography* , 10th edition, Prentice Hall, Englewood Cliffs. Todd, D.K. (2004): *Groundwater Hydrology* , 3rd edition, Wiley, Chechester.
16. Trujillo, A.P and Thurman, H,V. (2007): *E ssentials of Oceanography* , 9th edition, PrenticeHall, Englewood Cliffs.
17. Woodroffe, C.D. (2003): *C oasts: Form, Process and Evolution* , Cambridge University Press, Cambridge

**SEMESTER – II**  
**MODULE – PGGEOCCT-203**  
**SOCIAL AND CULTURAL GEOGRAPHY**

End-term Assessment – 38

Internal assessment – 12

Total – 50

**UNIT I**

Social Geography: Definition, Evolution and approaches; relation of social geography with other social sciences; social structure and social system: concept and element of social structure; Society – meaning, nature, characteristics and types of society; Social groups – classification, characteristics, importance and; Primary and secondary social groups; community; social space; social processes and its forms, social inequality, social justice, social well being.

**UNIT II**

Cultural Geography: Definition, development, scope and content, cultural region,, theme of cultural integration, theme of cultural landscape, methodology, culture – concept, significance, characteristics, functions and components;cultural hearth and cultural realm, cultural diffusion, cultural lag, cultural landscape, Cultural Region; Folk culture – folk culture regions, cultural diffusion in Folk Geography; cultural integration in Folk Geography; Cultural process – cultural assimilation, integration and **acculturation**; Cultural segregation and cultural regeneration.

**UNIT III**

Elements of Social and Cultural Geography in India: Caste System –meaning and characteristics, changes in caste system during British rule, caste in independent India;Caste and social stratification – the scheduled caste: definition and problems of scheduled castes, measures for welfares for scheduled castes; the Backward Classes: definition and description of backward classes, the Backward classes movement.

**UNIT IV**

The Scheduled Tribes: concept and definition of tribes – issues in Indian context; Tribes in India – their classification; Perspectives on Tribal India – approaches to tribal problems, major problems and related issues; Forests, tribals and forest policy; Development policies; tribal displacement and problems of rehabilitation; Issues of Social Change and Transformation in India: Constitutional imperatives – constitution and social change.Development planning and social change.

**Suggested Readings**

1. Ahmad, A.: Social Structure and Regional Development, Rawat Pub. Co., New Delhi, 1993.
2. Ahmad, Aijazuddin : Social Geography, Rawat Publications, New Delhi, 1999.
3. Bhattacharya, D.C.: Sociology, Vijaya Publishing House, Kolkata, 7<sup>th</sup> edition, 2002.
4. Bhowmick, Prabodh Kumar Ed :Tribal people of India : Societyculture and development ( R N, Bhattacharya Kolkata, 2008), (DELNET)
5. Bhupinder Singh and Mahanti, Neeti, Tribal policy in India.(Inter- India Publication, New Delhi, 1997) (NHRC)
6. Blunden, J., Haggett, P., Harnnett, C. and Sarre, P. ( 1985): The Fundamentals of Human Geography, Harper and Row, New York.
7. Carter, J. And Jones, T. 1989 : Social Geography: An Introduction to Contemporary Issues, Edward Arnold, London.
8. Choudhary, R N and Naqvi :Commentary on the scheduledcastes and scheduled tribes act, 1989. (Orient Publication, New Delhi, 2007) (DELNET)
9. Danda, Ajit K.: Ethnicity in India, Inter-India Publications,
10. De Blij H.J. 1995 : The Earth: An Introduction to its Physical and Human Geography, John Wiley and Sons Inc., New York.
11. Dreze Jean, Amartya Sen, Economic Development and Social opportunity, Oxford University Press, New Delhi, 1996.
12. Dubey, S.C.: Indian Society, National Book Trust, New Delhi, 1991.
13. Jones, Emrys and John Eyles : An Introduction to Social Geography, Oxford University Press, London, 1977.
14. Gupta, Ramnika: Tribal Contemporary Issues: Appraisal and Intervention, Concept Publishing Company, 2007.
15. Khare, R.S. : Cultural Diversity and Social Discontent, Sage India, New Delhi, 1998.
16. Mandelbaum, David G. : Society in India, University of California Press, Berkley, 1970.
17. Massey, James Ed :Indigenous people: Dalits issues in today'stheological debate (ISPCK, Delhi, 1994) (DELNET)
18. Meena, Radhakrishna :Dishonoured by history : Criminal tribes &British colonial policy. (Orient Longman, New Delhi, 2001) (NHRC)
19. Mehta, Parkash :Tribal rights. (Shiva Publishers Distributors,Udaipur, 1996) (NHRC)
20. Parvthamma, C : Scheduled Castes and Tribes. (New Delhi,1984) (DELNET)
21. Rao C,N. Shankar: Sociology, S Chand and Company Limited, New Delhi, 2005.
22. Rao, M.S.A.: Urbanisation and Social Change, Orient Longmans, New Delhi, 1970.
23. Rao, Vijendra K R V :Scheduled Castes and Tribes. (New Delhi,1984) (DELNET)
24. Sareen, T.R. and S.R. (ed.) : Castes and Tribes of India, Anmol, New Delhi, 1993.
25. Raza, Moonis and Ahmad, Aijazuddin :Atlas of tribal India : Withcomputed tables of district- level data and its geographical.
26. Russell, R V :Tribes and Castes of the Central Provinces of India.(Delhi, 1975) (DELNET)
27. Russell, R.V :Tribes and Castes of the Central Provinces of India,(London, 1916)
28. Sarkar, H S :Safeguards for Scheduled Castes and Tribes (NewDelhi, 1981) (DELNET)
29. Schwartzberg Joseph; An Historical Atlas of South Asia, University of Chicago Press,

- Chicago, 1978.
30. Sen, Amartya and Drze Jean, Indian Development: Selected Regional Perspectives, Oxford University Press, 1996.
  31. Sen, Jyotirmoy (2007): A Text Book of Social and Cultural Geography, Kalyani Publishers
  32. Singer, Milton and B.S. Cohn (ed.): Structure and Change in Indian Society, Aldine, Chicago, 1968.
  33. Singh, K.S.: Tribal Situation in India, Indian Institute of Advanced Studies, Shimla, 1972.
  34. Singh, K S :Scheduled Tribes : People of India.
  35. Singh, K.S :Jawaharlal Nehru : Tribes and tribes and tribal policy.(Anthropological Survey of India, Calcutta, 1989) (DELNET)
  36. Smith, David: Geography: A Welfare Approach, Edward Arnold, London, 1977
  37. Sopher, David E.: An Exploration of India, Longman, London, 1980.
  38. Srinivas, M.N.: Social Change in Modern India, Orient Longman, 1966.
  39. Srinivas, M.N. (ed.): Caste: Its Twentieth Century Avatar, Penguin India, New Delhi, 1997.
  40. Upadhyay, H C :Reservation for Scheduled Castes andScheduled Tribes (Anmol Publications, New Delhi, 1991) (SCJL)
  41. Vidyarthi L.P and Rai B.K.: The Tribal Culture of India, The Concept Company, New Delhi, 1985.

**SEMESTER – II**  
**MODULE – PGGEOCCT-204**  
**FUNDAMENTALS OF REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM**

End-term Assessment - 38

Internal assessment - 12

Total - 50

#### UNIT-I

Fundamentals: Remote Sensing –concept, data, process, source of energy, interaction with atmosphere and target, recording of energy by sensor, transmission, reception and processing, interpretation and analysis; Types of Remote Sensing and Sensor Characteristics; historical development of remote sensing with special reference to Indian Space Programme;; Photographic imaging; digital imaging; Visual image interpretation; Digital image processing; Data integration, analysis and presentation; Application of remote sensing - Landcover and Landuse, agriculture, forestry, geomorphology, urban applications, hydrology, ocean and coastal monitoring

#### UNIT-II

Aerial Photographs - types of aerial-photographs and their applications, measurement of scale, heights and slope from vertical aerial photos; image interpretation techniques, photo mosaics; Identification and mapping of elements of natural and cultural landscape including topography, drainage, surficial material, vegetation, settlements, transport networks and land use, image interpretation techniques, photo mosaics.

#### UNIT-III

Geographical Information System: concept of GIS, definition and development; Key concepts of GIS - Hardware, software, Procedure, Data and users; GIS -an integration of Spatial and Attribute Information; GIS and related terms; GIS - a knowledge hub; Functions, areas of application and advantages of GIS, functional requirements of GIS, limitation of GIS; Spatial data model; Process of GIS: Data capture, data sources, data encoding method, linking of spatial and attribute data.

#### UNIT-IV

Geospatial Analysis: Geospatial data analysis, integration and modelling of Geospatial data, Geospatial data analysis methods, database query-vector and raster data query; Geostatistics,

Geovisualization; Modern trends of GIS: Local to global concepts in GIS, increase in dimension in GIS, Linear to non-linear techniques in GIS, development in relation between geometry and algebra in GIS, developments of common techniques in GIS, integration of GIS and remote sensing and its application in resource mapping, urban management.

### **Suggested Readings:**

1. Aggarwal C.S. and P.K. Garg (2000). Remote Sensing, A.H. Wheeler & Co. Ltd, New Delhi.
2. Anji Reddy (2000) Remote Sensing and Geographical Information System (An Introduction), Hyderabad.
3. Avery T.E., and G.L. Berlin (1992): Fundamentals of Remote Sensing and Air Photo Interpretation, 514 Ed. Macmillan, New York, USA.
4. Avery T.E., and G.L. Berlin (1992): Fundamentals of Remote Sensing and Air Photo Interpretation, 514 Ed. Macmillan, New York, USA.
5. Bhatta Basudeb (2016): Remote Sensing and GIS, 2<sup>nd</sup> edition, Oxford University Press.
6. Campbell, J.B. (2002) Introduction to Remote Sensing, 3rd ed., Taylor & Francis, New York, USA.
7. Chrisman, Nicholas, (1997) Exploring GIS. John Wiley and Sons.
8. Jeffery Stare and John Estes (1990) Geographical Information Systems: An introduction, Prentice Hall.
9. Lillesand, Thomas M. and R. Kiffer (1994), Remote Sensing and Image Interpretation, 3rd edition, John Wiley & sons, Inc New York, USA.
10. Meenakhi Kumar(2000), Text book on Remote Sensing; NCERT, New Delhi.
11. Sabins, F (1982): Remote Sensing Principles and Application, Freeman and Company, New York, USA
12. Jensen, J.R. (2000), Remote Sensing of the Environment: An earth Resource Perspectives, Pearson Education Inc. India.
13. Nag and Kudrat (2002), Remote Sensing and Image Interpretation, Concept Publishers, Delhi.
14. Meenakhi Kumar(2000), Text book on Remote Sensing; NCERT, New Delhi.
15. Anji Reddy (2000) Remote Sensing and Geographical Information System (An Introduction), Hyderabad.
16. Ian Heywood, Sarah. C and Srinivas Raju (2006), An Introduction to GIS, Pearson Education, Delhi.
17. Nag, Prithvish and Sengupta Samita (2007), GIS Concepts and Business opportunities, Concept publication, Delhi.
18. T. Bernhardsen (1999), GIS: An Introduction, Wiley, New York.

