School of Earth Sciences

Swami Ramanand Teerth Marathwada University

Nanded

Syllabus

M.A. / M.Sc. Geography

Semester I & II

2019 - 2020

Semester I

Gg-C101: Geomorphology

Credits - 4 : Theory Paper

- **Pre-requisite:**

  The candidate should know the basic concepts from physical set-up, topographical & Morphometric changes and background of natural movements. The candidate should familiar with the SOI Topo-Sheet maps and given information about the topographical features.

- **Course Objectives**:

  The objectives of this paper are to understand the basic concepts of principles of geomorphology and fundamental theories about the geomorphological movements. Its prime aim is to understand and be capable to observe and note the endogenic forces and denudational processes in the field studies.

- **Course Outcomes:**

  After completion of the paper / course, the students will get capabilities and skills to correlate at primary level of natural cycles and manmade activities. In short, candidate will assess the cause-n-effect relationships.

- **Mode of Assessment**

  1. Tutorial examination
  2. Home assignments
  3. Field studies and its presentation
  4. Mid-term Theory Examination
  5. End-term Theory Examination
  6. P**PT** presentation on selected topic(s)

Gg-C101: Geomorphology
Course Contents

Unit	Teaching and Learning points	Periods
I	**A) Nature and Scope of Geomorphology:** Definition of Geomorphology, Fundamental Concepts in Geomorphology, **B) Basic Theories in Geomorphology:** Wegener's Continental Drift, Plate Tectonics, W M Davis's Concept of Geomorphic Cycle	18
II	**A) Endogenic Forces:** Epiorogenic and Orogenic Movements, Compression, Tension, Folds, Faults **B) Denudational Processes:** Weathering, Mass Movement, Erosion and Comparison of these processes	18
III	**Land Forms:** Associated with Fluvial, Glacial, Arid and Coastal processes	12
IV	**A) Slope Morphology:** Slope Forms and Processes **B) Application in Geomorphology:** Human activities and Geomorphology	12
Total Periods		60

Reference Books:

1. Thornbury, W. D. (I960): Principles of Geomorphology, John Wiley and Sons, New York.
2. Chorley, R. J., Schumm, S. A. and Sugden, D. E. (1984): Geomorphology, Methuen, London.
3. Kale, V. S. and Gupta, A. (2001): Introduction to Geomorphology, Orient Longman, Calcutta.
4. Savindra Singh (2002): Geomorphology, Prayag Pustak Bhawan, Allahabad
5. Spark B. W. (1972): Geomorphology, Longman, NewYork
6. Steers, A. (1958). The Unstable Earth, Methuen, London
7. Ollier, C. D. (1981) Tectonics and Landforms, Longman, London
8. Strahler A. H and Strahler, A. N. (1992): Modern Physical Geography, John Wiley, New York
9. Wooldridge and Morgan: Geomorphology
10. Holmes: Physical Geology
11. Fairbridge, R. W. (1968): Encyclopedia of Geomorphology, Reinholdts, New York.

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Gg-C102:Geographical Thought

Credits- 4 Theory Paper

Pre-requisite: Basic knowledge about development of geographical thought.

Course Objectives: The objectives of this course are to understand contributions of Greek, Roman, Arab, Chinese and Indian scholars in development of geography and also to know the development of modern geography.

Course Outcomes: After completion of the course, the students get capabilities on understanding the development of geography from ancient to modern age and also come to know the contribution of geographer to development of society.

Mode of Assessment

7. Tutorial examination
8. Home assignments
9. Seminar
10. Field studies
11. Quizzes
12. Oral presentation
13. Mid-term examination
14. End-term examination
15. Dissertation thesis

Gg-C102:Geographical Thought

Course Contents

Unit	Teaching / Learning Points
I	Contributions of Greek, Roman, Arab, Chinese and Indian Scholars in development of geography. Impact of Darwinian Theory on GeographicalThought
II	Founders of Modern Geography – i) Alexander Von Humboldt, ii) Carl Ritter, iii) Friedrich Ratzel iv) Vidal de la Blache, v) Ellen Churchill Sample, vi) Richard Hartshorne. vii)Scheafer
III	Dualisms in Geographic Studies physical vs. human, regional vs. systematic, qualitative vs. quantitative, ideographic vs. nomothetic,Concept of Determinism and Possibilism,Areal Differentiation, SpatialOrganization, Patterns and Processes, Explanation in Geography,Paradigm Shift, Quantitative Revolution.
IV	Perspectives in Geography (Positivism, Behaviouralism, Humanism, Structuralism, Feminism and Postmodernism).

References:

1. **Dixit, R.D. (1999): The Arts and Science of Geography, Integrated Readings; Prentice Hall of India Private Ltd, New Delhi.**
2. **Dickinson, R.E. (1969): The Makers of Modern Geography, Hall Book Depo, Bhopal Prenrtice-Hall of India,New Delhi. (English and Hindi)**
3. **Harvey, D. (1969): Explanation in Geography, London, Edward Arnold**
4. **Adams, Paul, Steven Holescher and Karel Till (eds.) (2001): Texture of Place. Exploring Humanistic Geographies. University of Minnesota Press, Minneapolis.**
5. **ArildHolf-Hensen (1999): Geography History and Concepts, Sage Publications, London**.
6. **Suja Edward (1989): Post-modern Geographies verso, London Reprinted 1997: Rawat Publication, Jaipur and New Delhi.**
7. **KapurAnu (ed.)(2001): Indian Geography – Voice of Concern Concept Publishing Company, New Delhi**
8. **Peet, Richard (1998): Modern Geographical Thought, Blackwell, Oxford**
9. **Braithwaite, E.B (1960): Scientific Explaination, Harper Toreh Books, New York.**
10. **Bunge, W. (1979): Fred K. Shaeffer and the Science of Geography, Annals, Association of American Geographers, 69:128-32.**

Gg-C103: Population Geography

Credits- 4 Theory Paper

Pre-requisite: Basic knowledge about elements of population and physical, culture and social geographical factors.

Course Objectives: The objectives of this course is to understand population growth, birth rate, death rate, crude birth rate, crude death rate, infant mortality rate, fertility, mortality, migration, age, sex ratio, age and sex pyramid, population density.

Course Outcomes: After completion of the course, the students get capabilities and skills on population geographical techniques, concepts, model and theories related to population geography. Also understand the various factor are affected of the population growth and population problems.

