

**SCHOOL OF ENVIRONMENTAL AND EARTH SCIENCES**



**KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA  
UNIVERSITY, JALGAON**

**REVISED SYLLABUS**

**UNDER CBCS**

**(With CGPA System)**

**For**

**M.A./ M. Sc. (Applied Geography)**

**w. e. f.**

**Academic Year 2019-2020**

**SCHOOL OF ENVIRONMENTAL AND EARTH SCIENCES**  
**KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY,**  
**JALGAON**

**Syllabus under CBCS for M.A. / M.Sc. (Applied Geography)**  
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**Course credit scheme**

Semester	(A) Core Courses			(B) Skill Based / Elective Course			(C) Audit Course (No Weightage in CGPA)			Total Credits (A+B+C)
	No. of Courses	Credits (T+P)	Total Credits	No. of Courses	Credits (T+P)	Total Credits	No. of Courses	Credits (Practicals)	Total Credits	
I	4	8 + 8	<b>16</b>	1	4 + 0	4	1	2	2	<b>22</b>
II	4	8 + 8	<b>16</b>	1	4 + 0	4	1	2	2	<b>22</b>
III	4	8 + 8	<b>16</b>	1	4 + 0	4	1	2	2	<b>22</b>
IV	4	8 + 8	<b>16</b>	1	4 + 0	4	1	2	2	<b>22</b>
<b>Total Credits</b>	<b>64</b>			<b>16</b>			<b>8</b>			<b>88</b>

(T-Theory; P-Practical)

### Prologue

The School of Environmental and Earth Sciences has established on 1<sup>st</sup> July 1999. In short span of 19 years, the School has established excellent laboratories and library facilities to get quality education in the field of environmental and earth sciences. School offers four Post Graduate courses in Environmental Science, Applied Geology, Applied Geography, and M.Tech. in Environmental Science and Technology. In addition to this, the school has started a Certificate Course in Industrial Safety and Management under career-oriented certificate courses of UGC from the academic year 2013-14. Eco-friendly sustainable approach in the process of development is a unique culture developed at the School. The School has received research project grants from various agencies like DST, UGC, MoEF, UNICEF, DRDO, MoWR, and State Government agencies. The School is covered for financial assistance under Special Assistance Programme (UGC-SAP-DRS, Phase II) of UGC, New Delhi for a period of 5 years (2015-2020). The School was also covered under DST-FIST programme Level-I (2012-2017) for financial support.

### Choice Based Credit System (CBCS)

The main feature of the CBCS is to make post graduate education student centric rather than system centric or teacher centric. For achieving these objectives, the CBCS strives to create a holistic syllabus. Thus, in addition to dedicated focus on a discipline through core papers whether in an honours curriculum or a regular curriculum, elective papers have been added which will give students the freedom to choose the allied or applied areas of their discipline and also the areas of other disciplines of their interest. Further in keeping with the vision of the Government, special emphasis has been given to ability enhancement and skill development of students through elective courses under these domains which every student is required to study. However, in keeping with the spirit of CBCS here also the students will have complete freedom to choose these courses from a pool suggested by the University. These elective papers provide them with the opportunity to develop competencies of students in their areas of strength, expertise, and specialization. The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising a core, elective and skill-based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marking system.

**Department of Applied Geography, School of Environmental and Earth Sciences**  
**Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon**  
 Syllabus under CBCS for M.A/M.Sc (Applied Geography)  
 Syllabus Structure (w.e.f. 2019-20)

**Semester I**

Course Code	Course Type	Title of the Course	Contact Hours/Week			Distribution of Marks for Examination						Credits
						Internal		External		Total		
			Th	Pr	Total	Th	Pr	Th	Pr	Th	Pr	
GG-101	Core	Principles of Geomorphology	04	--	04	40	--	60	--	100	--	04
GG-102	Core	Environmental Geosciences	04	--	04	40	--	60	--	100	--	04
<b>GG-103</b>	<b>Skill Based</b>	<b>Fundamental of Cartography</b>	<b>04</b>	<b>--</b>	<b>04</b>	<b>40</b>	<b>--</b>	<b>60</b>	<b>--</b>	<b>100</b>	<b>--</b>	<b>04</b>
GG-104	Core	Practicals in Physical Geography	--	08	08	--	40	--	60	--	100	04
GG-105	Core	Practicals in Cartographic Techniques With Help of GIS	--	08	08	--	40	--	60	--	100	04
<b>AC-101</b>	<b>Audit Course</b>	<b>Practicing Cleanliness</b>		<b>02</b>	<b>02</b>		<b>100</b>	--	--	--	<b>100</b>	<b>02</b>

**Semester-II**

Course Code	Course Type	Title of the Course	Contact Hours/Week			Distribution of Marks for Examination						Credits
						Internal		External		Total		
			Th	Pr	Total	Th	Pr	Th	Pr	Th	Pr	
<b>GG-201</b>	<b>Skill Based</b>	<b>Geoinformatics-I</b>	<b>04</b>	<b>--</b>	<b>04</b>	<b>40</b>	<b>--</b>	<b>60</b>	<b>--</b>	<b>100</b>	<b>--</b>	<b>04</b>
GG-202	Core	Climatology	04	--	04	40	--	60	--	100	--	04
GG-203	Core	Statistical Methods in Geography	04	--	04	40	--	60	--	100	--	04
GG-204	Core	Practical's in Human Geography	--	08	08	--	40	--	60	--	100	04
GG-205	Core	Practicals in Climatology	--	08	08	--	40	--	60	--	100	04
<b>AC-201/2/3/4</b>	<b>Audit Course</b>	<b>Choose one out of four (AC-201/201/202/203/204) (Personality and Cultural Development Related)</b>		<b>02</b>	<b>02</b>		<b>100</b>	--	--	--	<b>100</b>	<b>02</b>