**SEMESTER – II**  
**MODULE – PGGEOCCGP-205**  
**GENERAL PRACTICAL**

End-term Assessment - 100

**UNIT I**

**Surveying**

30

- Contouring of an area with the help of Dumpy Level
- Measurement of height of an object with the help of Theodolite when the base is inaccessible.
- Theodolite survey: Principles and Application, Traversing, Computation of Co-ordinates and areas.

**UNIT II**

**Remote Sensing**

30

- (i) Identification of Flight Line and Scale of Photographs; Determination of height of objects from single vertical photographs
- (ii) Identification of objects and features with stereoscope.
- (iii) Image to image rectification /Geo-referencing of satellite imagery in image processing software.
- (iv) Preprocessing techniques, image transformation techniques.
- (v) Image classification techniques and Preparation of thematic maps on landuse/land cover
- (vi) Image mosaicking and creation of subset; Merging images of various resolution
- (vii) Post-classification analysis and accuracy assessment, generation of classification report.

**UNIT III**

**Geographical Information System and Geospatial Analysis**

30

- (i) Geo-referencing of scanned maps and satellite images applying reference spheroids (WGS-84 and Everest etc.) and Projections (Universal Transverse Mercator's and Polyconic).
- (ii) Creation of Geo-data base and shape file.
- (iii) On screen digitization/vectorisation of spatial data in the form of - layers: polygon, polyline and point; adding attributes to these layers and statistical calculations.
- (iv) Digitization of administrative maps, drainage basin;
- (v) **Geospatial Analysis a) Geospatial measurements b) overlay operations c) network analysis b) surface analysis**



- (vi) Displaying attribute data on map by various methods.
- (vii) Preparing layout and printing of theme map.
- (viii) Uses of GPS device.

## UNIT IV

### Laboratory Analysis of Soil

10

#### 1. Soil Analysis

- Kit Box analysis (N.P.K., Organic Matter, and pH)
- Soil Profile Recognition and Microbial change

### Suggested Readings:

1. American society of Photogrammetry: Mannual of Photographic Interpretation , Banta Pub. Co., Wisconsin, 1960.
2. Avery, T.E., Interpretation of Aerial Photographs, Minnipolis, 1962.
3. Barett, E.C. & Curtis, L.F., Introduc. Of Environ. Remote Sensing, 1976.
4. Cromley, R.G., Digital Cartography, Prentice Hall, N.Jersey, 1992
5. Dury, G.M., Map Interpretation, IssacPitsman, London, 1952.
6. Cunan, R.J., Principles of remote sensing, London, 1985.
7. Fraser Taylor, D.R., " Geographical Information System, Pergmon Press, U.K., 1991
8. Higgings, A.L. – Higher surveying
9. Hord, R.M., Remote sensing: Methods and Applications, N.Y., 1986.
10. Lender, D.R., Aerial Photographic, Mc Graw Hill, N.Y., 1960.
11. Luder, D., Aerial Photography Interpretation: Principles and applications, McGraw Hill, N.Y., 1959.
12. Lilles&Klefer, Remote sensing & Image Interpretation.
13. Maquire, D.J., Good Child, M.F. and Rhind, D.W., " Geographical Information Systems: Principles and Application, Taylor and Francis Publication Washington, 1991
14. Monmonier, M.S., Computer Assisted Cartography: Prainciples and Prospects, P.Hall, New Jersey, 1982
15. Peuquet, D.J. and Markle, D.F "Introductory Reading in Geographical Information System" , Taylor and Francis Publication, Washington, 1990.
16. Reeves, R.G.(Ed.) Mannual of Remote sensing(Vol.2) Virginia, 1975.
17. Robinson, A. – Elements of Cartography.
18. Sabins, F.F., Remote sensing: Principles & Interpretation, 1982.
19. Shahab Fazal. GIS Basics, New age International Publisher.
20. Smith, H.T.V., Aerial Photographs & their Applications, N.Y., 1943.
21. Spurs S.H., Photogrammetry & Photo Interpretation, N.D., 1960.
22. Stershew, A.I., Aerial Photography.

24. Tomar, M.A. & Maslakar, A.R., Aerial Photographs in Landuse & Forest Survey, Dehra-Dun, 1974.
25. Thomas, E.A., Interpretation of Aerial Photographs, Minnesota.
26. Usill, G.W. (Revised by Hearn, G.S.G) Pract. Surveying, London, 1960.
27. White, L.P., Aerial Photography & Remote sensing for soil survey.
28. James, B. Campbell., Introduction to Remote Sensing- 2nd Edi. Taylor & Francis, London.

**SEMESTER – II**  
**MODULE – PGGEOIDC-2**  
**Interdisciplinary Course-2**  
**(for other streams)**

**LANDFORMS, ATMOSPHERE AND RESOURCES**

Paper Code - PGGEOIDC-2  
End Term : 75 (6 credit)  
Internal assessment - 25 (2 credit)  
Total :100 (8 credit)

**UNIT I**

Fundamental Concepts in Geomorphology - Geological structures and landforms; principles of uniformitarianism; Cycle of Erosion - concepts of Davis and Penck; Continental Drift Theory – concept of Wegener; Plate Tectonics – concept and related views.

**UNIT II**

Earth's Movement – endogenetic forces, folds, faults, rift valleys, exogenetic forces; Dynamics of fluvial processes and resulting landforms; Dynamics of glacial processes and resulting landforms; Dynamics of Aeolian processes and resulting landforms; Ground water Dynamics and Karst Landforms.

**UNIT III**

Nature and scope of climatology and its relationship with meteorology. The atmosphere: Structure and composition, insolation, heat-balance of the earth. Distribution of temperature: Temporal, vertical and horizontal, Green House effect. Distribution of atmospheric pressure and winds.

**UNIT IV**

Climatic Phenomena: Air masses and fronts, origin, growth, classification. Frontogenesis, types and weather associated with fronts. Climatic Classifications: Koppen's Thornthwaites - A critical appraisal of each classification.

**UNIT V**

Nature, scope and significance of Geography of Resources. Definition and concept of natural resources. Classification of resources. Characteristics of natural resources: Resource conservation and management with reference to land and forest resource.

**UNIT VI**

Theories of Resource Use - Theories of agricultural location; Theories of industrial location: Weber and Losch; Energy resources-Conventional energy resources - coal, petroleum, non - conventional - solar and geothermal energy.

## **Suggested Readings**

### **A. For Landforms**

1. Ahmed, E. (1985): Geomorphology. Kalyani Publishers, New Delhi.
2. Bloom, A. L. (1998/ 2001): Geomorphology. 3rd edition. Prentice Hall of India, New Delhi.
3. Chorley, R.J., Schumm, S. A. and Sugden, D. E. (1984): Geomorphology. Methuen and Company Ltd., London.
4. Dayal, P. (1994): A Text Book of Geomorphology. Kalyani Publishers, New Delhi.
5. Fairbridge, R.W. (ed.) (1968): Encyclopaedia of Geomorphology, Reinhold Book Corporation., New York
6. Gregory, K.J. and Walling, D.E. (1973): Drainage Basin Form and Process. Edward Arnold, London.
7. Jog, S. R. (ed.) (1995): Indian Geomorphology (2 vols.). Rawat Publications, Jaipur
8. Kale, V. and Gupta, A. (2001): Introduction to Geomorphology. Orient Longman, Hyderabad.
9. King, C.A.M. (1966): Techniques in Geomorphology. Edward Arnold, London.
10. Pethick, J. (1984): An Introduction to Coastal Geomorphology. Arnold, London. Indian, reprint , 2000.
11. Sharma, P. R. (ed.), (1993): Applied Geomorphology in Tropics. Rishi Publications, Varanasi
12. Singh, S. (2004): Geomorphology. PrayagPustak Bhawan, Allahabad.
13. Sparks, B.W. (1986): Geomorphology. Longmans, London.
14. Thornbury, W.D. (2005): Principles of Geomorphology. John Wiley and Sons, New York.
15. Wooldridge, S.W. and Morgan, R.S. (1959): The Physical Basis of Geography- An Outline of Geomorphology. Longman, London.

### **B. For Atmosphere**

1. Barry & Perry., Synoptic Climatology.
2. Blair, T.A., Climatology-General and Regional.
3. Chorley, R.J. & Barry, R.G., Atmospheric Weather and climate.
4. Donn, W.L., Meteorology.
5. Jackson, I.J., Climate, Water and Agriculture in the Tropics, 1977.
6. Kendrew, W.G., Climates of the Continents.
7. Lal, D.S., Climatology.
8. Mather, J.R., Climatology: Fundamental and Applications, 1974.
9. Patterson., Introduction to Meteorology.
10. Rama sastery, A.A., Weather & Weather fore casting.
11. Rummey, G., Climatology and the world's climate.
12. Stringer., Foundation of Climatology.

13. Stringer., Techniques in Climatology.
14. Trewartha, G.T., An Introduction to Climate.

### **C. For Resources**

1. Alexander, J.W., Economic Geography, New Jersey, 1965.
2. Ali, S.A., Resources for Future Economic Growth, New Delhi, 1979.
3. Behends, William, W., The Dynamics of Natural Resource Utilization in D.Meadow(Ed.), Masachusetts, 1972.
4. Duncan, G., Resource Utilization and Conservation, New York, 1975.
5. Earl, D.K., Forest Energy and Economic Development, Oxford, 1975.
6. Ranner, G.T., Conservation of Natural Resources, New York, 1942.
7. Zimmerman, E.W., Introduction to World Resources (edited by H.L. Honker, The Ohio State University, New York, 1964.
8. Zimmermann, E.N., World Resources & Industries, New York.