Mode of Assessment

16. Tutorial examination
17. Home assignments
18. Seminar
19. Field studies
20. Quizzes
21. Oral presentation
22. Mid-term examination
23. End-term examination
24. Dissertation thesis

Gg-C103: Population Geography
Course Contents

Unit	Teaching / Learning Points
I	**A. Population Geography:** Nature Scope, subject matter and recent trends **B. Basic Concepts:** Population Growth, Birth rate, Death rate, Crude Birth rate, Crude Death rate, Infant mortality rate, Fertility, Mortality, Migration, Age, Sex ratio, Age and sex pyramid, Density
II	**Population Growth and Distribution:** **A) Influencing Factors:** 1) Physical 2) Economic 3) Social 4) Political **B) World and India**
III	**Theory and Model:** Basic concept, Scope, Applications and relevance 1) Malthus theory of population growth 2) Demographic transition model
IV	**A. Population as a Resource:** 1) **Concepts**: Over, Optimum and Under population 2) **Various aspects**: Size, Growth, Age, Education and Health 3) Population resource regions **B. Population problems and policies in India**

References:

1. Barrett H.R. (1992): Population Geography, Oliver and Boyd Longman House, Harlow.

2. Bhende Asha & Kanitkar Tara (1975): principles of population Studies,Himalaya Publishing House, Bombay.

3. Chandna,R.C. & Manjit s. Sidhu(1980): Introduction to Population Geography, Kalyani Publishers, New Delhi.

4. Chandana, R.C. (1984): Geography of Population, Kalyani publisher, Ludhiana.

5. Garnier, J.B. (1976): Geography of Population, Longman Group Ltd., London.

6. Hausier, Philip M & Duncan (Eds.) (1959): The Study of Population, University Press, hicago.

7. Hussein, Majid (1999): Human Geography (2Ed.), Rawat Publications, Jaipur.

8. Ravenstein,E(1889):The Laws of Migration,journal,Royal Statistical Society,49,pp241-305.

9. Sinha V.C (1979): Dynamics of India's Population Growth,National Publishing House,New Delhi.

10. Smith,T.L)1960): Fundamental of Population Studies, Lipineott, London.

11. Zelinsky, W (1966): A Prologue of Population Geography, Prentice Hall Inc, M.J.

12. Sawant & Athawale A. S: Population Geography, Mehta Kolhapur.

Gg-E102: Physical Geography of Maharashtra

Credits - 3 : Theory Paper

- **Pre-requisite:**

  The candidate should know the basic concepts from regional Geography. The candidate should familiar with the natural and administrative boundaries and their relationships to each other. He / She should know the importance of physical features in demarcation of a region and regional entities.

- **Course Objectives**:

  The objectives of this paper are to understand the basic concepts of Regional Geography and fundamental theories about the region and their characteristics. Its prime aim is to understand the physical features and their spatial characters in details.

- **Course Outcomes:**

  This paper is providing basic information about the physical set up of the state. The students will get knowledge and will acquire skills for comparative regional study and correlate the cause-n-effect relationships of all basic topographical and morphometric aspects.

- **Mode of Assessment**

  25. Tutorial examination
  26. Home assignments
  27. Field studies and its presentation
  28. Mid-term Theory Examination
  29. End-term Theory Examination
  30. P**PT** presentation on selected topic(s)

Gg-E102-Physical Geography of Maharashtra
Course Contents

Unit	Teaching and Learning points	Periods
I	**Physical Settings:** Geographical Location, Hill ranges, Main Rivers, Major Soil types & distribution, Major Vegetation types	12
II	**Climate:** Major Climatic types & Characteristics, Distribution of Temperature and Rainfall,	15
III	**Resources:** **A) Mineral and Power Resources** Distribution and production of Bauxite, Manganese, Iron-Ore, Coal, Mineral Oil **B) Forest Resources** Distribution, Forest Products, Minor Forest Products, Need of Forest Conservation	18
Total Periods		45

Reference Books:

1. Gazetteer of Maharashtra, Govt of India.
2. B. Arunchalm, Regional Geography of Maharashtra
3. B.D. Nag Choudhary, "Introduction to Environment Management" Inter Print Mehata House, New Delhi.
4. Brucu Mitchell "Geography and resources analysis" John willey and sons, New York.
5. C.D. Deshpande, "Geography of Maharashtra" National book Trust of India, New Delhi.
6. Cutler L, Renwick H.L. Exploitation conservation and preservation : A
7. Geographical perspective and natural resource use, Rowmon and Allanhed, Towata.
8. Govt. of Maharashtra "Economic development of Maharashtra." (Maharashtra Economic Development Council)
9. Dixit K.R., "Maharashtra in Maps"
10. Deshpande, S.H. "Economy of Maharashtra"
11. Annual Socio-Economic Abstracts, (1951 to 2011, all concern districts), Govt of Maharashtra.

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Gg-E103: Physical Geography of India

Credits- 3. Theory Paper

Pre-requisite: Basic knowledge about physical factors and map of India.

Course Objectives: The objectives of this course is to understand physiography, climate, vegetation and soils of India.

Course Outcomes: After completion of the course, the students get capabilities to understand the physiography, climate, vegetation and soils of India.

Mode of Assessment

1. Tutorial examination
2. Home assignments
3. Seminar
4. Field studies
5. Quizzes
6. Oral presentation
7. Mid-term examination
8. End-term examination
9. Dissertation thesis

Gg-E103: Physical Geography of India

Course Contents

Unit	Teaching / Learning Points
I	Physiography – Structure, relief, physiographic divisions & natural drainage system of India.
II	Climate – climatic types & regional variations, Climate and agriculture
III	Natural vegetation – Vegetation types & regions, forests & their utilization and conservation
IV	Soil types and conservation in India.

Reference Books:

1. 1. Sharma, T.C. & Coutinho: "Economic, & CommercialGeography of India". Vikas Pub. House Delhi.
2. Negi, B.S: "Economic & Commercial Geography India."Kedar Nath Ram Nath, N.Delhi.
3. Mamoria, C.B. "Economic & Commercial Geography of India".
4. Singh, Gopal: "Geography of India".
5. Kuriyan. George: "India- A General Survey". National Bk. Trust.
6. Stamp, L.D: "Geography of Asia".
7. Spate, O.H.K. & Learmonth, A.T.A: "Geography of India & Pakistan".
8. Robinson: "India- resources & their Development.
9. Dobby, E.G.H:" Monsoon Asia.
10. Tirtha Ranjit (1996): Geography of India, RawatJaipur.
11. Tata McGraw Atlas: Socio Economic Atlas of India.
12. Singh R. L.: Regional Geography of India.