**List of elective courses to be offered in Semester-II**

**AC-201: Soft Skills**

**AC-202: Sports Activities**

**AC-203: Yoga**

**AC-204: Music**

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**Semester III**

Course Code	Course Type	Title of the Course	Contact Hours/Week			Distribution of Marks for Examination						Credits
						Internal		External		Total		
			Th	Pr	Total	Th	Pr	Th	Pr	Th	Pr	
GG-301	Core	Geography of Resources	04	--	04	40	--	60	--	100	--	04
<b>GG-302</b>	<b>Elective</b>	<b>Choose One from GG-302(A) and GG-302(B)</b>	<b>04</b>	<b>--</b>	<b>04</b>	<b>40</b>	<b>--</b>	<b>60</b>	<b>--</b>	<b>100</b>	<b>--</b>	<b>04</b>
GG-303	Skill Based	Geoinfometrics-II	04	--	04	40	--	60	--	100	--	04
GG-304	Core	Practical's in Remote Sensing and Image Processing	--	08	08	--	40	--	60	--	100	04
GG-305	Core	Practical's in GIS & GPS Techniques with Help of Computer.	--	08	08	--	40	--	60	--	100	04
<b>AC-301/2/3/4</b>	<b>Audit Course</b>	<b>Choose one out of four (AC-301/2/3/4)</b>		<b>02</b>	<b>02</b>		<b>100</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>100</b>	<b>02</b>

List of elective courses to be offered in Semester-III

**GG-302 (A): Urban Geography**

**AC-301: Computer Skill**

**AC-302: Cyber Security**

**GG-302 (B): Medical Geography**

**AC-303: Rainwater Harvesting**

**AC-304: Geo-tourism**

**Semester-IV**

Course Code	Course Type	Title of the Course	Contact Hours/Week			Distribution of Marks for Examination						Credits
						Internal		External		Total		
			Th	Pr	Total	Th	Pr	Th	Pr	Th	Pr	
GG-401	Skill Based	Watershed Management	04	--	04	40	--	60	--	100	--	04
<b>GG-402</b>	<b>Elective</b>	<b>Choose one from GG-402(A) and GG-402(B)</b>	<b>04</b>	<b>--</b>	<b>04</b>	<b>40</b>	<b>--</b>	<b>60</b>	<b>--</b>	<b>100</b>	<b>--</b>	<b>04</b>
GG-403	Core	Disaster Management	04	--	04	40	--	60	--	100	--	04
GG-404	Core	Practicals in Surveying	--	08	08	--	40	--	60	--	100	04
GG-405	Core	Dissertation	--	08	08	--	40	--	60	--	100	04
<b>AC-401/2/3/4</b>	<b>Audit Course</b>	<b>Choose one out of four(AC-401/2/3/4)</b>		<b>02</b>	<b>02</b>		<b>100</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>100</b>	<b>02</b>

List of elective courses to be offered in Semester-II

**GG-402 (A): Agricultural Geography**

**AC-401: Human Rights**

**AC-402: Current Affairs**

**GG-402 (B): Oceanography**

**AC-403: Surveying and Instrumentation**

**AC-404: Watershed Management**

**Program Objectives:**

1. To produce skilled experts with applied aspects of Geography employable for positions in the field of education, industry and government and non-government organizations.
2. To impart knowledge on advances and challenges in Geographical challenges.
3. To enhance the quality and standards of Geography Education.
4. To provide a broad common framework, for exchange, mobility and free dialogue across the Indian Geography and associated community.
5. To prepare our graduates to become effective scientific communicators/collaborators in multidisciplinary teams providing technical leadership to engage with the challenging Geographical problems of local, national and global nature.

**Program Outcomes:**

1. Understand the unifying themes of both human and physical geography as well as have a working knowledge of the discipline's diverse conceptual and methodological approaches.
2. Demonstrate an ability to develop research questions, critically understand quantitative and qualitative data sources, data bias, and data analysis and presentation, and conduct research using primary and/or secondary source material.
3. Students will be able to apply geographical knowledge for exploration of GIS, Remote Sensing and for geographical resources.
4. M.Sc. Applied Geography programme is structured for providing advances and by considering the overall development of students.
5. Students will be able to work in public and private sector companies working in the field of GIS, Tourism, and Cartographer.

**Eligibility**

Bachelor's degree in Geography from any recognized University with at least 50 % marks.

**Duration**

The duration of M.A. / M.Sc. (Applied Geography) the degree program shall consist of two academic years divided into four semesters. Each Semester consists of 90 working days. Each theory course will be completed in 60 hours and practical course in 96 hours.

**Medium of instruction**

The medium of instruction and examination for each course shall be English.

**Credit to contact hour**

One credit is equivalent to 15 periods of 60 minutes each for theory course lecture.

**Attendance**

The student enrolled must have 75% attendance in each course in order to appear for term end examinations, otherwise, the candidate may not be allowed to appear for term-end examination as per the Rules.

**Examination**

Each theory and practical course will be of 100 marks comprising of 40 marks for internal (20 marks of 2 internal examinations) and 60 marks external examination. Separate head of passing in Internal and External examination is mandatory. In case of failure in internal examination of a particular course, the student will have to appear for the same in next semester as per the schedule of the examination. In case a student fails in a particular course in a semester and the same course(s) are revised/removed from curriculum in due course, the student will have to appear as per the new curriculum and or pattern in a subsequent semester at his own responsibility.