### **Notes:**

1. *Question paper will be divided into Group A and Group B. Group A shall consist of long answer type questions and Group B brief answer type questions.*
2. *In Group A, there shall be two questions each carrying 10 marks from each unit. Out of two, examinees are to answer one question from each unit. Thus, six units shall carry  $6 \times 10 = 60$  marks of long answer type questions.*
3. *Group B shall consist of five questions each of 3 marks covering any five units. Thus, total marks for Group B shall be  $3 \times 5 = 15$*
4. *For internal assessment total marks are 25.*

**SEMESTER – III**  
**MODULE – PGGEOCCT-301**  
**TOURISM GEOGRAPHY**

End-term Assessment - 38

Internal assessment - 12

Total - 50

**UNIT I**

Geography of Tourism: Definition, nature, scope importance and extent; Relationship between Geography and Tourism; Tourism Promotion- Ecotourism, Agro-tourism, Heritage tourism and Adventure tourism. Factors affecting tourism - physical and cultural factors; Tourism motivation, tourism as an industry.

**UNIT II**

The Classification of Tourism and Tourists: Types of tourism - Domestic and International Tourism - adventure, wildlife, medical, pilgrimage, business, leisure, pleasure, eco and cultural tourisms. Comparison between mass and alternative tourism. Tourists types - Local, National and International. Impact of tourism- economic impact, physical and environmental impact, socio-cultural Impact.

**UNIT III**

Infrastructure and Support System: Accommodation, transport; other facilities and amenities; Impact of tourism: physical, economic and social and perceptual positive and negative impacts.

**UNIT IV**

Indian Tourism: Regional dimensions of tourist attraction, evolution of tourism, promotion of tourism. Tourism development in North Bengal: Darjeeling Himalayas, Duars and other places of North Bengal Region.

**Suggested Readings**

1. Bhatia A.K (1996): Tourism Development: Principles and Practices. Sterling Publishers, New Delhi.

2. Inskip, E (1991): *Tourism Planning: An Integrated and Sustainable Development Approach* Van.
3. Kaul R.K (1985): *Dynamics of Tourism and Recreation*, Inter- India, New Delhi.
4. Kaur, J. (1985): *Himalyan Pilgrimages and New Tourism*, Himalyan Books, New Delhi
5. Lea, J. (1988): *Tourism and development in the third world*
6. Milton, D. (1993): *Geography of World Tourism*, Prentice Hall, New York
7. Peace, D. G. (1987): *Tourism To-Day: A geographical Analysis*, Harlwo, Longman
8. Robinson, H. A.(1996): *A Geography of Tourism*, McDonald and Evans, London
9. Sharma, J. K. (ed.)(2000) : *Tourism, Planning and Development- A new perspective*, Kanishka
10. Singh, R. L. and KashiNath Singh (Ed.) 1975: *Readings in Rural Settlement Geography*, National Geographical Society of India, Varanasi

**SEMESTER – III**  
**MODULE – PGGEOCCT-302**  
**REGIONAL GEOGRAPHY OF INDIA**

End-term Assessment - 38

Internal assessment - 12

Total - 50

**UNIT - I**

Climate: Genesis of Indian Monsoon; Role of Jet Stream on Indian Monsoon; distribution of rainfall and rainfall zones in India; climatic regions and their characteristics; identification of drought and flood prone areas in India.

**UNIT - II**

Agriculture: Agricultural characteristics; agrarian problems and causes of low productivity; Green Revolution and White Revolution in India; Major agro-climatic and agro-ecological regions of India.

**UNIT - III**

Energy resources, Industry: Production and use of conventional and non-conventional sources of energy; Energy crises and conservation; Industrial development: historical perspective - development during Five Year Plans; Industrial policy; Impact of liberalization, Industrial problems ; industrial regions.

#### UNIT - IV

Micro-Regions: Case Study of North Bengal - Resource base of North Bengal: Physical, Economic and Manpower.

#### **Suggested Readings**

1. Atkinson, E. T., (Ed) 1882:Geology of the Himalayas, Cosmo Publications, New Delhi, India, Reprinted from ``The Himalayan Districts of the NWn provinces of India'', Reprinted in 1993.
2. B. C. C. & I. - West Bengal: An Analytical Study.
3. Bagchi, K. and Mukherjee, K. N. : Diagnostic survey of West Bengal, A Research Publication,Vols. I - IV, Calcutta University, 1980.
4. Bose, S. C., 1978: Geography of West Bengal, National Book Trust, India, New Delhi, Second Revised Edition.
5. Centre for Science & Environment (1988) State of India's, Environment, New Delhi.
6. Centre for studies in Social Sciences: Problems of the economy and planning in West Bengal.
7. Chatterjee, A. B., Gupta, Avijit and Mukhopadhyay, Pradip K. (Ed.) 1970: West Bengal Firma K L Mukhopadhyay, Calcutta.
8. Dasgupta, B. (Ed.) - Urbanisation, Mirgration and rural change: A Study of West Bengal.
9. Deshpande, C. D., 1992: India: a Regional Interpretation ICSSR & Northern Book Centre.
10. Dreze, Jean & Amartya Sen (ed.) 1996: India Economic development and Social opportunity. : Oxford University Press, New Delhi.
11. F. E. Pergiter: The Sundarbans.
12. Ghosh, Arun, 1989: West Bengal: Landscapes, Nov. 1983 - Feb. 1983- Feb. 1986, A Travel Diary, K. P. Bagchi& Company, Calcutta, First Edition.



13. Govt. of West Bengal - West Bengal Forests. (Forest Directorate Centenary Commemoration Volume)
14. Hunter, W. W. : Statistical Accounts of Bengal, Trubner & Company, 1875, London, UK, First Edition in India in 1973 by D. K. Publishing House, Delhi, India.
15. Krishnan, M. S., 1982: Geology of India & Burma, CBS Publishers & Distributors India, New Delhi, Sixth Edition.
16. Kundu, A. and Raza, Moonis, 1982: Indian Economy: the Regional Dimension. Spectrum Publishers, New Delhi.
17. Mukherjee, K. N., 1996: Agricultural land capability of West Bengal: Part - I : West Bengal, Part - II: The Ganga Delta, Ma Sitala Composing Works, Calcutta, First Edition.
18. Oldham, R. D. : Manual of Geology of India (Vide O'Malley).
19. Pascoe, Kt., Edwin H. (Ed) 1959: A Manual of the Geology of India and Burma, Geological Survey of India, Calcutta Third Edition, revised & Largely rewritten.
20. Robinson, Francis, 1989: The Cambridge Encyclopaedia of India, Pakistan, Bangladesh, Sri Lanka, Nepal, Bhutan & Maldives. Cambridge University Press, London.
21. Saklani, P. S., (Ed.) 1978: Tectonic geology of the Himalaya, Today and Tomorrow's Printers & Publishers, New Delhi, India, First Edition.
22. Singh, R. L. (Ed.) 1971: India: A Regional Geography, National Geographical Society, India, Varanasi.
23. Spate, OHK & ATA Learmonth, 1967: India & Pakistan Methuen, London.
24. Vaidyanadhan, R., (Ed.) 1991: Quaternary Deltas of India, Memoir 22, Geological Survey of India, Bangalore.
25. Wadia, D. N. 1975: Geology of India, Tata McGraw-Hill Publishing Company Ltd., New Delhi, Fourth Edition.

**SEMESTER – III**  
**MODULE – PGGEOCCT-303**  
**POPULATION GEOGRAPHY**

End-term Assessment – 38

Internal assessment – 12

Total – 50

**UNIT - I**

Population Geography: Scope of Population Geography; development of Population Geography; Sources of population data; Classical and modern theories in population.

**UNIT - II**

Population Dynamics: Fertility - concepts, measures and world pattern. Mortality - concepts, measures and world pattern; Migration - causes, consequences and world pattern.

**UNIT - III**

World Population and Development: Population resource region, human development index (HDI), Population and economic development, poverty.

**UNIT - IV**

India's Population: Population distribution and density; growth of population, age-sex structure, rural-urban composition, urbanization, literacy, economic activities, Scheduled Caste and Scheduled Tribe population, population policy.

**Suggested Readings**

1. Berclay, George W. – Techniques of Population analysis.
2. Bhattacharya A. – Human migration through the ages, The Calcutta Review, new Series, Vol. III, No. 1, 1977.
3. Bhattacharya A. – Population Geography of India.
4. Bilasborrow, Richard E and Daniel.Hogan, Population and Deforestation in the Humid Tropics, International Union for the Scientific Study of Population, Belgium ,1999.
5. Bogue, D, J., Principles in Demography, John Wiley, New York ,1969.
6. Bose, Ashish et.al.: Population in India's Development (1947-2000); Vikas Publishing House, New Delhi ,1974.
7. Census of India, India: A State Profile, 1991.

8. Chandna, R. C., *Geography of Population: Concept, Determinants and Patterns*, Kalyani Publishers, New York , 2000.
9. Clarke, John I., *Population Geography*, Pergamon Press, Oxford ,1973.
10. Crook, Nigel, *Principles of Population and Development*. Pergmon Press, New York , 1997.
11. Daugherty, Helen Gin, Kenneth C. W. Kammeyir , *An Introduction to Population* (Second Edition), The Guilford Press, New York, London, 1998.
12. Garnier, B. J., *Geography of Population* , Longman, London, 1970.
13. Jones Emrys - *Metropolis*.
14. Kanitkar Tara and Vende Asha – *Studies in Population*.
15. Kochhar, Rajesh, *The Vedic People: Their History and Geography* , Orient Longman Ltd., New Delhi , 2000.
16. Mamoria, C. B. ,*India's Population Problem*, Kitab Mahal, New Delhi , 1981.
17. Mitra, Asoka, *India's Population; Aspects of Quality and Control*. Vol. I & II, AbhinarPublications , New Delhi , 1978.
18. Premi, M. K., *India's Population: Heading Towards a Billion*, B. R. Publishing Corporation, 1991.
19. Smith ,R. I. (Ed.) – *The ecology of man*.
20. Srinivasan, K. and M. Vlassoff., *Population Development Nexus in India: Challenges for the New Millenium*. Tata McGraw – Hill, New Delhi, 2001.
21. Srinivasan, K., *Basic Demographic Techniques and Applications* Sage publications, New Delhi 1998.
22. Sundaram K. V. and Sudesh Nangia, (ed.), *Population Geography*, Heritage, Publications, Delhi 1986.
23. *The determinants and consequens of population trends*, Vol. I, United nations Publication, 1977.
24. UNDP: *Human Development Report*. Oxford University Press ,Oxford 2000.
25. United Nations, *Methods for Projections of Urban and Rural Populations*, No.VIII , New York 1974.
26. Woods, R. *Population Analysis in Geography*. Longman, London 1979.
27. Zelinsky Wilbur, *A prologue to Population Geography*, Prentice Hall, 1966.