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Gg-OE102: Physical Geography of Marathwada

Credits - 2 : Theory Paper

- **Pre-requisite:**

  The candidate should know the basic concepts from regional Geography. The candidate should familiar with the natural and administrative boundaries and their relationships to each other. He / She should know the importance of physical features in demarcation of a region and regional entities.

- **Course Objectives**:

  The objectives of this paper are to understand the basic concepts of Regional Geography and fundamental theories about the region and their characteristics. Its prime aim is to understand the physical features and their spatial characters in details.

- **Course Outcomes:**

  This paper is providing basic information about the physical set up of the state. The students will get knowledge and will acquire skills for comparative regional study and correlate the cause-n-effect relationships of all basic topographical and morphometric aspects.

- **Mode of Assessment**

  31. Tutorial examination
  32. Home assignments
  33. Field studies and its presentation
  34. Mid-term Theory Examination
  35. End-term Theory Examination
  36. P**PT** presentation on selected topic(s)

Gg-OE102-Physical Geography of Marathwada

Course Contents

Unit	Teaching and Learning points	Periods
I	**Physical Settings:** Location and administrative set-up, Hill ranges Main Rivers, Major Soil types & distribution, Major Vegetation types & distribution,	10
II	**Climate:** Major Climatic types & Characteristics, Distribution of Temperature and Rainfall,	12
III	**A) Water Resources:** Main Sources & Distribution, Major and Minor Projects	8
Total Periods		30

Reference Books:

12. Gazetteer of Maharashtra, Govt of India.
13. B. Arunchalm, Regional Geography of Maharashtra
14. B.D. Nag Choudhary, “Introduction to Environment Management” Inter Print Mehata House, New Delhi.
15. Brucu Mitchell “Geography and resources analysis” John willey and sons, New York.
16. C.D. Deshpande, “Geography of Maharashtra” National book Trust of India, New Delhi.
17. Cutler L, Renwick H.L. Exploitation conservation and preservation : A
18. Geographical perspective and natural resource use, Rowmon and Allanhed, Towata.
19. Govt. of Maharashtra “Economic development of Maharashtra.” (Maharashtra Economic Development Council)
20. Dixit K.R., “Maharashtra in Maps”
21. Deshpande, S.H. “Economy of Maharashtra”
22. Annual Socio-Economic Abstracts, (1951 to 2011, all concern districts), Govt of Maharashtra.

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Gg-C104: Morphometric Analysis

Credits - 2 : Practical Paper

- **Pre-requisite:**

  Conceptual understanding about the physical geography, geomorphological processes and mainly morphometric changes.

- **Course Objectives**:

  The objectives of this practical paper / course are to understand the spacio-temporal changes in the morphological situation of the region and their effects on various aspects of the concerned topography. It is also aims to see the influencing factors of the same.

- **Course Outcomes:**

  After completion of this practical paper / course, the student will assess the changes of any morphological aspects with proper scientific and statistic methods. He / she will draw a multi-applicable and suitable plan for the future changes.

- **Mode of Assessment**

  37. Test examination
  38. Preparation of Practical Book
  39. Field Observations and its presentation
  40. Mid-term Practical Examination
  41. End-term Practical Examination
  42. P**PT** presentation on selected topic(s)

Gg-C104-Morphometric Analysis
Course Contents

Unit	Teaching and Learning points	Practicals
I	**Drainage Patterns** 1. To understand the basics of Drainage and its Pattern 2. To understand and draw Dendritic drainage pattern 3. To understand and draw Parallel drainage pattern 4. To understand and draw Trellis drainage pattern 5. To understand and draw Rectangular drainage pattern 6. To understand and draw Radial drainage pattern 7. To understand and draw Centripetal drainage pattern 8. To understand and draw Annular drainage pattern 9. To understand and draw Barbed drainage pattern	4
II	**Stream Ordering** 1. To understand Basics of Stream Ordering 2. To apply Horton's Method of Stream Ordering 3. To apply Strahler's Method of Stream Ordering 4. To apply Streve's Method of Stream Ordering	5
III	**Morphometric Analysis** 1. To measure basin length and width 2. To measure Stream Length 3. To calculate Stream Length Ratio 4. To calculate Drainage Density 5. To calculate Bifurcation Ratio 6. To measure basin area 7. To calculate stream frequency 8. To calculate total slope of the basin 9. To calculate total slope of the given stream 10. To analyze sediments by using sieve analysis method 11. To represent sieve analysis data	9
Total Practicals		18

(Note: Cover at least 60% practicals from each unit)

Reference Books:

1. King, C. A.M (1966): Techniques in Geomorphology, Edward Arnold, London
2. Monkhouse, F. J. and Wilkinson, H. R., (1976). Maps and Diagrams, Methuen & Co.
3. Savindra Singh (2002): Geomorphology, Prayag Pustak Bhawan, Allahabad
4. Miller, Austin (1953): The skin of the Earth, Methuen & Co. Ltd. London
5. Strahler: Physical Geography

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Gg-C105: Representation of Demographic Data

Credits- 2 Practical Paper

Pre-requisite: Basic knowledge of population distribution, density and population growth. The knowledge about graph and map preparation is required for this paper.

Course Objectives: The objective of this course is to understand, calculation and construction of graphs and maps about population elements.

Course Outcomes: After completion of the course the student, get capabilities and skills on population geographical techniques, calculations in population geography, construction of population graphs and diagrams and preparation of maps regarding population geography.

Mode of Assessment

43. Tutorial examination
44. Home assignments
45. Field studies
46. Mid-term practical examination
47. End-term practical examination

Gg-C105: Representation of Demographic Data

Course Contents

Unit	Teaching and Learning points
I	**Formulae and Calculations in Population Geography:** 1) Density of Population 2) Sex Ratio 3) Crude Birth and Death Rate 4) Literacy Rate 5) Life Expectance Rate 6) Dependency Ratio 7) Population growth rate 8) Population projection
II	**Population Graphs and Diagrams:** 1) Bar Graphs 2) Line Graphs 3) Population (Age-Sex) Pyramid - i) Compound pyramid ii) Superimposed Pyramid
III	**Preparation of Maps regarding** 1) Decadal Change of Population 2) Population Density 3) Population Growth 4) Population Distribution 5) Sex Ratio 6) Population Literacy 7) Dependency Ratio

Reference Books:

1. Lawrence, G.R.P. (1973): Cartographic methods, Methuen & Co. London.
2. Mishra, R.P. (1982): Fundamentals of cartography, Prasaranga, University of Mysore.
3. Monkhouse,F.J.R & Wilkinson, H.R: Maps & diagrams, Methuen & company, London.
4. Raisz, Erwin: Principles of cartography, McGraw – hill Book Co., New York.
5. Robinson A.H.& Sale R.D. Element of Cartography, John House & Sons Ltd., London.
6. Singh R. L.: Elements of Practical Geography.