**SYLLABUS**  
M.A / M.Sc. Applied Geography  
**SEMESTER – I**

<b>GG-101: PRINCIPLES OF GEOMORPHOLOGY</b>		
	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. Students will understand the concept of place and how it is connected to people's sense of belonging to the physical environment, landscape and culture.</li> <li>2. Students will understand the fundamental concepts of spatial interaction and diffusion, which explain how human activities are influenced by the concept of distance.</li> <li>3. Students will be exposed to the nature of physical systems such as geomorphologic processes and natural hazards.</li> <li>4. Students will be able to read and interpret information on different types of physical features maps.</li> <li>5. Students will learn how human, physical and environmental components of the world interact.</li> </ol> <p><b>Course Outcomes:</b></p> <p>On completion of this (GG-101) course, students are able to:</p> <ol style="list-style-type: none"> <li>1. Understand the nature, scope, and significance of geomorphology and fundamental concepts in the subject.</li> <li>2. To examining the Origin and Evolution of the earth primary relief features by different theories in the subject.</li> <li>3. Understand about Exogenous Processes considering weathering and mass wasting and nature and types of the slope.</li> <li>4. Evaluate the fundamental Model of Davisian Cycle of Erosion to learn the function of river and its landforms development process.</li> <li>5. Understand the formation, process, and development of Fluvial and Karst Landforms.</li> <li>6. To recognize and understand the formation, process, and development of Glacial and aeolian Landforms in geomorphology.</li> </ol>	
<b>Unit 1</b>	<p><b>Fundamentals of Geomorphology</b></p> <ol style="list-style-type: none"> <li>1. Nature and Scope; Definition and history of Geomorphology.</li> <li>2. Concepts; Uniformitarianism and Catastrophism, Geomorphic Scale – Timescale (Cyclic, Graded and Steady) and Spatial Scale Ergodic Principle Process Geomorphology.</li> </ol>	<b>10 L</b>
<b>Unit 2</b>	<p><b>Tectonism and Geomorphology</b></p> <ol style="list-style-type: none"> <li>1. Interior of the Earth. Sources of Knowledge; Inferred Knowledge (Density, Temperature, Pressure), Surface Expressions, (Seismic Wave Evidences) Holmes Convection Current Theory.</li> <li>2. Isostasy; Gravity Anomalies and Correction.</li> <li>3. Wegener's Continental Drift Theory; Theory, Supporting Evidence and Validity.</li> <li>4. Plate Tectonics and Sea Floor Spreading; Palaeomagnetism, Oceanic Relief, Sea Floor Spreading, Plate Boundaries, Mechanics and Movements of Plates, Zone of Collision and Associated Landforms.</li> <li>5. Endogenic Forces; Epiorogenic and Orogenic Movements, Compression, Tension, Folds, Types and Landforms, Faults, Types, and Landforms.</li> </ol>	<b>15 L</b>
<b>Unit 3</b>	<p><b>Weathering, Mass Movement Processes, and Hillslopes</b></p> <ol style="list-style-type: none"> <li>1. Weathering: Types and related landforms.</li> <li>2. Mass Movement: Types of the mass movement.</li> </ol>	<b>15 L</b>

	3. Hillslope processes and forms. 4. Models of hillslope evolution.	
<b>Unit 4</b>	<b>Fluvial Processes and Glacial Processes</b> 1. Drainage Basin and Drainage Patterns. 2. Davisian Cycle of Erosion and Concept of Peneplanation. 3. Mechanics of Erosion, Transportation, and Deposition. 4. Erosional Landforms. 5. Depositional Landforms.	<b>12 L</b>
<b>Unit 5</b>	<b>Coastal Processes</b> 1. Sea waves, currents, and tides. 2. Coastal processes: erosion, transportation and deposition. 3. Coastal landforms: erosional and depositional.	<b>08 L</b>
<p><b>Suggested reading:</b></p> <ol style="list-style-type: none"> <li>1. Migon, P. (2010): Geomorphological Landscapes of the World, Springer, London/New York.</li> <li>2. Ollier, C. D. (1981) Tectonics and Landforms, Longman , London</li> <li>3. Siddhartha, K. (2001): The Earth's dynamic surface, Kosalaya, Delhi.</li> <li>4. Singh, S. (2011): Geomorphology, PrayagPustakBhawan, Allahabad.</li> <li>5. Spark B. W. (1972): Geomorphology, Longman, New York</li> <li>6. Steers, A. (1958): The Unstable Earth, Methuen, London.</li> <li>7. Strahler A. H and Strahler, A. N. (1992) : Modern Physical Geography, John Wiley, New York</li> <li>8. Thornbury, W. D. (1960): Principles of Geomorphology, John Wiley and Sons, New York.</li> <li>9. Wooldridge and Morgan: Geomorphology</li> </ol>		

<b>GG-102: ENVIRONMENTAL GEOSCIENCES</b>		
	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. The fundamental issues and debates that circulate around the intersection of geography and environmental science, with a particular focus on how humans affect and are affected by modifications of the physical environment.</li> <li>2. The importance of ‘thinking ecologically’ when approaching complex environmental problems.</li> <li>3. The key environmental inequalities that underpin contemporary globalization, and the ways that race, class, and gender frequently limit access to social and environmental justice.</li> <li>4. The tensions that arise from global environmental change in particular places and geographic conditions.</li> </ol> <p><b>Course Outcomes:</b> On completion of this (GG-102) course, students are able to:</p> <ol style="list-style-type: none"> <li>1. Understand Structure, Components of Atmosphere.</li> <li>2. Study about Nutrient cycling.</li> <li>3. Acquire knowledge about biodiversity.</li> <li>4. Understand the value of the Resource.</li> <li>6. Understand environmental problems there Cause, Effect, and Remedies.</li> <li>7. Get knowledge about environmental hazards and management.</li> <li>8. Make aware about conservation of resources.</li> <li>9. Understand the various environmental protection acts.</li> </ol>	
<b>Unit 1</b>	<p><b>Basic issues in environmental sciences:</b></p> <ol style="list-style-type: none"> <li>1. Definition, principles and scope of environmental science.</li> <li>2. Components of environment.</li> <li>3. Geography and environment.</li> <li>4. Man and nature, Environment and resources.</li> <li>5. Man – Environment Relationships: i. Approaches to the study ii. Environmental deterministic approach iii. Teleological approach, iv. Possibilistic approach v. Economic deterministic approach, vi. Ecological approach.</li> <li>6. Environment and man; Man’s interaction with the environment.</li> </ol>	<b>10 L</b>
<b>Unit 2</b>	<p><b>Ecological systems:</b></p> <ol style="list-style-type: none"> <li>1. Ecological concepts i. Meaning and definitions ii. Ecosystem concepts and Components.</li> <li>2. Ecosystem; form and functions, Food chain, Food web, Tropic level, Ecological niche.</li> <li>3. Biosphere and Ecosystem; Material circulation through ecosystem, Natural system, and man-induced changes, Energy cycle, Hydrological cycle, Nutrient cycle (carbon, nitrogen, phosphorous).</li> </ol>	<b>15 L</b>
<b>Unit 3</b>	<p><b>Environmental Degradation</b></p> <ol style="list-style-type: none"> <li>1. Concepts and types of environmental degradation.</li> <li>2. Causes of environmental degradation.</li> <li>3. Population growth and development, urbanization, land degradation.</li> <li>4. Environmental Pollution; i. Sources and types of pollution, ii. Air pollution, adverse effects of air pollution on weather and climate-ozone, depletion, iii. Greenhouse effect, iv. Effects on human health, v. Water pollution, vi. Surface and groundwater, vii. Adverse effects on human health.</li> </ol>	<b>15 L</b>
<b>Unit 4</b>	<b>Atmospheric Changes and the Biosphere</b>	<b>10 L</b>