**SEMESTER – III**  
**MODULE – PGGEOCCT-304**  
**GEOGRAPHICAL THOUGHT**

End-term Assessment – 38

Internal assessment – 12

Total – 50

**UNIT - I**

Geography during the Ancient and Medieval period: Ancient period: Contribution of Greeks, Romans and Indians; Medieval period - Dark Age in Geography; Arab Geographical thoughts; Age of Explorations and Travels.

**UNIT - II**

Geography during the Modern period (since 18<sup>th</sup> Century): Contribution of German School; Contribution of French School; Contribution of Russian School; Contribution of American School; Contribution of British School.

**UNIT - III**

Recent Trends in Geography (Since 1950): Positivist spatial science view point and systems approach; Behavioural Geography; Humanistic Geography; Relevant, Liberal and Radical Geography.

**UNIT - IV**

Explanation in Geography: Philosophy, methodology and explanation in Geography; Role of laws, theories and models in explanations in Geography.

**Suggested Readings**

1. Abler, Ronald; Adams, John S. Gould, Peter, 1971: Spatial Organization: The Geographer's View of the World, Prentice Hall, N.J.
2. Ali, S. M. 1966: The Geography of Puranas, Peoples Publishing House, Delhi.
3. Ambrose, P. Analytical Human Geography.
4. Amedeo, Douglas, 1971: An Introduction to Scientific Reasoning in Geography, John Wiley, U.S.A.
5. Annals of Association of American Geographers Vol.69. No.3, 1979.
6. Blunden, J., Hagget P., Hamnett C. & Sarre P. Ed., Fundamentals of Human Geography: A Reader.
7. Brown, E.H. (Ed): Geography, Yesterday and Tomorrow.
8. Coffey, William J., Geography towards general spatial systems approach.

9. Cox, K. R. & Colledge R.C.: Behavioural problems in Geography revisited.
10. Cox, K. R. : Man; Location and Behaviour: An Introduction to Human Geography
11. Dickinson, R. E.; The makers of modern Geography.
12. Dikshit, R. D. (Ed.) 1994: The Art & Science of Geography Integrated Readings, Prentice Hall of India, New Delhi.
13. Gould, J. R: An introduction to Behavioural Geography
14. Hagget, Peter; Geography: A modern synthesis.
15. Hagget, Peter; Locational analysis in Human Geography.
16. Hartshorne, R, 1959: Perspectives on Nature of Geography, Rand McNally & Co.
17. Hartshorne, R.; The Changing nature of Geography.
18. Harvey, David, Explanation in Geography
19. Husain, Majid; 1984: Evolution of Geographical Thought, Rawat Publications, Jaipur.
20. James, P. E.; All possible world: A history of Geographical Ideas.
21. Jensen, A. H.; Geography its history and concepts.
22. Johnston, R. J., 1983: Philosophy and Human Geography, Edward Arnold, London.
23. Johnston, R. J., 1988: The Future of Geography, Methuen, London.
24. Johnston, R. J.; 1945: Geography and geographers: Anglo American Human Geography.
25. Jones, Emrys, Human Geography.
26. Minshull, Roger, 1970: The Changing Nature of Geography, Hutchinson University Library, London.
27. Minshull, Roger, Regional Geography: Theory and Practice.
28. New Zealand Journal of Geography - No.61, Oct. 1976.
29. Peet, Richard, Radical Geography: Alternative view points on Contemporary Social issues.
30. Smith, D. M., Human Geography: A Welfare approach
31. Taylor, Griffith, Geography in the twentieth century

**SEMESTER – III**  
**MODULE – PGGEOCE-305**

<b>SEMINAR:</b>	<b>50</b>
<b>GROUP DISCUSSION:</b>	<b>25</b>
<b>VIVA:</b>	<b>25</b>
<b>TOTAL</b>	<b>100</b>

Sl. No.	Seminar/Viva/Group Discussion	Marks	Credit	Remarks
1	Seminar (Report+Presentation)	30+20=50	4	<ol style="list-style-type: none"> <li>1. Student shall choose any specific topic (within the purview of the syllabus) and prepare it in report form to be presented through seminar. The report may be prepared through field study and using primary and secondary data.</li> <li>2. Seminar presentation shall be conducted by all the internal teachers and one external teacher.</li> </ol>
2.	Group Discussion	25	2	<ol style="list-style-type: none"> <li>1. Group discussion shall be conducted by all the internal teachers and one external teacher.</li> </ol>
3.	VIVA	25	2	<ol style="list-style-type: none"> <li>1. Viva shall be conducted by all the internal teachers and one external teacher.</li> </ol>
Total Marks/credits		100	8	

**SEMESTER – III**  
**MODULE – PGGEOCCGP-306**  
**GENERAL PRACTICAL**

End-term Assessment - 100

**UNIT- I**

**Computer Applications in Geography**

**25**

- Fundamentals of computer
- Computer organization, Components of Hardware and Software.
- Operating Systems: MS-DOS, MS-Windows, etc.
- Data Structure and Data Format, A - D and D - A presentation, Data representation, Computer Programming and Networking.
- Familiar with MS-Office, Page Maker, Corel Draw, etc. scanning,
- Work on Ms excel/SPSS: data entry, tabulation and analysis (Central tendency, Dispersion, Coefficient of Variation)
- Representation of geographic data through computer aided techniques: scatter diagram with trend line, bar graph, pie graph, and histograms. Diagrammatic illustrations and mapping.

**UNIT- II**

**Statistics**

25

- Samples and Sampling: Sampling units and sample frame, methods of different sampling, estimates of mean, proportion and their standard errors, sample size.
- Bi-variety analysis: Measuring the strength of association and relationship; Scatter diagram, Product moment correlation coefficient and Spearman's rank correlation coefficient, Ordinary least squares method; Simple linear regression equation, prediction, explanation, residuals, test of significance of the regression coefficient and correlation coefficient.
- Chi-Square tests for goodness of fit and association.

**UNIT- III**

**Map Projections**

Marks: 25

- Concept and properties

- Gall's Stereographic Projection
- Mercator's Projection
- Mollweide's Projection.
- Simple Conical Projection with Two Standard Parallels
- Conical Equal-Area Projection (with one SP).
- Conical Equal-Area Projection (with two SP).
- Conical Orthomorphic Projection with one S.P.
- Interrupted Sinusoidal Projection

#### UNIT IV

Marks: 25

- Megascopic Identification of Rocks and Minerals
- Interpretation of Geological Maps (folds and faults)

#### SUGGESTED READINGS

1. Alvi, Z. 1995 : Statistical Geography: Methods and Applications, Rawat Pub. New Delhi.
2. Berry, B.J.L., & Marble, D.F., Spatial Analysis: A Reader in Statistical Geography, New Jersey, 1968.
3. Cole, J.P., & King, C.A.M., Quantitative Methods in Geography, New York, 1968.
4. Cromley, Robert G., 1997: Digital Cartography, Prentice Hall, Englewood Cliffs, New Jersey, First Edition.
5. Ebdon, David: Statistics in Geography: A Practical Approach, Basil Blackwell Publisher, Oxford, England, 1983.
6. Elhance, D.N., Elementary Statistics.
7. Gregory, S., Statistical Method for Geography, Longman, 1975
8. Hammond / Mc Cullah., Quantitative Techniques in Geog, Oxford, 1974
9. Hinks, A.R.: Map Projections, Cambridge University Press, Cambridge, UK, First Edi., 1921.
10. Johnson, R.J., Multivariate Statistical Analysis in Geography, 1978.
11. Kellaway, George P.: Map Projections, Methuen & Co. Ltd., London, Second edi., 1949.
12. King, L.J., Statistical Analysis in Geography, New Jersey.
13. Krakk Menno-Jan and Brown Allan: Web Cartography: developments and prospects, Taylor & Francis, London, First Edition, 2001.
14. Mailing, D.H.: The Terminology of Map Projections, International year Book of Cartography VIII, George Philip & Sons Ltd., London, First Edition 1968.
15. Mainwaring, James: An Introduction to the study of Map Projection, Mc Millan & Co., NY 1960
16. Misra, R.P.: Fundamentals of Cartography, Concept Publishing Company, New Delhi, Revised & Enlarged Edition, 1989.



17. Monkhouse & Monkhouse : *Maps and Diagrams*
18. Monmonier, M. S., Computer Assisted Cartography: Principles and Prospects, Prentice Hall, New Jersey, 1982.
19. Pal, S.K. 1999 : Statistics for Geoscientists, Concept publishing Company, New Delhi:
20. Rabinson, Arthur H., Morison, Joel L., Muehrcke, Philip C., Kimerling, A. Jon and Guptill, Stephen C.: Elements of Cartography ,John Wiley & Sons, Inc., N.Y., Sixth Edition, 1995.
21. RaiszErwin.: Principles of Cartography, International Student Edition, McGraw-Hill Book Co. Inc., Tokyo, Japan, First Edition 1962.
22. Raisz, Erwin.: General Cartography, McGraw Hill Book Co., New York, 1938.
23. Richardus, Peter and Adler, Ron K.: Map Projections, North-Holland Publishing Company, Amstardam, First Edition, 1972.
24. Roy, P. : An Analytical Study of Map Projections, Applied and Mathematical Geographic Studies, Calcutta, First Edition, 1988.
25. Saha, P.K. & Basu, P. (2003) : *Practical Geography : A Laboratory Manual*
26. Sarkar, Ashis : Practical Geography – A Systematic Approach, Orient Longman, Cal First Edition, 1991.
27. Sarkar, Ashis and Roy, P., 1983: Some selected Map Projection for India – their relative efficiencies, Geographical Review of India, Kolkata, Vol. 43, No. 2.
28. Silk, J. 1979 : Statistical techniques in Geography, George Allen and Unwin, London:
29. Singh, R. L.: Elements of Practical Geography, Kalyani Publishers, New Delhi, First Ed., 1979.
30. Snyder, John P.: Flattening the Earth-Two thousand years of Map Projections, The University of Chicago Press, Chicago, First Edition 1997.
31. Steers, J.A.: An introduction to the Study of Map Projections, University of London Press Ltd., London, Thirteenth Edi., 1962.
32. Stout, K.J. and Blunt, L., 1994: Three-Dimensional Surface Topography, Penton Press, London, First Edition.
33. Tobler, W. R.: Automation and Cartography, in Geographical Review of India, Calcutta, Vol. 49, No. 4.
34. Walford, P., 1995: Geographical Data Analysis, John Wiley and Sons Inc., New York:

**SEMESTER – IV**  
**MODULE – PGGEOCCT-401**  
**REGIONAL PLANNING AND DEVELOPMENT**

End-term Assessment – 38

Internal assessment – 12

Total – 50

**UNIT - I**

Region, Regionalization and Regional Planning: Concept of region, classification of region, methods of delineation of region, schemes of regionalization of India; Concept of Planning and Regional Planning.