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Gg-C106: Representation of Landforms and Slope

Credits - 2 : Practical Paper

- **Pre-requisite:**

  Conceptual understanding about the physical geography, geomorphological processes and mainly morphometric changes.

- **Course Objectives**:

  The objectives of this practical paper / course are to understand the spacio-temporal changes in the morphological situation of the region and their effects on various aspects of the concerned topography. It is also aims to see the influencing factors of the same.

- **Course Outcomes:**

  After completion of this practical paper / course, the student will assess the changes of any morphological aspects with proper scientific and statistic methods. He / she will draw a multi-applicable and suitable plan for the future changes.

- **Mode of Assessment**

  48. Test examination
  49. Preparation of Practical Book
  50. Field Observations and its presentation
  51. Mid-term Practical Examination
  52. End-term Practical Examination
  53. P**PT** presentation on selected topic(s)

Gg-C106-Representation of Landforms and Slope

Course Contents

Unit	Teaching and Learning points	Practical
I	**Method of Relief Representation (SOI)** • To understand and Identify Spot height, Bench Mark & Triangulation Station marks on SOI Toposheet • To understand and Indentify different forms of Contour lines • To draw contours on given map	**4**
II	**Relief Representation with Contour lines (any 5 features)** • To use counters for relief representation of Hill • To use counters for relief representation of Ridge • To use counters for relief representation of Saddle • To use counters for relief representation of Col • To use counters for relief representation of Pass • To use counters for relief representation of Spur • To use counters for relief representation of Plateau • To use counters for relief representation of Escarpment • To use counters for relief representation of Cliff • To use counters for relief representation of V-Shaped Valley • To use counters for relief representation of River Terraces	**4**
III	• **Drainage Patterns** • To understand and draw Dendritic drainage pattern • To understand and draw Parallel drainage pattern • To understand and draw Trellis drainage pattern • To understand and draw Rectangular drainage pattern • To understand and draw Radial drainage pattern • To understand and draw Centripetal drainage pattern • To understand and draw Annular drainage pattern • To understand and draw Barbed drainage pattern	**4**
IV	**Types of Slope** • To understand and draw a type of slope: Steep and Gentle • To understand and draw a type of slope: Concave and Convex • To understand and draw a type of slope: Uniform and Uneven • To understand and draw a type of slope: Terraced	**4**
V	**Profile** • To draw a cross profile • To draw a longitudinal profile	**2**
Total Practicals		**18**

(Note: Cover at least 60% practicals from each unit)

Reference Books:

1. King, C. A.M (1966): Techniques in Geomorphology, Edward Arnold, London
2. Monkhouse, F. J. and Wilkinson, H. R., (1976). Maps and Diagrams, Methuen & Co.
3. Savindra Singh (2002): Geomorphology, Prayag Pustak Bhawan, Allahabad
4. Miller, Austin (1953): The skin of the Earth, Methuen & Co. Ltd. London
5. Strahler: Physical Geography

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Gg-C107: Interpretations of Topographical Maps

Credits- 2 Practical Paper

Pre-requisite: Basic knowledge about elements of maps and construction of maps. The knowledge about physicals and cultural features is required for this paper.

Course Objectives: The objectives of this course are to understand, calculation, construction and interpretation of topographical maps.

Course Outcomes: After completion of the course the student, get capabilities and skills on construction and interpretation of topographical maps and identified the physical and cultural features of on the map.

Mode of Assessment

54. Tutorial examination
55. Home assignments
56. Field studies
57. Mid-term practical examination
58. End-term practical examination

Gg-C107: Interpretations of Topographical Maps

Course Contents

Unit	Teaching and Learning points
I	**Study of S.O.I. Topographical Maps (1: 50,000 Series):** 1. Indexing and conventional signs and symbols (OS) 2. Grid references. 3. Locational and Relief aspects of the area **a**. Latitudinal & Longitudinal extension **b.** Contour interval **c.** Maximum and Minimum heights
II	**Interpretation of S.O.I Toposheets:** **1.Marginal Information,** **2.Patterns of Relief** **a**. Distribution of Spot heights, benchmarks, Trigonometrically Points etc. **b**. Types of Slopes (convex, concave, uniform etc.) **c**. Major landforms from contour patterns 3. **Patterns of Drainage network** **a.** Types-trellis, dendritic, radial, etc. **b**. Streams with water, without water. **c.** Influence of relief on drainage 4**. Patterns of Vegetation.** **a**. Types of vegetation **b**. Association of relief and drainage **c**. Reserved Forest and Protected Forest 5. **Patterns of Settlements.** **a**. Types, amenities, facilities and communication, etc. **b**. Distribution, relative size, relative distance (dispersed, nucleated etc.) 6. **Patterns in Land Use** **a.** Occupation, Agriculture, mining etc. areal distribution, **b.** Transportation and Communication,**c.** Irrigation, **d**. impact of physical landscape.

Reference Books:

1. Monkhouse F.X.J. and Wilkinson H. R. (1971), Maps and Diagrams, London
2. Ramamurthy, K. (1982): Map interpretation, Madras
3. Petrie N. (1992), Analysis and Interpretation of Topographical Maps. Orient Longman Limited Calcutta.
4. Singh R. L. (1997), Elements of Practical Geography, Kalyan Publishing, New Delhi
5. Meux A. H. (1960), Reading Topographical Maps.University of London Press Limited
6. Jones P. A. (1968), Fieldwork in Geography. Longmans, Green and Company Limited
7. Archer J. E and Dalton T. H. (1968), Fieldwork in Geography B.T. Batsford Limited London
8. Wheeler K.S. Ed (1970), Geography in the field. Blond Educational, London.
9. Gupta, K. K. and Tyagi, V. C. (1992): Working with maps, Survey of India Publication, Dehradun.

Semester II

Gg-C201: Agriculture Geography

Credits - 4 : Theory Paper

- **Pre-requisite:**

  Basic concepts of Agriculture Geography i.e. general landuse, agricultural landuse, cropping pattern, soil and crop relationships etc. Basic information about the various types of theories in agricultural geography, related to market, network etc.