	<ol style="list-style-type: none"> <li>1. Climatic Factors shaping the Geographical, Zoning and its Periodicity.</li> <li>2. Changing Climate of the World.</li> <li>3. Climatic Hazards and Management, Social Response to Climatic Hazard.</li> <li>4. Biomes and their relationships to Climate and Hydrological Cycle.</li> </ol>	
<b>Unit 5</b>	<b>Environmental Degradation and Hazards</b> <ol style="list-style-type: none"> <li>1. Water, Air and Noise problems in urban-industrial Environment; Water and soil pollution in rural landscape.</li> <li>2. Impact of Green Revolution; Problems of Solid waste and nuclear fallout.</li> <li>3. Human response to Flood, Drought, Landslide, Earthquake, and Cyclone.</li> <li>4. Disaster Management.</li> </ol>	<b>10 L</b>

**Suggested reading:**

1. Chandna R. C., 2002: Environmental Geography, Kalyani, Ludhiana.
2. Cunningham W. P. and Cunningham M. A., 2004: Principals of Environmental Science: Inquiry and Applications, Tata Macgraw Hill, New Delhi.
3. Goudie A., 2001: The Nature of the Environment, Blackwell, Oxford.
4. Mal, Suraj., and Singh, R.B. (Eds.) (2009) Biogeography and Biodiversity. Rawat Publication, Jaipur
5. Miller G. T., 2004: Environmental Science: Working with the Earth, Thomson BrooksCole, Singapore.
6. MoEF, 2006: National Environmental Policy-2006, Ministry of Environment and Forests, Government of India.
7. Singh, R.B. and Hietala, R. (Eds.) (2014) Livelihood security in Northwestern Himalaya: Case studies from changing socio-economic environments in Himachal Pradesh, India. Advances in Geographical and Environmental Studies, Springer
8. Odum, E. P. et al, 2005: Fundamentals of Ecology, Ceneage Learning India.
9. Singh S., 1997: Environmental Geography, Prayag Pustak Bhawan. Allahabad.
10. UNEP, 2007: Global Environment Outlook: GEO4: Environment For Development, United Nations Environment Programme.
11. Singh, M., Singh, R.B. and Hassan, M.I. (Eds.) (2014) Climate change and biodiversity: Proceedings of IGU Rohtak Conference, Volume 1. Advances in Geographical and Environmental Studies, Springer
12. Singh, R.B. (1998) Ecological Techniques and Approaches to Vulnerable Environment, New Delhi, Oxford & IBH Pub..
13. Singh, Savindra 2001. Paryavaran Bhugol, Prayag Pustak Bhawan, Allahabad. (in Hindi)

<b>GG-103: FUNDAMENTAL OF CARTOGRAPHY</b>		
	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. Create professional and aesthetically pleasing maps through thoughtful application of cartographic conventions.</li> <li>2. Select and combine appropriate visual variables to clearly represent geospatial data and communicate map content.</li> <li>3. Classify and generalize data, apply principles of color and contrast, and choose projections and scales for maps of varying purpose.</li> <li>4. Discuss current trends in cartographic science &amp; technology, including virtual reality, open-source web tools, and geo-visual analytics.</li> <li>5. Demonstrate mastery in map production for communication and research; analyze, critique, and share high-quality maps.</li> </ol> <p><b>Course Outcomes:</b></p> <p>On completion of this (103) course, students are able to:</p> <ol style="list-style-type: none"> <li>1. Having completed cartography programme, a graduate has a complex understanding between functions and interaction of nature and anthropogenic structures; principles of sustainable development; systematic and critical approach.</li> <li>2. Understanding scalability and existence of geographic systems.</li> <li>3. Recognize cartographic modeling in interdisciplinary research.</li> <li>4. Ability to formulate scientific and applied research objectives, shape content and possible results.</li> <li>5. Strategic analyse and evaluate cartographic projects requirement and complication degree.</li> <li>6. Formulate results of scientific research.</li> <li>7. Perform quantitative and qualitative data analysis; formulate and present research results; analyze of scientific reference sources, juridical acts.</li> <li>8. Use varied technologies for scientific research, information search, evaluation, and recall.</li> </ol>	
<b>Unit 1</b>	<p><b>Fundamental of Cartography</b></p> <ol style="list-style-type: none"> <li>1 Definition, Nature, Scope, History, Types, Developments.</li> <li>2 Significance.</li> <li>3 Advance Cartographic techniques.</li> <li>4 Application of cartography.</li> </ol>	<b>10 L</b>
<b>Unit 2</b>	<p><b>Qualitative Cartography</b></p> <ol style="list-style-type: none"> <li>1 Map i. Definition ii. Elements iii. Types iv. Characteristics v. Map Making Methods.</li> <li>2 Scale i. Definition ii. Types of Scale, Presentation Techniques &amp; Conversion of Scale iii. Characteristics iv. Scaling Methods &amp; Uses.</li> <li>3 Relief: i. Definition ii. Types iii. Characteristics iv. Relief Presentation Techniques: hachure's, shading, contours, and layer tints) &amp; Uses.</li> <li>4 Profiles: i. Definition ii. Types iii. Characteristics iv. Drawing of profiles v. Significance.</li> <li>5 Gradient &amp; Slope i. Definition ii. Types iii. Characteristics iv. Slope analysis methods v. Significance.</li> </ol>	<b>15 L</b>
<b>Unit 3</b>	<p><b>Quantitative Cartography</b></p> <ol style="list-style-type: none"> <li>1 Representation of numerical data: i) line graphs ii) bar graphs iii) Proportional Circle iv) Divided Circle v) Histogram vi) Thematic Mapping- Choropleth and</li> </ol>	<b>10 L</b>