**UNIT - II**

Regional Development Strategies: Growth pole theory, Neo-populist regional development strategies; Market town as rural growth centre of EAJ Johnson; Integrated regional development of **RondinelliandRuddle**; selective spatial closure of **StohrandTodtling**. Territorial Regional Planning and development from below; Agro-politan development of Friendmann and Douglass.

**UNIT - III**

Regional Disparity in India: Indicators of regional development, extent of interstate imbalances in India & policy measures to remove regional disparity.

**UNIT - IV**

Regional planning practices in India: District level planning and Block level planning. Target group and Target area approach.

**Suggested Readings**

1. AVARD – Block level planning.
2. Aziz A. – Studies in Block Level Planning.
3. Bhat L S. – Regional Planning in India, Statistical Publishing Society, Calcutta, 1973.
4. Bhat L. S. et. at. : Micro-Level Planning: A Case Study of Karnal Area, Haryana, K.B. Publishing, New Delhi, 1976.
5. Chand M. &Puri V.K.– Regional Planning in India, Allied Publishers Pvt. Ltd., N.Delhi, 1983.

6. Friedman J. & Alonso W. – Regional Development and Planning – A Reader, M.I.T. Press, Cambridge, Mass, 1967.
7. Friedmann, J. and Alonso, W. : Regional Development Policy – A Case Study of Venezuela, M.I.T. Press, Cambridge, Mass, 1966.
8. Glasson J. - An Introduction to Regional planning : Concept, Theory & Practice, Hutchinson & Co.(Publishers) Ltd., London, 1983.
9. Glikson, Arthur : Regional Planning and Development, Netherlands Universities foundation for International Co-operation, London, 1955.
10. Gosal, G. S. and Krishan, G. : Regional Disparities in Levels of Socio-Economic Development in Punjab, Vishal Publications, Kurukshetra, 1984.
11. Government of India, Planning Commission: Third Five year Plan, Chapter on Regional Imbalances in Development, New Delhi, 1961.
12. Inamdar, N. R. &Kshire, V.K., - District Planning in India : A Case study of Maharastra, Oxford & IBH Publishing Co., Delhi, 1986.
13. Indian Council of Social Science Research: Survey of Research in Geography, Popular Prakashan, Bombay, 1972.
14. Kabra K. N. – Planning process in a District.
15. Kundu A. & Raza M. – Indian Economy : The Regional dimension – Spectrum Publishers, N. Delhi, 1982.
16. Misra R. P. – Regional Planning : Concepts, Techniques and Policies, University of Mysore, Mysore, 1969.
17. Misra R. P., et. al – Multi-level planning & Integrated Rural Development in India - Heritage Publishers, Delhi, 1980.
18. Misra R. P., et. at. – Regional development Planning in India : A Strategy, Vikas Publishing House Pvt. Ltd., Delhi, 1974.
19. Mundle S. – District planning in India.
20. Nangia, Sudesh. - Delhi Metropolitan Region , Rajesh Publication, Delhi, 1976.
21. Rao Hemlata – Regional disparities and Development in India, Ashish Publishing House, N. Delhi, 1984.
22. Raza M. (Ed.) – Regional Development – Heritage Publishers, Delhi, 1988.
23. Richardson, H. W., - Regional economics, Weidenfeld and Nicolson, London, 1969.
24. Sundaram K. V. – Urban and Regional Planning, Vikas Publishing House Pvt. Ltd., New Delhi, 1977.
25. Sundaram, K. V. (Ed.) – Geography and Planning, Essays in Honour of V.L.S. Prakasa Rao, Concept Publishing Co., New Delhi, 1985.

**SEMESTER – IV**  
**MODULE – PGGEOSPCT-402**  
**SPECIAL COURSE**  
**CARTOGRAPHY**

End-term Assessment - 38

Internal assessment - 12

Total - 50

**UNIT - I**

**Fundamentals of Cartography**

- a) Scope, content and history of Cartography.
- b) Sources of Cartographic Information and data.
- c) Cartographic techniques and methods in the preparation of cartograms.

**UNIT - II**

**Spherical Trigonometry**

- a) Fundamental Principles of spherical triangle, Spherical Excess.
- b) Napier's Rule of circular parts.
- c) Application for determination of distance, azimuth and area on the Earth's Surface.

**UNIT - III**

**Surveying with Theodolite and Levels**

- a) Theodolite Traversing (Omitted Measurements), Determination of coordinates and area from the data.
- b) Principles and methods of Triangulation Surveying, Base line measurement and corrections, Satellite stations.
- c) Determination of heights, distance and reduced levels by Tachometric Surveying.
- d) Principles, corrections for curvature and refraction of Reciprocal Surveying, and determination of reduced level of a place.

**UNIT - IV**

**Instruments**

- a) Clinometer
- b) Abney's level.
- c) Planimeter.
- d) Box Sextant.

**SEMESTER – IV**  
**MODULE – PGGEOSPCT-403**  
**SPECIAL COURSE**  
**CARTOGRAPHY**

End-term Assessment – 38

Internal assessment – 12

Total – 50

**UNIT - I**

Fundamentals of Map Projections

- a) Scale and choice of map projections.
- b) Classification of map projection and different properties.
- c) Application of spherical trigonometry in polar zenithal cases of map projections – Gnomonic, Stereographic and Orthographic and calculation of distance, azimuth and scale variations.

**UNIT - II:**

Conical Projections

- a) Conical Orthomorphic with two standard parallels.
- b) Conical Equal Area with two standard parallels.
- c) Polyconic Projection.
- d) Modified International Projections.
- e) Calculation of distance, azimuth and scale variations.

**UNIT - III**

Cylindrical projections

- a) Cylindrical Equal Area Projection with two standard parallels.
- b) Mercator's Projection.
- c) Cassini's Projection.
- d) Calculation of distance, azimuth and scale variations.

**UNIT - IV**

Conventional Projections

- a) Mollweide's Projection (Normal case)
- b) Parabolic Projection (Normal and Oblique cases)
- c) Calculation of distance and azimuth and scale variations.

**SEMESTER – IV**  
**MODULE – PGGEOSPCT-404**  
**SPECIAL COURSE**  
**CARTOGRAPHY**

End-term Assessment – 38

Internal assessment – 12

Total – 50

**UNIT - I**

**Air Photographs**

- a) Definition, scope and history of Aerial photography.
- b) Fundamentals of photography.
- c) Basic information of Aerial photography, Determination of scale of aerial photograph, Different corrections in Aerial photography.
- d) Geometry of Aerial Photographs.
- e) Elements of air photo interpretations.
  - i) Visual interpretation of air photographs.
- f) Air photo mosaics.
  - i) Merits and demerits of air photo mosaics.
  - ii) Preparation of maps from air photographs.
- g) Difference between maps and air photos

**UNIT - II**

**Remote Sensing**

- a) Definition, scope and Basics of Remote Sensing.
- b) Satellites, Platforms and Scanners.
- c) Data acquisition and data products.
- d) Manual Methods of Image Interpretation
- e) Digital Image Processing, rectification and enhancement .
- f) Image classifications.

**UNIT - III**

**Geographic Information Systems**

- a) Geographic Information System : definition
- b) Components & Structure of GIS
- c) Data Entry, Editing & Validation
- d) Manipulation & Analysis
- e) Display & Product creation

- f) Emerging Trends in GIS
- g) Geospatial Analysis a) Geospatial measurements b) overlay operations c) network analysis b) surface analysis

**UNIT - IV:** Applications of Remote Sensing and GIS in different Geographical Studies

- a) Water resource
- b) Urban & Rural Planning
- c) Agriculture Resource
- d) Forest Management.

**Suggested Readings**

1. Deetz, C. H. Adams O. S. - Elements of Map projection.
2. Gupta, R. K. - Planning Natural Resources.
3. Higgings, A. L. - Higher surveying.
4. Hanks, A. R. - Map Projection, 2<sup>nd</sup> Edition 1942.
5. Kanetkar, T. G. & Konkani S. V. - Surveying and leveling Part I & II.
6. Kellaway, G. P. - Map Projections 1st Indian edition 1974.
7. Kumar, G. S. - Aerial Photography.
8. Lieder, D. R. - Aerial Photo Interpretation - Principles theories and application.
9. Mailing, D. H. - Map Projection.
10. Misra, R. P. - Fundamentals of Cartography.
11. Raisz, E. - General Cartography.
12. Raisz, E. - Principles of Cartography.
13. Robinson, A. - Elements of Cartography.
14. Roy, P. - An analytical Study of Map Projection, 1988.
15. Steer, J. A. - An introduction to the Study of Map Projection.
16. Tobler, W. R. -A classification of Map Projection.

**SEMESTER – IV**  
**MODULE – PGGEOSPCP-405**  
**SPECIAL COURSE PRACTICAL**  
**CARTOGRAPHY**

End-term Assessment – 50

*UNIT – I*

**Surveying**

- a) Determination of area by traversing with Theodolite.
- b) Base line corrections with the help of triangulation survey with Theodolite.
- c) Determination of reduced level of a place by Reciprocal survey by Dumpy level.
- d) Determination of difference in heights by Tacheometric surveying with Theodolite.

*UNIT - II*

Map Projections

- a) Conical projection with two standard parallels.
- b) Mercator's projection (Normal Case)
- c) Mollweide's Projection (Normal Case)
- d) Parabolic Projection (Normal Case)

*UNIT - III*

Air photo Interpretation

- a) Calculation of Scale and number of photographs.
- b) Identification of objects from air photo.
- c) Visual interpretation of air photographs.
- d) Preparation of mosaics from air photos.

*UNIT - IV*

Interpretation of Satellite Imagery and Application of GIS

- a) Visual interpretation of satellite imagery.
- b) Digital Image processing.
- c) Application of GIS in Thematic Maps.