- **Course Objectives**:

  The objectives of the paper / course are to understand relationships between physical nature of the region and overall agrarian practices.

- **Course Outcomes:**

  After completion of the paper / course, the student will be familiar with cropping pattern and change in the same. He/ she will draw a suitable plan for agrarian activities as per the natural and manmade available and feasible resources.

- **Mode of Assessment**

  59. Tutorial examination
  60. Home assignments
  61. Field studies and its presentation
  62. Mid-term Theory Examination
  63. End-term Theory Examination
  64. P**PT** presentation on selected topic(s)

Gg-C201-Agriculture Geography
Course Contents

Unit	Teaching and Learning points	Periods
I	**a) Introduction to Agricultural Geography:** • Nature scope and significance. • Different Approaches to study the subject **b) Land use:** • General and Agricultural Land use • Land use surveys • Land Classification in India	14
II	**Determinants of Agricultural Patterns:** • Relief, climate, soil • Land holding, marketing, transport • Irrigation • Mechanization. • Biochemical inputs	12
III	**Agricultural Types:** • Shifting cultivation • Intensive subsistent farming. • Mixed farming • Plantation agriculture • Commercial grain farming	12
IV	**Problems & Prospects of Agriculture:** • Definition and characteristics of arid and semi-arid regions. • Droughts and famines • Role of irrigation and dry farming.	12
V	**Agricultural Regionalization (Methods):** • Views of Baker Whittlesey Hann. • Crop combination techniques, Weaver and Thomas method. • Agricultural efficiency, Kendall's ranking coefficient, Bhatia's method • Agricultural regions of India.	10
Total Periods		**60**

Reference Books:

- Aiyer, A.K.Y.N.(1949) – Agricultural and Allied Arts in Vedic India.
- Grigg. D.G. (1974) – The Agricultural Systems of the world An Evolutionary Approach.
- Grigg. D.G.(1964) – An Introduction to Agricultural Geography Hutchinson & Co.Ltd.,
- Illbery, B.W. (1985) – Agricultural Geography, Social & Economic Analysis, Oxford University Press.
- Morgan. W.B. & S.C. Monton (1971) – Agricultural Geography Methuen, London.
- Randhawa, M.S. (1980) – An History of Agriculture in India Vols. I, II, III,IV ICAR, New Delhi.
- Singh. J. and Dhillon S.S. (1994) – Agricultural Geography. Tata McGraw Hill, Publishing Co. Ltd.
- Symons, Leslie (1970) – Agricultural Geography, G. Belt and Sons Ltd., London.
- Tarrent, J.R. (1970) – Agricultural Geography, David and Charles, Newton Abbot.

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Gg-C202: Economic Geography

Credits- 4 Theory Paper

Pre-requisite: Basic knowledge about economic activities, geographical factors and their relationship with economical activities and economical development leads to social developments.

Course Objects: After completion of the course the student gets knowledge about the economical activities are related to geographical factors and various theories and models of economic developments. On successful completion of the module, students should be capable of explaining the principles of economic geography and their relation with development of the nation.

Couse Outcome- This course is useful in understanding about basics of economic geography. This will be useful for application of the principles of economics in geography. Knowledge of this course will used for sustainable development

Mode of Assessment

65. Tutorial examination
66. Home assignments
67. Seminar
68. Field studies
69. Quizzes
70. Oral presentation
71. Mid-term examination
72. End-term examination
73. Dissertation thesis

Gg-C202: Economic Geography

Course Contents

Unit	Teaching / Learning Points
I	**A) Economic Geography:** Definition, nature and scope Recent trends in Economic Geography **B) Basic Economic processes:** Production, exchange & consumption Classification of economic Activities and their characteristics Location of Economic activities
II	**A) Resources:** Classification of Resources Resources and Environment - Scarcity and Sustainability Conversation of resources **B) Industries:** Classification of Industries, Principles of Industrial Location Profit maximization - Least cost location Location theories – Weber & Losch.
III	**Trade and Transport:** Major Transport Routes -Land, Rail, Water and Air Routes Models of transportation and transport cost Accessibility and connectivity Trade - National and International
IV	**A) Economic Development:** Measures of economic development, Sustainable Development **B) Economic Development in India:** Regional disparity in economic Development Impact of Green Revolution Privatization, Globalization

Reference Books:

1. Alexander J.W. (1976): Economic Geography. Prentice Hall of India. New Delhi.
2. Hartshorne, T.A. and J.W. Alexander (1988) –Economic Geography, Prentice Hall.
3. Berry, Conkling & Ray (1988): Economic Geography Prentice Hall of India New Jersey.
4. Hurst Elliott (1986): Geography of Economic Behaviour. Unwin, London.
5. Johnson R.J. & Taylor D.J. (1989): A world in crisis. Basil-Blackwell, Oxford.
6. Losch (1954): Economics of Location. Yale University Press New York.
7. Redcliff M. (1987): Development & the environmental crisis. Methuen. London.
8. Sinha B.N.(1971): Industrial geography of India
9. Watts H.D. (1987): Industrial Geography, Longman scientific and Technical New York.
10. Haggett, Peter: Modern Synthesis in Geography.
11. Robinson H & Bamford C. G. (1978): Geography of Transport, Macdonald & Evans USA.
12. Jones & Darkenwald : Economic geography.
13. Fairbridge, R. W. (1968): Encyclopedia of Geomorphology, Reinholdts, New York.

Gg-C203: Fundaments of Remote Sensing

Credits- 4 Theory Paper

Pre-requisite: Basic knowledge about 10 level physics and having the knowledge of geographical factors.

Course Objectives: The objectives of this course is to develop the skill of the remote sensing and use of remote sensing in the geography

Course Outcomes: Aftercompletion of the course, the students get capabilities and skills on remote sensing and application of the remote sensing in geography and map making.