	<p>Isopleths.</p> <p>2 Methods of Area Measurement.</p> <p>3 Methods of Map enlargement and reduction.</p>	
<b>Unit 4</b>	<p><b>Computer Cartography</b></p> <p>1 Fundamentals of computer cartography i. Digital cartography ii. History iii. Developments and advantages of computerize cartography.</p> <p>2 Representation of geographic data with the help of Advance Techniques: CAD, GIS, and GPS.</p>	<b>10 L</b>
<b>Unit 5</b>	<p><b>Map Interpretation Techniques</b></p> <p>1 Study of Survey of Indian topographical maps i. Classification scale and Indexing of Toposheets ii. Introduction to SOI topographical maps: numbering, scales, and grid reference, signs and symbols, color system, etc.</p> <p>2 Interpretation of SOI maps i. Hilly, Mountainous, Plain, Desert, Coastal Areas.</p> <p>3 Interpretation of Foreign Toposheets i. Ordnance Survey Map of UK ii) Geological Survey of USA.</p>	<b>15 L</b>
<p><b>Suggested reading:</b></p> <ol style="list-style-type: none"> <li>1. Anson, R., and Ormelling, F. J., 1994: International Cartographic Association: BasicCartographic Vol., Pregmen Press</li> <li>2. Campbell, J., (1984): Introductory Cartography Prentice Hall, Inc., Englewood Cliff, NewJersey.</li> <li>3. Cromley, R.G., (1992): Digital Cartography Prentice Hall, New Jersey.</li> <li>4. Fraser Taylor (1991): Geographical Information System, Pergmon Press, U.K.</li> <li>5. Glodard R. H., (1982): Field Techniques and Research Methods in Geography Dubuque.</li> <li>6. Gupta, K. K., and Tyagi, V. C., 1992: Working with Map, Survey of India, DST, New Delhi</li> <li>7. Mahmood A., (1977): Statistical Methods in Geographical Studied Rajesh Publication, Delhi.</li> <li>8. Maquire, D.J (1991): Geographical Information Systems - Principles and Application Good Child, M.F. and Rhind, D.W., Taylor and Francis Publication Washington,.</li> <li>9. Mishra, R. P., and Ramesh, A., 1989: Fundamentals of Cartography, Concept, New Delhi</li> <li>10. Monkhouse, F. J., and Wilkinson H. R., 1973: Maps and Diagrams, Methuen, London</li> <li>11. Monmonier, M. S. (1982): Computer Assisted Cartography: Principles and Prospects Prentice Hall, New Jersey.</li> <li>12. National Atlas and Thematic Maps Organization (NATMO): National Atlas of India Calcutta.</li> <li>13. Robinson, A. H., 2009: Elements of Cartography, John Wiley and Sons, New York</li> <li>14. Robinson, A.H., John Willey and Sons: Elements of Cartography (New edition):, New York.</li> <li>15. Sarkar, A. 2015: Practical Geography: A systematic approach. Orient Black Swan PrivateLtd., New Delhi</li> <li>16. Singh, R. L., and Singh, R. P. B., 1999: Elements of Practical Geography, Kalyani Publishers</li> </ol>		

**GG-104: PRACTICALS IN PHYSICAL GEOGRAPHY**

	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"><li>1. To introduce some basic research method to the students to be applied to various themes in Physical Geography.</li><li>2. To indicate the assumptions, limitations, and interpretation of these methods and results.</li></ol> <p><b>Course Outcomes:</b></p> <p>On completion of this (GG-104) course, students are able to:</p> <ol style="list-style-type: none"><li>1. To know the fundamentals of Physical Geography.</li><li>2. To learn drawing of Scale Diagram for representing geographical data.</li><li>3. The skill of drawing of map, grapes, diagrams scale.</li></ol>
1	<p><b>Drainage Network Hierarchy:</b></p> <ol style="list-style-type: none"><li>1. Drainage network hierarchy i) Horton's method ii) Strahler's method.</li><li>2. Laws of drainage composition;<ol style="list-style-type: none"><li>a. Law of stream order: i) Measurement of order wise stream number ii) Stream number v/s Stream order. (Preparation of graph) iii) Bifurcation ratio.</li><li>b. Law of stream length i) Measurement of stream length and average. ii) Stream order v/s average stream length. (Preparation of graph) iii) Length Ratio.</li></ol></li></ol>
2	<p><b>Measurement of the catchment area of the drainage basin unit:</b></p> <ol style="list-style-type: none"><li>i) Drainage Frequency ii) Drainage Density iii) Constant of Channel Maintenance.</li><li>iv) Basin Elongation vi) Ruggedness Number vii) Stream order v/s mean area</li></ol> <p>Interpretation of the results of all subunits.</p>
3	<p><b>Relief and Slope Analysis</b></p> <ol style="list-style-type: none"><li>i) Absolute Relief Map, ii) Relative Relief Map, iii) Dissection Index Map, iv) Hypsometric Integral, Miller's Isotan Map, Slope Map by Wentworth's Method</li></ol>
4	<p><b>Geological Maps:</b></p> <ol style="list-style-type: none"><li>1. Introduction of Geological Maps: i) Dip ii) Strike Line iii) Bedding Plane iv) Plane of Unconformity v) Out Crop.</li><li>2. Drawing of Geological Section and its Interpretation.</li></ol>
5	<p><b>Sediment Analysis:</b></p> <ol style="list-style-type: none"><li>1. Sieving and pipette method; i) Analysis of 1 sandy and 1 Clayey sample, ii) Plotting of data on probability graph paper and estimation of grain size parameters, iii) Interpretation of processes.</li><li>2. Study of Sedimentary sequences and weathering profile, i) Study of 1 sedimentary sequence of river or costal sediments and 1 weathering profiles, ii) Interpretation in terms of past and present processes.</li></ol>
<p><b>Suggested reading:</b></p> <ol style="list-style-type: none"><li>1. Anson, R., and Ormelling, F. J., 1994: International Cartographic Association: Basic Cartographic Vol., Pergmen Press</li><li>2. Campbell, J., (1984): Introductory Cartography Prentice Hall, Inc., Englewood Cliff, New Jersey.</li><li>3. Cromley, R.G., (1992): Digital Cartography Prentice Hall, New Jersey.</li><li>4. Fraser Taylor (1991): Geographical Information System, Pergmon Press, U.K.</li><li>5. Glodard R. H., (1982): Field Techniques and Research Methods in Geography Dubuque.</li><li>6. Gupta, K. K., and Tyagi, V. C., 1992: Working with Map, Survey of India, DST, New Delhi</li><li>7. Mahmood A., (1977): Statistical Methods in Geographical Studied Rajesh Publication, Delhi.</li><li>8. Maquire, D.J (1991): Geographical Information Systems - Principles and</li></ol>	

Application Good Child, M.F. and Rhind, D.W., Taylor and Francis Publication Washington,.