**Suggested Readings**



1. Deetz, C. H. Adams O. S. - Elements of Map projection.
2. Gupta, R. K. - Planning Natural Resources.
3. Higgings, A. L. - Higher surveying.
4. Hanks, A. R. - Map Projection, 2<sup>nd</sup> Edition 1942.
5. Kanetkar, T. G. & Konkani S. V. - Surveying and leveling Part I & II.
6. Kellaway, G. P. - Map Projections 1st Indian edition 1974.
7. Kumar, G. S. - Aerial Photography.
8. Lieder, D. R. - Aerial Photo Interpretation - Principles theories and application.
9. Mailing, D. H. - Map Projection.
10. Misra, R. P. - Fundamentals of Cartography.
11. Raisz, E. - General Cartography.
12. Raisz, E. - Principles of Cartography.
13. Robinson, A. - Elements of Cartography.
14. Roy, P. - An analytical Study of Map Projection, 1988.
15. Steer, J. A. - An introduction to the Study of Map Projection.
16. Tobler, W. R. - A classification of Map Projection

**SEMESTER – IV**  
**MODULE – PGGEOSPCT-402**  
**SPECIAL COURSE**  
**URBAN GEOGRAPHY**

End-term Assessment - 38

Internal assessment - 12

Total - 50

**UNIT - I**

Scope and content of Urban Geography and its changing nature; definition of urban places.

**UNIT - II**

Origin and growth of Pre-industrial cities: the ancient cities and the medieval cities; growth of modern cities; trends in urbanisation in the third world during the modern period with particular reference to India.

***UNIT - III***

Concept of sub-urbanisation, counter urbanisation and re-urbanisation.

***UNIT - IV***

Size and spacing of cities with reference to rank-size relationships.

**SEMESTER – IV**  
**MODULE – PGGEOSPCT-403**  
**SPECIAL COURSE**  
**URBAN GEOGRAPHY**

End-term Assessment - 38  
Internal assessment - 12  
Total - 50

***UNIT - I***

Classification of urban settlements: Functional Classification of Urban Centres and the concept of Basic and Non-Basic Functions.

***UNIT - II***

Theories on urban land use structure; Urban Morphology with particular reference to Indian cities; Physical Structure and Functions of the C.B.D.

***UNIT - III***

The Concept and Structure of the city Region; Impact of the city on its Countryside; Concept of Urban Field.

***UNIT - IV***

Principles of urban planning and the major elements of a city plan; Master planning and land use zoning. Town Planning in India with specific Case Study.

**SEMESTER – IV**  
**MODULE – PGGEOSPCT-404**  
**SPECIAL COURSE**  
**URBAN GEOGRAPHY**

End-term Assessment - 38

Internal assessment - 12

Total - 50

***UNIT - I***

Demographic Characteristics of Urban Populations; Pattern of rural-urban migration: its causes and impact. Urban land values: Factors determining urban land values; spatial structure of urban land values; urban land value theory.

***UNIT - II***

Urbanisation and environmental problems; Sustainable development and cities: its needs and implications; city as an ecological unit.

***UNIT - III***

Solid waste Management: Types and various sources; Associated problems and planning with particular reference to Indian cities.

***UNIT - IV***

Slums, urban renewal and urban sprawl in India.

**SEMESTER – IV**  
**MODULE – PGGEOSPCP-405**  
**SPECIAL COURSE PRACTICAL**  
**URBAN GEOGRAPHY**

End-term Assessment – 50

**UNIT – I**

Analysis of breaking points and detour index.

**UNIT – II**

Analysis of Morphology of the Urban area

- a) Preparation of Thematic Map of Urban Land use.
- b) Preparation of land use/land cover map using R.S. data.

**UNIT – III**

Interpretation of Urban land values using time series data

- a) Preparation of spatial distribution maps.
- b) Trend analysis by fitting:
  - i. Straight line.
  - ii. Parabola of the second degree and
  - iii. Exponential form.

**UNIT – IV**

Testing Urban Rank Size Rule and its applications.

**Suggested Readings**

1. Abercrombie, P. - Town and Country Planning.
2. Allen, Noble & Dutt - Indian Urbanization and Planning Vehicles of Modernization.
3. Balchin, P. N. & J. L. Kieve - Urban Land Use Economics.
4. Beajeugarnier, J. and G. Chabot - Urban Geography.
5. Bergel, E. E. - Urban Sociology.
6. Berry, B. J. L. & F. E. Horton - Geographic Perspective on Urban Systems.
7. Bhattacharya, B. - Urban Development in India : Since Pre-Historic Times.
8. Bose, A. - Studies in India's Urbanization.

9. Breese, G. – Urbanization in Newly Developing Countries.
10. Breese, G. and D. W. Whiteman – An approach to Urban Planning.
11. Butler, E. W. – Urban Sociology.
12. Carter, H. – The Study on Urban Geography.
13. Centre for Urban Studies, Indian Institute of Public Administration: Slum Clearance and Improvement.
14. Chapin, F.S. – Urban Land Use Planning.
15. Clark, D. – Urban Geography.
16. Clark, D. N. Rothblatt and D. J. Garr – Suburbia.
17. Darin, H. & Dasabkin – Land Policy & Urban Growth.
18. Desai and Pillai – Slums and Urbanization.
19. Dickinson, R. E. – City and Region.
20. Drakakis, David & Smith – Urbanization in the Developing World.
21. Gallion, A. B. & Eisner, S. – The Urban Pattern.
22. Godda, K. S. R. – Urban and Regional Planning.
23. Hauser, P. H. and L. F. Schnove – The Study of Urbanization.
24. Hegde, P. V. – Ancient and Medieval Town Planning in India.
25. Johnson, J. H. – Urban Geography.
26. Jones, E. – Towns and Cities.
27. Maunder, P. S. & I. Majumdar – Rural Migration in an Urban Setting.
28. Mayer, H. M. & C. F. Kohn – Readings in urban Geography.
29. Northam, R. M. – Urban Geography.
30. Putnam, Taylor & Kettle – A Geography of Urban Places.
31. Quinn, J. A. – Urban Sociology.
32. Ratcliffe, J. – Introduction to Town and Country Planning.
33. Sexena, D. P. – Rural Migration in India.
34. Singh, R. L. (Ed) – The Ecology of Man.
35. Sjoberg, G. – The Pre-Industrial City.
36. Smailes, A. E. – Geography of Towns.
37. Warner, S. B. – Planning for a Nation of Cities.

**SEMESTER – IV**  
**MODULE – PGGEOSPCT-402**  
**SPECIAL COURSE**  
**FLUVIAL GEOMORPHOLOGY**

End-term Assessment - 38

Internal assessment - 12

Total - 50

**UNIT - I**

Fundamentals of river hydraulics and mechanics

- a) Fluid mechanics.
- b) Forces acting in channels.
- c) Factors controlling flow velocity.
- d) Velocity and its distribution.
- e) Measurement of velocity and discharge.
- f) Types of stream flow.

**UNIT - II**

Hydraulic Geometry

- a) Shape of the channel.
- b) Variation of Hydraulic Characteristics at a given Cross Section.
- c) Variation of Hydraulic Characteristics in a Downstream Direction.
- d) Longitudinal profile of the river Channel.

**UNIT - III**

Transportation of the sediment load

- a) Competancy, and Capacity of a Stream.
- b) Energy Losses in Stream flow.
- c) Loss of Transporting ability.
- d) The Debris load of rivers.
- e) The nature of Fluid Force and its relation to Debris Movement.
- f) Computation of Sediment Load.

**UNIT - IV**

Channel Behaviour

- a) Behaviour of Tidal channels and their associated problems of maintenance in South Bengal.
- b) Flood problems of West Bengal and their remedies with special reference to North Bengal.

**SEMESTER – IV**  
**MODULE – PGGEOSPCT-403**  
**SPECIAL COURSE**  
**FLUVIAL GEOMORPHOLOGY**

End-term Assessment - 38

Internal assessment - 12

Total - 50

**UNIT - I**

Major Changes of River Courses in Bengal during historical period

- a) Tista.
- b) Damodar.
- c) Bhagirathi-Hooghly.
- d) River Metamorphosis in Sub-Himalayan West Bengal: Causes and Effects.

**UNIT - II**

Channel Forms and Processes of Indian Rivers

- a) Bhagirathi-Hooghly.
- b) Tista.

**UNIT - III**

Drainage Basin as a Fundamental Geomorphic Unit

- a) Morphometric units.
- b) Linear Aspects of the basin.
- c) Areal Aspects of the basin.
- d) Relief aspects of the basin

**UNIT - IV**

Channel pattern

- a) Straight channel.
- b) Braided channel.
- c) Meandering channel.
- d) Meandering valleys.
- e) The configuration of Floodplain channels.



**SEMESTER – IV**  
**MODULE – PGGEOSPCT-404**  
**SPECIAL COURSE**  
**FLUVIAL GEOMORPHOLOGY**

End-term Assessment - 38  
Internal assessment - 12  
Total - 50

UNIT - I

Evolution of drainage Patterns and their Geomorphic Characteristics of some Indian Rivers

- a) Ganga.
- b) Brahmaputra.
- c) Mahanadi.
- d) Narmada.

UNIT - II

National Policy of Water Resource Development

- a) Hydrological regions.
- b) Irrigation and Water power.
- c) Inter-Basin Water transfer.
- d) Flood Control and Stream flow routing.
- e) National Water Grid.

UNIT - III

Channel behavior under human influence (with Indian example)

- a) Effect of Dam.
- b) Effect of Reservoir.
- c) Effect of Embankments.
- d) Hydrological effects of urbanisation.

UNIT - IV

Remote Sensing and GIS applications to the Fluvial Environment.

**SEMESTER – IV**  
**MODULE – PGGEOSPCP-405**  
**SPECIAL COURSE PRACTICAL**  
**FLUVIAL GEOMORPHOLOGY**

End-term Assessment – 50

Quantitative and qualitative geomorphic analysis of a selected drainage basin:

- a) Morphometric analysis of drainage basin.
- b) Use of Hydrological instruments.
- c) Univariate & Bi-variate analysis.
- d) Geomorphological mapping.
- e) Fluvio-Geomorphological mapping with the help of RS and GIS techniques.

**Suggested Readings**

2. Bagchi, K.: The Bhagirathi-Hooghly Basin.
3. Basu, S. R.: Major changes of the river courses in West Bengal, Observer.
4. Basu, S. R.: On some aspects of fluvial dynamics of river Bhagirathi, Indian Journal of River Valley Development, 17 No. 11.
5. Basu, S. R., 1981: Some consideration on the process of sedimentation in Hooghly
6. tidal channel, North Bengal University Review (Science & Technology), Vol.2.
7. Chorley, Richard J., (Ed.), 1969: Water, Earth and Man: A synthesis of Hydrology, Geomorphology and Socio-economic Geography, Methuen and Company Ltd., New York, USA.
8. Chow, VenTe, (Editor-in-Chief), 1964: Handbook of Applied Hydrology: A Compendium of Water-resources Technology, McGraw-Hill Book Company, New York, USA.
9. Compton, Robert R., 1965: Manual of Field Geology, Wiley Eastern Pvt. Ltd., New Delhi, Second Edition.
10. Crickmay, C. H., 1974: The Work of the River: A critical study of the central aspects of Geomorphogeny, The Macmillan Press Ltd., London, UK, First Edition.
11. Doornkamp, John C. and King, Cuchlaine A.M., 1971: Numerical analysis in Geomorphology: An introduction, St. Martin's Press, New York, USA, First Edition.
12. Dury, G. H., (Ed.), 1970: Rivers and River Terraces, Macmillan, Edinburgh, UK.