Mode of Assessment

74. Tutorial examination
75. Home assignments
76. Seminar
77. Field studies
78. Quizzes
79. Oral presentation
80. Mid-term examination
81. End-term examination
82. Dissertation thesis

Gg-C203: Fundaments of Remote Sensing

Course Contents

Unit	Teaching / Learning Points
I	**Introduction of Remote Sensing** Definition and scope of remote sensing; History and development of remote sensing technology; Electromagnetic radiation (EMR) and electromagnetic spectrum; EMR interaction with atmosphere and earth surface; Resolutions in remote sensing; Types of remote sensing; Principles and applications of optical, thermal & microwave remote sensing.
II	**Fundamentals of Aerial Photography**, History of Aerial Photographs, Types of Aerial Photographs- Vertical and Oblique Photographs, Aerial Cameras, Flying Plan, Photogrammetry -- Basic Geometric Characteristics- Scale, Overlap, Tilt, Distortion and Displacement of Aerial Photographs, Advantages and Disadvantages of Aerial Photographs, EMR and its interaction with matter, Reflection, Absorption, Transmission, Scattering. Concept of Signatures- Photo Interpretation Elements.
III	**Satellite Remote Sensing** Indian Remote Sensing Programme, Types of Satellites- Sun-synchronous and Geostationary Satellites, Launch Vehicles- PSLV, GSLV, Payloads, Active and Passive Remote Sensing, Classification of Remote Sensors, Resolution- Spatial, Spectral, Radiometric, Temporal, Microwave Sensors, SLAR, Digital Image Processing- Image Classification, Supervised and Unsupervised Classification, Image Enhancement, Filtering, PCA .
IV	**Applications of Remote Sensing in Geography** Interpretation of Visual and Digital data, Applications in Water Resources, Land use/Land Cover Mapping, Agriculture, Forest, Oceanography, Snow and Glaciers, Coastal, Landform analysis, Resource evaluation, Natural hazards assessment, and Urban & regional planning.

References:

1. **Jensen, J.R. (2004): Remote sensing of the environment: An Earth Resource Perspective, Prentice Hall, Englewood Cliffs, N.J.**
2. **Jones, C.B. (1997): Geographical Information Systems and Computer Cartography, Addison Wesley Longman Ltd. England.**
3. **Kraak, M.J. and A. Brown (1996): Web Cartography: Developments and Prospects, Addison Wesley Longman Ltd, England.**
4. **Monmonier, M.S. (1982): Computer Assisted Cartography: Principles and Prospects,**
   Prentice Hall, Inc. London.
5. **Jenson, J.R. : Introduction to Digital image processing , Prentice Hall, Englewood cliffs, N.J.**
6. **Peuquet, D.J. & Marble, D.F. :** Introductory Readings in Geographic information Systems Taylor & Francis, Washington, 1990
7. **Panwar, Mohan Singh (2017) - "SookchamStariyaNiyozanEvam PRA Techniques"**Binser Publication.

Gg-E202: Human Geography of Maharashtra

Credits - 3 : Theory Paper

- **Pre-requisite:**

  The candidate should know the basic concepts from region with the perspective of Human Geography. The candidate should familiar with the socio-economical and cultural aspects and administrative boundaries and their relationships to each other. He / She should know the importance of all manmade characteristics of the region or any administrative region in the demarcation of a region and regional entities with their balanced identity or unbalanced changes.

- **Course Objectives**:

  The objectives of this paper are to understand the basic concepts of Regional Geography with socio-cultural perspectives and fundamental theories about the region and their characteristics, mainly based on the economical and cultural activities of the region. Its prime aim is to understand the features of human geography and their spatial characters in details of the region as a whole and or with sub-regions and their pockets.

- **Course Outcomes:**

  This paper is providing basic information about the human geographical set up of the state. The students will get knowledge and will acquire skills for comparative regional study and correlate the cause-n-effect relationships of all basic socio-economical, demographical and cultural aspects.

- **Mode of Assessment**

  83. Tutorial examination
  84. Home assignments
  85. Field studies and its presentation
  86. Mid-term Theory Examination
  87. End-term Theory Examination
  88. P**PT** presentation on selected topic(s)

Gg-E202-Human Geography of Maharashtra

Course Contents

Unit	Teaching and Learning points	Periods
I	**A) Industries:** Major Industrial Belts / Pockets and Distribution Problems and Prospects of Industrialization **B) Trade and Transportation:** Agro-based Goods & Their Trading Industrial Produces & Their Trading Transport Network	12
II	**Agriculture:** **A) Major Crops and Cropping Pattern** Wheat, Rice, Jawar, Bajra, Pulses, Oil seeds, etc **B) Cash Crops and Horticulture** Cotton, Sugarcane, Banana, Grapes, etc. **C) Problems and Prospects** Influencing Factors, Irrigation, Regional Disparities	15
II	**A) Population:** Decadal Growth, District-wise Distribution Sex Ratio, Literacy Rate, Occupational structure, Seasonal Migration **B) Settlement:** District-wise Rural Settlement District-wise Urban Settlement Growth & Comparative Proportion Trend of Urbanization	18
Total Periods		45

Reference Books:

23. Gazetteer of Maharashtra, Govt of India.
24. B. Arunchalm, Regional Geography of Maharashtra
25. B.D. Nag Choudhary, “Introduction to Environment Management” Inter Print Mehata House, New Delhi.
26. Brucu Mitchell “Geography and resources analysis” John willey and sons, New York.
27. C.D. Deshpande, “Geography of Maharashtra” National book Trust of India, New Delhi.
28. Cutler L, Renwick H.L. Exploitation conservation and preservation : A
29. Geographical perspective and natural resource use, Rowmon and Allanhed, Towata.
30. Govt. of Maharashtra “Economic development of Maharashtra.” (Maharashtra Economic Development Council)
31. Dixit K.R., “Maharashtra in Maps”
32. Deshpande, S.H. “Economy of Maharashtra”
33. Annual Socio-Economic Abstracts, (1951 to 2011, all concern districts), Govt of Maharashtra.

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Gg-E203: Human Geography of India

Credits- 3. Theory Paper

Pre-requisite: Basic knowledge about human geographical factors and map of India.

Course Objectives: The objectives of this course is to understand Irrigation, Agriculture, Agro based Industries, Mineral & Power resources and Transport and communication systems in India

Course Outcomes: Aftercompletion of the course, the students get capabilities to understand the Agro based Industries, Mineral & Power resources and Transport and communication systems in India

Mode of Assessment

1. Tutorial examination
2. Home assignments
3. Seminar
4. Field studies
5. Quizzes
6. Oral presentation
7. Mid-term examination
8. End-term examination
9. Dissertation thesis

Gg-E203: Human Geography of India

Course Contents

Unit	Teaching / Learning Points
I	Irrigation, Agriculture & live stock in India, Problems of Agricultural Development. Agro based Industries (Sugar, Cotton textile, Jute)
II	Mineral & Power resources- Iron, Mica, Manganese, Hydel, Coal, Petroleum.
III	Major industries - Mineral based (Iron & steel, Copper, Aluminum) & Industrial region of India. Transport and communication systems in India – Roads, Railways, Inland Waterways & Air Ways, Major ports & Sea Routes.
IV	Population as a resource- Distribution, Growth and Problems.