9. Mishra, R. P., and Ramesh, A., 1989: Fundamentals of Cartography, Concept, New Delhi
10. Monkhouse, F. J., and Wilkinson H. R., 1973: Maps and Diagrams, Methuen, London
11. Monmonier, M. S. (1982): Computer Assisted Cartography: Principles and Prospects Prentice Hall, New Jersey.
12. National Atlas and Thematic Maps Organization (NATMO): National Atlas of India Calcutta.
13. Robinson, A. H., 2009: Elements of Cartography, John Wiley and Sons, New York
14. Robinson, A.H., John Willey and Sons: Elements of Cartography (New edition):, New York.
15. Sarkar, A. 2015: Practical Geography: A systematic approach. Orient Black Swan Private Ltd., New Delhi
16. Singh, R. L., and Singh, R. P. B., 1999: Elements of Practical Geography, Kalyani Publishers

**GG-105: PRACTICALS IN CARTOGRAPHIC TECHNIQUES WITH HELP OF GIS**

	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"><li>1. To introduce GIS (Geographic Information System) as a tool of spatial science.</li><li>2. To indicate the basic elements of GIS and methodology of GIS.</li><li>3. To outline the steps and areas of application of GIS.</li></ol> <p><b>Course Outcomes:</b></p> <p>On completion of this (GG-105) course, students are able to:</p> <ol style="list-style-type: none"><li>1. Understand the introductory part of GIS software, its tool, functions, data import, scale factors, and basics of digitization.</li><li>3. Use this software to prepare the various types of maps in geography with the help of cartographic Techniques of GIS software.</li><li>4. Applied this software and cartographic techniques for analysis and study in rural settlement geography and urban settlement for planning and development.</li><li>5. Understand the cartographic techniques and its tolls, functions, applied in agriculture geography and physical geography for assessment and visualization purpose.</li><li>6. Help with these techniques, tool, methods, procedures; analysis potential and cartographic technique, etc. prepare the project report considering all types of data related to the geography of any selected study area or village.</li></ol>
1	<p><b>Introduction to Auto CAD Map Software:</b> Interface, Menu bar, Toolbar, Data import, Scale, factor, Layer Properties.</p>
2	<p><b>Spatial Database</b> Layer Generation</p> <ol style="list-style-type: none"><li>1. Raster: Full Grid, Chain Codes, and Run Length Codes.</li><li>2. Vector: Manual Digitization, Digitization Errors and Topology Building.</li></ol>
3	<p><b>Cartographic Techniques with the help of GIS:</b> Techniques to Prepare Following Maps; Choropleth Map: i) Shading ii) Colour, Dot Map, Transformation of Dot map into Isopleth Map, Proportional Circle Map</p> <p><b>Query in GIS</b> Simple and advanced, Spatial and nonspatial, Topological, SQL.</p>
4	<p><b>Overlay Analysis</b> Polygon-on-polygon overlay, line-in-polygon overlay, point-on-polygon-overlay</p> <p><b>Network Analysis</b> Principle and computation; Pathfinding. Shortest path, Location Allocation: Supply and demand.</p> <p><b>Proximity Analysis</b> Point, Line, Polygon Buffer Zone</p>
5	<p><b>Excursion:</b></p> <ol style="list-style-type: none"><li>a) Visit a place or a region of geographical interest.</li><li>b) The report should include the following points: Landforms- More emphasis should be given on the formation of the landforms, Economy, Settlements, Transport, and General Observations. While writing the report students may.</li></ol> <p><b>Write a report on anyone point or may consider all points.</b></p> <ol style="list-style-type: none"><li>a) Maps Photographs &amp; Diagrams are necessary for the report.</li><li>b) Collection of rock specimens is also expected. Students should bring them at the time of examination &amp; show them to the examiner. Examiners are requested to give</li></ol>

	weightage to such students.
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**Suggested reading:**

1. Agricultural Geography (1984): Sing J. and Dhillon.
2. Agricultural Geography: Majid Hussen.
3. An Introduction to Quantitative Analysis in Human Geography (1974): Yeats M.H.
4. Geography of Settlement (1976): Hudson F.S.
5. Maps and Diagram: Monkhouse.
6. Mastering Auto CAD: George Omura, BPB Publication, B14 Connaught place, New Delhi
7. Readings in Rural Settlement Geography: Sing R.L.
8. Statistic for Geography and Social Science: R. B. Mandal.
9. The Study of Urban Geography: Edward Arnold.
10. Transportation Geography: Michael E. and E. Hurse.

## SEMESTER – II

<b>GG-201: GEOINFOMETICS- I</b>		
	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"><li>1. Maximize the efficiency of decision making and planning.</li><li>2. Provide efficient means for data distribution and handling.</li><li>3. Elimination of redundant database-minimize duplication.</li><li>4. Capacity to integrate information from many sources.</li><li>5. Complex analysis/queries involving geographical reference data to generate new information.</li><li>6. It will be teaching about the important elements of Geospatial technology.</li><li>7. Update data quickly and cheaply.</li></ol> <p><b>Course Outcomes:</b></p> <p>On completion of this (GG-201) course, students are able to:</p> <ol style="list-style-type: none"><li>1. Students will demonstrate knowledge of the foundations and theories of geographic information systems (GIS) and use the tools and methods of GIS.</li><li>2. Understand the modern techniques in geography under this course such as remote sensing and aerial photography.</li><li>3. Examining the history and concepts.</li><li>4. Students will demonstrate their competence to work individually and as a team to develop and present a client-driven GIS solution.</li><li>5. Student will be familiar with modern techniques in Geography.</li><li>6. Students will be prepared to apply their skills in professional careers.</li></ol>	
<b>Unit 1</b>	<p><b>Introduction to GIS</b></p> <ol style="list-style-type: none"><li>1. Definition, potential of GIS, concept of space &amp; time.</li><li>2. Spatial Information Theory.</li><li>3. History of GIS.</li><li>4. Objectives of GIS.</li><li>5. Elements of GIS, hardware &amp; software requirements.</li><li>6. GIS Applications.</li><li>7. GIS Tasks- input, manipulation, management, query &amp; analysis, visualization.</li></ol>	<b>15 L</b>
<b>Unit 2</b>	<p><b>Database and Data Models</b></p> <ol style="list-style-type: none"><li>1. Spatial: spatial relationship, functional relationship, logical relationship.</li><li>2. Non-spatial: nominal, ordinal, ratio and cyclic.</li><li>3. Spatial: Geometric primitives, Raster, Vector, comparative overview of raster and vector models, layers and coverage.</li><li>4. Non-spatial: DBMS Advantages, conceptual models; Implementation models hierarchical, network and relational.</li></ol>	<b>15 L</b>
<b>Unit 3</b>	<p><b>Structuring of Spatial Data</b></p> <ol style="list-style-type: none"><li>1. Digitizers: manual, semi-automatic &amp; automatic.</li><li>2. Editing error: detection &amp; correction, topology building.</li></ol>	<b>10 L</b>