13. Dury, G. H., (Ed.), 1966: *Essays in Geomorphology*, Heinemann Educational Book Ltd., London, UK.
14. Eagleson, Peter S., 1970: *Dynamic Hydrology*, McGraw-Hill Book Company, New York, USA, First Edition.
15. Embleton, Clifford, Burnsden, D. and Jones, D.K.C., (Ed.), 1978: *Geomorphology: Present problems and future prospects*, Oxford University Press, Oxford, UK, First Edition.
16. Gregory, K. J., (Ed.), 1977: *River Channel Changes*, John Wiley & Sons, Chichester, UK, First Edition.
17. Institute of Civil Engineering, 1966, *River Flood Hydrology*, ICE, London.
18. Julien, Pierre Y., 1988: *Erosion and Sedimentation*, Cambridge University Press, Cambridge, UK, First Edition.
19. Kirkby, M. J., (Ed.), 1978: *Hillslope Hydrology*, John Wiley & Sons, Chichester, London, UK.
20. Knighton, David, 1998: *Fluvial forms and processes: A new perspective*, Arnold Publishers, Cornwall, UK, First Edition.
21. Leopold, Luna B., Wolman, M. Gordon and Miller, John P., 1970: *Fluvial Processes in Geomorphology*, S. Chand and Company Ltd., New Delhi, First Indian Reprint.
22. Linsley Jr., Ray K., Kohler, Max A. and Paulhus & Joseph, L. H., 1949: *Applied Hydrology*, McGraw-Hill Civil Engineering Series, McGraw-Hill Book Company, New York, USA, First Edition.
23. Maidment, David R., (Editor-in-Chief) 1993: *Handbook of Hydrology*, McGraw-Hill, Inc., New York, USA, First Edition.
24. Morisawa, Marie, (Ed.), 1981: *Fluvial Geomorphology*, George Allen and Unwin, London, UK.
25. Morisawa, Marie, 1968: *Streams: their dynamics and morphology*, Earth and Planetary Science Series, McGraw-Hill Book Company, New York, First Edition.
26. Morisawa, Marie, 1985: *Rivers: Form and Process*, Geomorphology Texts, Longman Group Ltd., New York, First Edition.
26. Mutreja, K. N., 1986: *Applied Hydrology*, Tata McGraw-Hill Publishing Company, Ltd., New Delhi, India, First Edition.
27. Newson, Malcolm, 1994: *Hydrology and the Environment*, Oxford University Press, New York, USA, First Edition.

28. Rao, K. L., 1979: India's Water Wealth: Its Assessment, Uses and Projections, Orient Longman Limited, New Delhi, Revised Edition.
29. Richards, Keith, 1982: Rivers: Form and Processes in Alluvial Channels, Methuen & Company Ltd., New York, USA, First Edition.
30. Richards, Keith, (Ed.), 1987: River Channels: Environment & Process, Basil Blackwell, Oxford, UK, First Edition.
31. Saha, S. K. and Barrow, Christopher, J., (Ed.), 1981: River basin planning: Theory and Practice, John Wiley & Sons, Chichester, USA.
32. Schumm, Stanley Alfred and Mosley, M. Paul, (Ed.), 1973: Slope Morphology, Benchmark Papers in Geology, Dowden, Hutchinson & Ross, Inc., Pennsylvania, USA.
33. Schumm, Stanley Alfred, 1977: The Fluvial System, John Wiley & Sons, Inc., A Wiley-Interscience Publications, New York, USA, First Edition.
34. Slaymaker, Olav, (Ed.), 2000: Geomorphology, human activity and global environment, John Wiley & Sons, Ltd., England, UK.
35. Smith, David Ingle and Stopp, Peter, 1978: The River Basin: An introduction to the study of hydrology, Cambridge University Press, Cambridge, UK, First Edition.
36. Smith, Keith and Ward, Roy, 1998: Floods: Physical processes and Human Impacts, John Wiley & Sons, Chichester, England, UK, First Edition.
37. Statham, Ian, 1979: Earth Surface Sediment Transport: Contemporary problems in Geography, Oxford University Press, Oxford, UK, First Edition.
38. Ward, R. C., 1967: Principles of Hydrology: McGraw-Hill Publishing Company, Ltd., London, UK, First Edition.
39. Ward, Roy, 1978: Floods: A geographical perspective, Focal problems in Geography, The Macmillan Press Ltd., London, UK, First Edition.
40. Young, A., 1972: Slopes, Geomorphology Text 3, Oliver & Boyd, Edinburgh, UK, First Edition.

**SEMESTER – IV**  
**MODULE – PGGEOSPCT-402**  
**SPECIAL COURSE**  
**POPULATION GEOGRAPHY**

End-term Assessment - 38

Internal assessment - 12

Total - 50

***UNIT - I***

Scope and content of Population Geography. Sources of Demographic data; History of Census - World with special reference to India.

***UNIT - II***

Population Theories.

***UNIT - III***

Population, Environment and Development-combating poverty and implementing sustainability. Population Resources: Optimum, Over and Under Population; Population consumption and threatened resources.

***UNIT - IV***

Human resource development

**SEMESTER – IV**  
**MODULE – PGGEOSPCT-403**  
**SPECIAL COURSE**  
**POPULATION GEOGRAPHY**

End-term Assessment - 38

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Total - 50

**UNIT - I**

Distribution and Trends of Population in India. Components of Population Changes: Fertility, Mortality and Migration in India.

**UNIT - II**

Age-sex Structure of population in India. Rural & Urban Population in India.

**UNIT - III**

Social Characteristics of Population in India.

**UNIT - IV**

Population problems and policies in India. Human resource development planning in India.

**SEMESTER – IV**  
**MODULE – PGGEOSPCT-404**  
**SPECIAL COURSE**  
**POPULATION GEOGRAPHY**

End-term Assessment - 38

Internal assessment - 12

Total - 50

UNIT - I

Population trends in Developed and Developing countries of the world,  
Population Explosion.

UNIT - II

Fertility; Concepts, sources of data, measures, factors affecting fertility.

UNIT - III

Mortality, Concept, measures, affects.

UNIT - IV

Migration: Definition, sources of data, measures, type, laws, causes and consequences, migration pattern in modern period. Urbanisation: concepts, measures, pattern, in Developing and Developed Countries

**SEMESTER – IV**  
**MODULE – PGGEOSPCP-405**  
**SPECIAL COURSE PRACTICAL**  
**POPULATION GEOGRAPHY**

End-term Assessment – 50

UNIT – I

- a) Measurement of density of population and its changes.
- b) Trends of population growth.

UNIT – II

Determination of change of population pressure by central tendency

- a) Mean centres of population and area
- b) Median centres of population and area

UNIT – III

Measures of Age sex

- a) Fertility
- b) Mortality  
(Selecting five developed and five developing countries of the world)

UNIT – IV

Age-sex ratio of selected countries of the world and India.

Suggested Readings

1. A. Bhattacharya – Population Geography of India.
2. A. Mitra – India's Population, Vol. I & II.
3. A.V. Perpilou – Human Geography.
4. Anthony Sellery – Africa –A social geography.
5. J. Garnier – Geography of Population.
6. J. Garnier – Geography of Population.
7. Berolay George W. – Techniques of Population analysis.
8. T. Valentey 1977 – An outline theory of population.



9. George W. Berelay –Techniques of Population analysis.
10. Gupta, S. P. – Advanced Practical Statistics.
11. Handbook of Population Census Methods – Vol. II, United Nations, 1958.
12. Kenneth Scott Latourette – The Chinese, their history and culture.
13. Mahammad A. – Sati Geographical studies.
14. Monkhouse and Wilkinson – Maps and Diagrams.
15. Paul, R. Ehrlich and Anne H. Enrlich – Population, Resources Environment.
16. R. B. Mandal & V.N.P. Sinha; Recent trends and concepts in geography, Vol. III.
17. R. J. Harrison Church – Africa and the Island.
18. Ramdayal Singh – Population structure of Indian cities, Inter India Publication, 1985, New Delhi.
19. Tara Kanitkar and Asha Vende (1980) – Studies in Population.
20. The determinants and consequences of population trends – United Nations, New York, 1953
21. The Determinants and consequences of Population trends: United Nations, New York, 1953.
22. U. Yuan Teen, M. E. Sharpe – Population theory in China.
23. V. N. P. Sinha and R. B. Mandal – Dimensions in Geography.
24. Walter Fitzerland – Africa

**SEMESTER – IV**  
**MODULE – PGGEOSPCT-402**  
**SPECIAL COURSE**  
**ADVANCED GEOTECTONIC AND GEOLOGY**

End-term Assessment - 38

Internal assessment - 12

Total - 50

**UNIT - I**

Earth Systems Science: Definitions and Scope of Geotectonic, Geology, Meteorology, Significance of Exogenetic and Endogenetic forces.

**UNIT - II**

Elementary information on solar system, members of the solar system, terrestrial and Jovian planets. Origin of the solar system, nebular hypothesis, formation of planets. Layered structure of Earth, differentiation of Earth's core, mantle and crust, formation of Earth's oceans and atmosphere.

**UNIT - III**

Earth as a system of interacting components- solid earth, atmosphere, hydrosphere, biosphere. History of development of geological thoughts, Neptunism, Plutonism, Uniformitarian's, law of superposition, law of faunal succession. Contribution of Werner, Hutton, Smith and Lyell.

**UNIT - IV**

Earth's materials, minerals and rocks. Broad groups of minerals, oxides, sulphides, carbonates, sulphates and phosphates, silicates. Rocks as mineral assemblages, fabric, texture. Igneous rocks, acid, intermediate, mafic and ultramafic rocks. Sedimentary rocks, clastic and non-clastic. Metamorphic rocks, foliated, nonfoliated. Common rocks - granite, granodiorite, pegmatite, rhyolite, syenite, trachyte, diorite, andesite, gabbro, dolerite, basalt, peridotite; conglomerate, sandstone, shale, limestone, slate, phyllite, schist, gneiss, quartzite, marble.