Reference Books:

1. Sharma, T.C. &Coutinho: "Economic,& CommercialGeography of India". Vikas Pub. HouseDelhi.
2. Negi, B.S: "Economic & Commercial Geography India."KedarNath Ram Nath, N.Delhi.
3. Mamoria, C.B. "Economic & Commercial Geography of India".
4. Singh, Gopal: "Geography of India".
5. Kuriyan. George: "India- A General Survey". National Bk. Trust.
6. Stamp, L.D: "Geography of Asia".
7. Spate, O.H.K.& Learmonth, A.T.A: "Geography of India & Pakistan".
8. Robinson: "India- resources & their Development.
9. Dobby, E.G.H:" Monsoon Asia.
10. TirthaRanjit (1996): Geography of India, RawatJaipur.
11. Tata McGraw Atlas: Socio Economic Atlas of India.
12. Singh R. L.: Regional Geography of India.

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Gg-OE202: Human Geography of Marathwada

Credits - 2 : Theory Paper

- **Pre-requisite:**

  The candidate should know the basic concepts from region with the perspective of Human Geography. The candidate should familiar with the socio-economical and cultural aspects and administrative boundaries and their relationships to each other. He / She should know the importance of all manmade characteristics of the region or any administrative region in the demarcation of a region and regional entities with their balanced identity or unbalanced changes.

- **Course Objectives**:

  The objectives of this paper are to understand the basic concepts of Regional Geography with socio-cultural perspectives and fundamental theories about the region and their characteristics, mainly based on the economical and cultural activities of the region. Its prime aim is to understand the features of human geography and their spatial characters in details of the region as a whole and or with sub-regions and their pockets.

- **Course Outcomes:**

  This paper is providing basic information about the human geographical set up of the state. The students will get knowledge and will acquire skills for comparative regional study and correlate the cause-n-effect relationships of all basic socio-economical, demographical and cultural aspects.

- **Mode of Assessment**

  89. Tutorial examination
  90. Home assignments
  91. Field studies and its presentation
  92. Mid-term Theory Examination
  93. End-term Theory Examination
  94. P**PT** presentation on selected topic(s)

Gg-OE202-Human Geography of Marathwada

Course Contents

Unit	Teaching and Learning points	Periods
I	**A) Population:** Decadal Growth, District-wise Distribution Sex Ratio, Literacy Rate, Occupational structure, Seasonal Migration **B) Settlement:** District-wise Rural Settlement District-wise Urban Settlement Growth & Comparative Proportion Trend of Urbanization	12
II	**Agriculture:** Major Crops, Cropping pattern Irrigated & Rainfed crops Problems & Prospects of agriculture	10
II	**Industries:** A) Major Industrial Belts / Pockets, MIDC Zones B) Growth and Distribution, Connectivity Problems and Prospects of Industrialization	8
Total Periods		30

Reference Books:

34. Gazetteer of Maharashtra, Govt of India.
35. B. Arunchalm, Regional Geography of Maharashtra
36. B.D. Nag Choudhary, "Introduction to Environment Management" Inter Print Mehata House, New Delhi.
37. Brucu Mitchell "Geography and resources analysis" John willey and sons, New York.
38. C.D. Deshpande, "Geography of Maharashtra" National book Trust of India, New Delhi.
39. Cutler L, Renwick H.L. Exploitation conservation and preservation : A
40. Geographical perspective and natural resource use, Rowmon and Allanhed, Towata.
41. Govt. of Maharashtra "Economic development of Maharashtra." (Maharashtra Economic Development Council)
42. Dixit K.R., "Maharashtra in Maps"
43. Deshpande, S.H. "Economy of Maharashtra"
44. Annual Socio-Economic Abstracts, (1951 to 2011, all concern districts), Govt of Maharashtra.

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Gg-C201: Agriculture Geography

Credits - 4 : Theory Paper

- **Pre-requisite:**

  Basic concepts of Agriculture Geography i.e. general landuse, agricultural landuse, cropping pattern, soil and crop relationships etc. Basic information about the various types of theories in agricultural geography, related to market, network etc.

- **Course Objectives**:

  The objectives of the paper / course are to understand relationships between physical nature of the region and overall agrarian practices.

- **Course Outcomes:**

  After completion of the paper / course, the student will be familiar with cropping pattern and change in the same. He/ she will draw a suitable plan for agrarian activities as per the natural and manmade available and feasible resources.

- **Mode of Assessment**

  95. Tutorial examination
  96. Home assignments
  97. Field studies and its presentation
  98. Mid-term Theory Examination
  99. End-term Theory Examination
  100. P**PT** presentation on selected topic(s)

Gg-C201-Agriculture Geography
Course Contents

Unit	Teaching and Learning points	Periods
I	**a) Introduction to Agricultural Geography:** • Nature scope and significance. • Different Approaches to study the subject **b) Land use:** • General and Agricultural Land use • Land use surveys • Land Classification in India	14
II	**Determinants of Agricultural Patterns:** • Relief, climate, soil • Land holding, marketing, transport • Irrigation • Mechanization. • Biochemical inputs	12
III	**Agricultural Types:** • Shifting cultivation • Intensive subsistent farming. • Mixed farming • Plantation agriculture • Commercial grain farming	12
IV	**Problems & Prospects of Agriculture:** • Definition and characteristics of arid and semi-arid regions. • Droughts and famines • Role of irrigation and dry farming.	12
V	**Agricultural Regionalization (Methods):** • Views of Baker Whittlesey Hann. • Crop combination techniques, Weaver and Thomas method. • Agricultural efficiency, Kendall's ranking coefficient, Bhatia's method • Agricultural regions of India.	10
Total Periods		**60**

Reference Books:

- Aiyer, A.K.Y.N.(1949) – Agricultural and Allied Arts in Vedic India.
- Grigg. D.G. (1974) – The Agricultural Systems of the world An Evolutionary Approach.
- Grigg. D.G.(1964) – An Introduction to Agricultural Geography Hutchinson & Co.Ltd.,
- Illbery, B.W. (1985) – Agricultural Geography, Social & Economic Analysis, Oxford University Press.
- Morgan. W.B. & S.C. Monton (1971) – Agricultural Geography Methuen, London.
- Randhawa, M.S. (1980) – An History of Agriculture in India Vols. I, II, III,IV ICAR, New Delhi.
- Singh. J. and Dhillon S.S. (1994) – Agricultural Geography. Tata McGraw Hill, Publishing Co. Ltd.
- Symons, Leslie (1970) – Agricultural Geography, G. Belt and Sons Ltd., London.
- Tarrent, J.R. (1970) – Agricultural Geography, David and Charles, Newton Abbot.