<b>Unit 4</b>	<b>Data Analysis (I)</b> 1. Attribute databases: operations from algebraic theory. 2. Operations from set theory SQL: attribute query.	<b>10 L</b>
<b>Unit 5</b>	<b>Data Analysis (II)</b> 1. Spatial Databases: map algebra, grid Operations: Local, Focal. 2. SQL: spatial query.	<b>10 L</b>

**Suggested reading:**

1. **Burroughs, P. A. and McDonnell, R.A. (2002):** Principles of Geographical Information System, Oxford University Press.
2. **George J. (2004):** Fundamentals of Remote Sensing, Universities Press Pvt. Ltd., Hyderabad.
3. **Jensen, J. R. (2003):** Remote Sensing of Environment, An Earth Resource Perspective, Pearson Education Pvt. Ltd., New Delhi.
4. Kang- Tsung-Chang, Introduction to Geographical Information System, 2002, McGraw Hill.
5. **Lillesand, T. M. and Kiefer R. W. (2002):** Remote Sensing and Image Interpretation, John Wiley and Sons, New Delhi.
6. **Lo C. P. and Yeung, A.K.W. (2002):** Concepts and Techniques of Geographic Information System, Prentice Hall, India.
7. **Paul A. Lonfley, Michel F. Goodchild, D J. Maguire and D W. Rhind, (2002):** Introduction to Geographic Information Systems and Science, John Wiley and Sons Ltd.
8. Fundamentals of Remote Sensing, A Canada Centre for Remote Sensing Remote Sensing Tutorial.  
[https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/resource/tutorial/fundamentals\\_e.pdf](https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/resource/tutorial/fundamentals_e.pdf)

<b>GG-202: CLIMATOLOGY</b>		
	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. Climatology is important since it helps determine future climate expectations.</li> <li>2. Through the use of latitude, one can determine the likelihood of snow and hail reaching the surface.</li> <li>3. You can also be able to identify the thermal energy from the sun that is accessible to a region.</li> <li>4. Provide training in theoretical and applied aspects of atmospheric physics and dynamics, quantitative modeling techniques, weather forecasting, climate prediction and observation of atmospheric processes.</li> <li>5. Equip you with the skills of quantitative and statistical analysis with regards to atmospheric data processing and management.</li> <li>6. Enable you to apply theoretical concepts and analytical techniques to the resolution of environmental and socio-economic problems that have an atmospheric origin.</li> <li>7. Develop your independent research ability.</li> <li>8. Convert participants with non-environmental backgrounds to applied meteorologists and climatologists.</li> </ol> <p><b>Course Outcomes:</b></p> <p>On completion of this (GG-202) course, students are able to:</p> <ol style="list-style-type: none"> <li>1. Understand the introduction to Climatology considering weather &amp; climate, the role of climate in human life, aims, nature, scope, and some other subdivision of the course.</li> <li>2. Understand the Atmosphere and their process and function, origin, composition, structure of Atmosphere.</li> <li>3. To examining the Insolation and Heat Budget and its factors effects and their relations to other some elements.</li> <li>4. Understand the concept of temperature and factors, horizontal, vertical and invasion of temperature.</li> <li>5. Identify the Atmospheric pressure and winds humidity and concept of precipitation and its types.</li> <li>6. To compare the Air masses and Fronts, atmospheric destructions and its relation of local to global.</li> <li>7. Understand the climatic classification based on nature and variability in climatic variations by Koppen.s and Thornwaites climatologist.</li> </ol>	
<b>Unit 1</b>	<p><b>Introduction</b> Nature and scope; Weather, Climate, Subdivisions of Climatology, Development of Modern Climatology, Tropical Climatology</p> <p><b>Earth`s atmosphere</b></p> <ol style="list-style-type: none"> <li>1.Composition; Physical properties, Chemical composition.</li> <li>2.Vertical structure; Temperature changes, Vertical variations in the composition, Ionosphere and aurora.</li> </ol>	<b>08 L</b>
<b>Unit 2</b>	<p><b>Insolation and Heat Balance</b></p> <ol style="list-style-type: none"> <li>1. Solar radiation; Electromagnetic spectrum, Factors affecting insolation.</li> <li>2. Distribution; Latitudinal and Seasonal, variation of insolation.</li> <li>3. Effect of Atmosphere; Scattering, Diffusion, Absorption, Reflection, Albedo, Green House Effect.</li> </ol>	<b>15 L</b>

	4. Terrestrial Radiation; Heat Budget, Latitudinal Heat Balance, Atmospheric window. <b>Temperature</b> Basic concept; Difference between Heat and Temperature, Controls of temperature Horizontal and Vertical distributions, Inversion of temperature.	
<b>Unit 3</b>	<b>Atmospheric Pressure and Winds</b> Pressure measurement and distribution; ii. Factors affecting distribution of pressure, iii. Wind observation and measurement, iv. Factors affecting wind, v. Geostrophic wind and Gradient wind, vi. Models of general circulation of the atmosphere, vii. Eddy theory, viii. Local winds, ix. Jet stream, x. Cyclones and Anticyclones	<b>12 L</b>
<b>Unit 4</b>	<b>Atmospheric Moisture</b> i. Atmospheric moisture, ii. Hydrologic cycle, iii. Evaporation and condensation, iv. Forms of condensation, v. Precipitation, vi. Types of precipitation, vii. Measurement of humidity.	<b>10 L</b>
<b>Unit 5</b>	<b>Atmospheric Stability</b> i. Lapse Rate: normal, environmental, dry adiabatic lapse rate and wet adiabatic lapse rate, ii. Stable and unstable air, iii. Absolute stability, iv. Absolute instability, v. Conditional instability. <b>Air Masses and Fronts</b> i. Introduction to air masses and fronts, ii. Types of air masses, iii. Types of fronts.	<b>15 L</b>

**Suggested reading:**

1. Critchfield, H.J. (Rep. 2010): General Climatology. Prentice Hall, New Delhi.
2. Lal, D.S. (1998): 'Climatology', Chaitanya Publishing House, Allahabad.
3. Lutgens, Frederic K. & Tarbuck, Edward J. (2010): 'The Atmosphere: An Introduction to Meteorology', Pearson Prentice Hall, New Jersey.
4. Oliver, John E. & Hidore, John J. (2003): Climatology: An Atmospheric Science, Pearson Education, Delhi
5. Savindra Singh (2005): Climatology, PrayagPustakBhawan, Allahabad.
6. Trewartha: Introduction to Weather and Climate.
7. More, Pagar, Thorat (2014): (Marathi), Elements of Climatology & Oceanography, Atharv Publication, Pune.