**SEMESTER – IV**  
**MODULE – PGGEOSPCT-403**  
**SPECIAL COURSE**  
**ADVANCED GEOTECTONIC AND GEOLOGY**

End-term Assessment - 38

Internal assessment - 12

Total - 50

**UNIT - I**

Structure of geologic bodies. Extrusive and intrusive igneous rock bodies, lava flows, sills, dykes, batholiths. Bed and stratum, dip and strike. Folds, antiform, synform, anticline, syncline. Fractures, joints and faults. Foliation, lineation, unconformity.

**UNIT - II**

Earth's surface processes, weathering, erosion, mass wasting; bed rock, regolith, soil, soil profile. Erosion, transportation and deposition by wind, river, glacier, groundwater and ocean. Common landforms related to action of wind, river, glacier; coastal landform. Ice ages, evidence and causes. Oceanic and atmospheric circulation patterns.

**UNIT - III**

Elementary idea of theory of plate tectonics. Lithosphere, asthenosphere. Plates and plate boundaries, relative motion of plates. Present day configuration of plates.

**UNIT - IV**

Earth's internal processes, magmatism, metamorphism, deformation. Volcanoes and volcanism, products of volcanic eruption, eruptive styles, volcanic belts, recent volcanism in India.

**SEMESTER – IV**  
**MODULE – PGGEOSPCT-404**  
**SPECIAL COURSE**  
**ADVANCED GEOTECTONIC AND GEOLOGY**

End-term Assessment - 38

Internal assessment - 12

Total - 50

**UNIT - I**

Earthquakes, causes, elastic rebound theory, focus and epicenter, intensity and magnitude. Seismic waves, seismograms, travel-time curves for seismic waves, seismic discontinuities, locating epicenter, and determining magnitude. Earthquake belts. Effects of earthquakes, seismic zones of India

**UNIT - II**

Internal Constitution of Earth; Evidence from seismic waves, meteorites, other lines of evidence. Heat flow, basic concepts, geothermal gradient. Hotspot and mantle plume. Gravity and magnetic field of the earth; and gravity anomaly on Earth, Bouguer and free-air anomaly. Concept of isostasy and compensation, hypotheses of Airy, and Pratt. Gravity and magnetic field of the earth; and gravity anomaly on Earth, Bouguer and free-air anomaly. Concept of isostasy and compensation, hypotheses of Airy, and Pratt.

**UNIT - III**

Principles of determination of relative ages of rock bodies and geologic event. Absolute ages of Rocks and minerals, fundamental principles radiometric dating. Age of the Earth. Geologic TimeTable up to the level of Eras and Periods. The fossil record; Fossils as evidence of past life; modes of preservation of fossils. Uses of fossil.

**UNIT - IV**

Physical meteorology, Atmospheric electricity, cloud physics, Dynamic meteorology, numerical weather prediction, general circulation and climate modelling; Aviation meteorology.

**MODULE – PGGEOSPCP-405**  
**SPECIAL COURSE PRACTICAL**  
**ADVANCED GEOTECTONIC AND GEOLOGY**

End-term Assessment – 50

UNIT - I

**Systematic study of hand specimens of the minerals listed below on the following points:** Form and structure, colour, transparency, lustre, streak, cleavage, parting, fractures, hardness, specific gravity, magnetism, and treatment with dilute HCl. Haematite, magnetite, goethite, ilmenite, chromite, pyrolusite, **psilomelane**, bauxite; Pyrite, chalcopyrite, pyrrhotite, sphalerite, galena; Calcite, aragonite, dolomite, magnesite, siderite, malachite; Fluorite, gypsum, barite, wolframite, apatite, graphite; Quartz, feldspar, muscovite, biotite, pyroxene, amphibole, beryl, tourmaline, garnet, serpentine (including asbestos variety), talc, chlorite, kyanite, sillimanite, staurolite.

UNIT - II

**Structural Geology:** Reading and interpretation of topographic maps; Use of Clinometer and Brunton compass, measurement of attitude of planar and linear structural elements. Graphical solution of true dip – apparent dip problems, three-point problems. Stereographic projection of planes and lines: solution of simple structural problems using a net, e.g., true dip – apparent dip relations, determination of axis of cylindrical folds. Construction of block diagrams of homoclinal beds and folded beds

UNIT - III

- a. **Identification in hand specimen by studying mineralogical composition and texture of the following rock types:** Granite, granodiorite, syenite, nepheline syenite, aplite, granophyre, diorite, gabbro, **anorthosite, pyroxenite**, peridotite, mica-lamprophyre, dolerite, basalt, andesite, and rhyolite; C.I.P.W. norm calculation of granitic and basic rock (without **foid**).
- b. Orthographic projection of cubic, tetragonal and orthorhombic crystal models; Stereograms (with and without the **stereonets**) from given crystallographic data.
- c. Field Work - **Field work of approximately 10 days (under the supervision of teacher)**
  - i. Geological mapping of a small area, collection and study of samples and preparation of Geological Maps.
  - ii. Chain/Tape and compass surveying and use of Brunton compass, and GPS

## UNIT - IV

- a. Remote Sensing, GIS and GPS: Stereo test. Interpretation of stereogram under pocket stereoscopes. Interpretation of single vertical air photo, including boarder Information. Interpretation of stereo pairs of vertical air photos under mirror stereoscopes. Interpretation of multi band satellite images. Interpretation of false colour composites. Use of topographic maps, air photos and satellite images for geological mapping and resource surveys.
- b. **Geomathematics and Geo-statistics:** Scientific methods & some basic concept of statistics; Sample - Universe: Measurement- scale and error; Models; Measurement of variability; Probability. Population distribution- binomial, normal, Poisson; Statistical inferences- errors in judgment Confidence Intervals. Small sampling theory- Chi-square, Student's t, Snedecor's F tests Non -parametric tests- Kolmogorov-Smirnov. ANOVA-correlation & linear regression

**SEMESTER – IV**  
**MODULE – PGGEOSPCT-402**  
**SPECIAL COURSE**  
**GEOGRAPHY OF TRANSPORT AND TRADE**

End-term Assessment - 38

Internal assessment - 12

Total - 50

**UNIT - I**

History of Development, Approaches Modes of transportation: Contribution of different scholars; Functional Approach; Significance of transportation in world and regional economies.

**UNIT - II**

Development and distribution of different modes: Characteristics and significance; Landways - roadways, railways and pipeline; Waterways - ocean and inland; Airways.

**UNIT - III**

Factors associated with their growth Characteristics and relative significance of different modes of transport.

**UNIT - IV**

Location of seaports and airports: Factors associated with their growth - Physical factors; Economic factors; Political factors.

**SEMESTER – IV**  
**MODULE – PGGEOSPCT-403**  
**SPECIAL COURSE**  
**GEOGRAPHY OF TRANSPORT AND TRADE**

End-term Assessment - 38

Internal assessment - 12

Total - 50

**UNIT - I**

Network structure and measurement of accessibility: Nodes and routes; Hierarchies; Hinterlands; Models of network changes; Graph theoretic measures; Traffic flow; Gravity models; Transport network and economic development.

**UNIT - II**

Concept, development and significance of trade: Concept of trade, types of trade, concept of balance of trade; role of trade in the world and regions; significance of trade.

**UNIT - III**

Urban transport - growth and their problems: Growth of urban transportation in developing countries; Transport and environmental degradation; vehicular pollution and congestion; alternative transport system in mega cities of India; national highway development and planning in India.



**SEMESTER – IV**  
**MODULE – PGGEOSPCT-404**  
**SPECIAL COURSE**  
**GEOGRAPHY OF TRANSPORT AND TRADE**

End-term Assessment - 38

Internal assessment - 12

Total - 50

**UNIT - I**

Types of trade theories: i. Theory of comparative advantage ii. Neo-classical theory iii. Modern theory

**UNIT - II**

International trade: Trade areas and economic blocks; Various treaties of trade at international level; History and development of International trade; Geographical factors influencing international trade; Problems and prospects of international trade in globalisation.

**UNIT - III**

Transport India's foreign trade: Transport development: Rail, Road, water, air transport and Ports; Transport and pollution; Volume of trade, patterns of imports, composition of export tradeoff India, features of India's foreign trade, trade with U.S.A, U.K, Germany, Russia, Canada, Japan.

**SEMESTER – IV**  
**MODULE – PGGEOSPCP-405**  
**SPECIAL COURSE PRACTICAL**  
**GEOGRAPHY OF TRANSPORT AND TRADE**

End-term Assessment – 50

UNIT - I

Indices of transport network analysis – Detour Index and shape index

UNIT - II

Measures of network connectivity and accessibility.

UNIT - III

Relation between settlement and physiography (transect chart), Road density with topographical map, identify route map from aerial photograph and satellite imagery.

UNIT - IV

Traffic Flow line map of a particular area in west Bengal; statistical analysis of transport and settlement data, agriculture and industrial data.

**Suggested Readings**

**SEMESTER – IV**  
**MODULE – PGGEOCCGP-406**  
**GENERAL PRACTICAL**

End-term Assessment – 50

**Digital Thematic Mapping**

**UNIT - I:** Preparation of Choropleth Map by using Computer.

**UNIT - II:** Preparation of Chorochromatic (Mono and Multi) Map by using Computer.

**UNIT - III:** Preparation of Digital Thematic Map by using Statistical and Cartographic Techniques.

**SEMESTER – IV**  
**MODULE – PGGEOSPCPR-407**  
**SPECIAL COURSE PROJECT**  
**FOR ALL SPECIAL COURSE**

A. Project Report	Marks:75	
B. Viva-voce on project report		25
Total	100	

1. Preparation of a Report containing at least 50 pages (including maps, diagrams and tables) which will involve the application of any one of the topics of the concerned Special Course: The report based on fieldwork (not exceeding a week and under the supervision of a teacher) should be well represented by suitable statistical techniques and cartographic methods.
2. The students should follow the research guidelines by reading ResearchMethodology before taking up the Project Work.
3. The Project Report should include followings:

- a) Title of the project
- b) Introduction
- b) Objectives
- c) Methodology and Data sources
- d) Study Area
- e) Review of literature
- f) Results and Discussion
- g) Conclusion
- h) Bibliography
- i) Appendices

### **Suggested Readings**

1. Archer J.E. and Dalton T.H. (1968): The fields work in Geography, E.t. Batsford Ltd., London.

2. Haring, Lloyed (1975): Scientific Geographic Research W C. Brow Company USA.
3. Johnes, P.A. (2008): Field Work in Geography, Longman.
4. Kothari C.R.(1996): Research Methodology, VishwasPrakashan, New Delhi
5. Misra R.P. (1991): Research Methodology in Geography, concept pub. New Delhi.