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Gg-C 205: Practical in Economic Geography

Credits- 2 Practical Paper

Pre-requisite: practical knowledge about economic activities, geographical factors and their relationship with economical activities and economical development leads to social developments.

Course Objectives: The objectives of the course are to understand and develop the skill about economic activities of human and how geographical factors are responsible for different economic activities on the earth surface.

Course Outcomes: After completion of the course the student gets practical knowledge about the economical activities are related to geographical factors and various theories and models of economic developments. On successful completion of the module, students should be capable of representation economical geographical data with cartographic techniques and how to represent the data of economic activities.

Mode of Assessment

101. Tutorial examination
102. Home assignments
103. Field studies
104. Mid-term practical examination
105. End-term practical examination
106. Report of visit to Industrial Unit

Gg-C 205: Practical in Economic Geography

Course Contents

Unit	Teaching and Learning points
I	**Distributional Maps:** 1. Choropleth maps: Socio-Economic Phenomena 2. Dot method & its relevance to distribution maps 3. Flow line charts & maps of transport flows
II	**Maps with Two and Three Dimensional Figures:** 1. Maps with proportional circles 2. Maps with divided circles 3. Maps with proportional spheres 4. Maps with Cube Diagram 5. Map with Proportional Square
III	**Techniques in Industrial Location Analysis:** 1.Location quotient 2.Lorenz curves 3.Gini's coefficient (Visit to 2 Industrial units, out of which one has to be Agro based Industrial Unit)

Reference Books:

1. Lawrence, G.R.P. (1973): Cartographic methods, Methuen & Co. London.
2. Mishra, R.P. (1982): Fundamentals of cartography, Prasaranga, University of Mysore.
3. Monkhouse, F.J.R & Wilkinson, H.R: Maps & diagrams, Methuen & company, London.
4. Raisz, Erwin: Principles of cartography, McGraw – hill Book Co., New York.
5. Robinson A.H. & Sale R.D. Element of Cartography, John House & Sons Ltd., London.
6. Singh R. L. Elements of Practical Geography.

Gg-C 206: Practical in Remote Sensing

Credits- 2 Practical Paper

Pre-requisite: Basic knowledge about 10 level physics and having the knowledge of geographical factors.

Course Objectives: The objectives of this course is to develop the skill of the remote sensing and use of remote sensing in the geography

Course Outcomes: After completion of the course, the students get capabilities and skills on remote sensing and application of the remote sensing in geography and map making.

Mode of Assessment

107. Tutorial examination
108. Home assignments
109. Field studies
110. Mid-term practical examination
111. End-term practical examination

Gg-C 206: Practical in Remote Sensing
Course Contents

Unit	Teaching / Learning Points
I	**Practical's in Aerial Photographs** **1). Indexing of aerial photographs.** **2) Introduction to vertical aerial photographs and its geometry.** **3) Introduction to stereoscopes i) Stereoscopic Vision test ii) Orientation & construction of 3-D model under Pocket stereoscope and Mirror stereoscope.** **4) Determination of scale - By establishing relationship between Photo distance and Ground distance ,By establishing relationship between Photo distance and Map distance ,By establishing relationship between Focal length and Flying height,Determination of Average Scale of Vertical Aerial Photograph** **5) Relief Displacement - Calculation of Relief Displacement, Object height determination from relief Displacement**
II	Interpretation of Satellite Image 1) **Annotations of Satellite image** **2) Visual interpretation of satellite image- Satellite image interpretation in terrain and resource evaluation, environmental monitoring;** 3) **Land use/land cover mapping; water and forest Digital interpretation of satellite image- Digital image processing**

References:

1. **Agarwal, C.S. and Garg, P.K. 2000. Textbook of Remote Sensing in Natural Resources Monitoring and Management. New Delhi: Wheeler Publishing.**
2. **Jensen, John R. 2000. Remote Sensing of the Environment – An Earth Resource Perspective. Pearson Education (First Indian Edition, 2003).**
3. **Rampal, K.K. 1999. Handbook of Aerial Photography and Interpretation. New Delhi: Concept Publishing Company.**
4. **Rampal, K.K. 1999. Handbook of Aerial Photography and Interpretation. New Delhi: Concept Publishing Company.**
5. **Floyd, F. Sabins, Jr. (1986): Remote Sensing: Principles and Interpretation, W.H. Freeman, N.Y.**

Gg-C207: Interpretation of Climatic Data

Credits- 2 Practical Paper

Pre-requisite: Basic knowledge about element of weather and climate, such as temperature, precipitation, humidity, wind speed and direction, knowledge of graph paper also required for this course.

Course Objectives: To understand knowledge of weather and climate element, their nature and data collection method. Drawing of different graphs with helps of climatic data and understands of weather instruments objectives of this course.

Course Outcomes: After completion of the paper, student will get knowledge about the nature of climatic data, collection of climatic data and their interpretation. Reading of weather instruments also a out came of this course.

Mode of Assessment

1. Tutorial examination
2. Home assignments
3. Field studies
4. Mid-term practical examination
5. End-term practical examination

Gg-C207: Interpretation of Climatic Data

Course Contents

Unit	Teaching and Learning points
I	**Climatic Data:** Nature and sources of climatic data. Application of climatic data in Geography
II	**Construction and Interpretations of Climatic Graphs:** Line graph, Bar graph, Trend graphs- moving averages and semi-Average, Climograph, Hythergraph, Water Budget graph and Soil-Moisture graph
III	**Weather Instruments:** Study of Thermograph, Barograph, Hair Hygrograph, Wind Vane, Rain Gauge, Anemometer

Reference Books:

1. Ashish Sarakar: Practical Geography A systematic approach. Orient Longman Limited, Kolkatta.
2. Critchifield: Principles of Climatology.
3. Lawrence, G.R.P.: Cartographic Methods. Mathur co., London
4. Mather JR (1974) Climatology, Fundamentals and applications. Mc Grew Hill Book Co, New York
5. R.L. Singh &Rana P.B. Singh: Element of Practical Geography. Kalyani Pub. New Delhi (1999).
6. Trewartha G.T.: An Introduction to climate McGraw – Hill Book Co. New York.
7. Monkhouse, F. J. and Wilkinson, H. R., (1976). Maps and Diagrams, Methuen & Co. London

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