**GG-203: STATISTICAL METHODS IN GEOGRAPHY**

**Course Objectives:**

1. To change a descriptive character of geography and make it a scientific discipline.
2. To explain and interpret the spatial patterns of geographical phenomena in a rational, objective & cogent manner.
3. To use mathematical language instead of the language of literature like 'Af' in the koeppen's classification of climate this stands for 'tropical rainforest climate'.
4. To make precise statements about locational order.
5. To test hypothesis and formulate models, theories and laws.
6. To identify the ideal locations for the various economic activities so that profit may be maximized.
7. To provide geography a sound philosophical theoretical base

**Course Outcomes:**

On completion of this (GG-203) course, students are able to:

1. Get knowledge about Geo Statistical Methods.
2. Understand the representation of Statistical data.
3. Know the Importance of Statistic in Geography.
4. Understand the introduction of the geo-sciences system and statistical techniques and characteristics of data.
5. To examining to probability assessment and their calculation procedures and applications and uses in different field of geography.
6. Understand the concept of sampling and designing and conducting a sample survey for data collation and data analysis.
7. Evaluate, calculate and understand the parametric statistics in geoscience system small-sized sample and Non-Parametric Statistics in geoscience system of various test and techniques.
8. To understand the regression analysis in geosciences system and calculation, application in various field of geography.

<b>Unit 1</b>	<p><b>Geographical data</b></p> <ol style="list-style-type: none"> <li>1. Nature; Spatial and Temporal, Discrete and Continuous Data, Grouped and Ungrouped data</li> <li>2. Scales of measurement; Nominal, ordinal, Interval and ratio scale descriptive and Inferential</li> <li>3. Types of statistics.</li> </ol>	<b>10 L</b>
<b>Unit 2</b>	<p><b>Descriptive statistics and Probability</b></p> <ol style="list-style-type: none"> <li>1. Analytical methods; Meaning, description and calculation of mean, median, variance, standard deviation, skewness, and kurtosis.</li> <li>2. Methods of Determination; Normal probability distribution, central limit theorem, the Confidence interval for means, Determination of the probability of a continuous random event using the normal distribution, Determination of the probability of a discrete random event using Binomial and Poisson distributions.</li> </ol>	<b>15 L</b>
<b>Unit 3</b>	<p><b>Time series analysis</b></p> <p>Meaning, and Definition of time series, Methods of analysis;</p> <ol style="list-style-type: none"> <li>1. Properties of a time series, trends, and periodicity.</li> <li>2. Calculation and plotting of running means (3 and 5)</li> </ol>	<b>10 L</b>

	3. Curve fitting by the method of least squares.	
<b>Unit 4</b>	<b>Structural Analysis</b> 1. Scope of structural analysis, the concept of Tectonite fabric and Tectonite Symmetry 2. Structural analysis on microscopic, mesoscopic and macroscopic scales 3. Introduction to petrofabrics 4. Structural behavior of igneous rocks, diapirs and salt domes diapirs and salt domes.	<b>10 L</b>
<b>Unit 5</b>	<b>Inferential statistics</b> 1. <b>General requirements for conducting an inferential Statistical test;</b> Population and sample, Meaning of unbiased random sample, Standard error estimates of mean and standard deviation. 2. <b>Testing of hypothesis;</b> Null and Alternative hypothesis, Level of significance (Rejection level), Degrees of freedom, Parametric and Nonparametric tests, 3. <b>Application of following tests,</b> i) Non- parametric test, chi-squared test; a. Two or more samples, b. Using relative frequency table, ii) Parametric tests; a. Student's test (comparison of sample means), b. ANOVA(Analysis of variance)	<b>15 L</b>
<b>Suggested reading:</b> 1. Borradaile, G. (2003): Statistics of Earth Science Data, Springer, New York 2. Ebdon David (1989). Statistics for Geographers 3. Frank, H. and Althoen, S. C. (1994): Statistics: Concepts and Applications, Cambridge University Press, Cambridge 4. Hammond, R. and Mc Cullagh, P. (1991): Quantitative Techniques in Geography, Clarendon Press, Oxford 5. King, (1975). Statistical Geography 6. Mann, P. S. (2007): Introductory Statistics, John Wiley and Sons, New Delhi 7. Norcliffe G.B. (1977). Inferential statistics for Geographers (Hutchinson, London) 8. Rogerson P.A. (2001). Statistical methods for Geography (SAGE pub., London, New Delhi) 9. Rogerson, P. A. (2010): Statistical Methods for Geography, Sage Publications, London 10. Shaw G. & Wheller D. (1985). Statistical Techniques in Geographical Analysis, John Wiley & Sons, New York.		

**GG-204: PRACTICAL'S IN HUMAN GEOGRAPHY****Course Objectives:**

1. To introduce some basic research method to the students to be applied to various themes in Human Geography.
2. To indicate the assumptions, limitations, and interpretation of these methods and results.

**Course Outcomes:**

On completion of this (GG-204) course, students are able to:

1. Students understand the Microsoft Excel, worksheet and learn the basics about the preparation of graphs, maps, in software for Presentation Techniques
2. To evaluate and investigation the population data in Microsoft Excel software.
3. Applied and understand the data analysis techniques for rural and urban settlement and prepare the adequate maps, various graphs.
4. Evaluate the Data Analysis Techniques in Agricultural Geography and Climatology
5. Understand the various basics statistical Techniques for analysis of the geographical data.
6. Organize the fieldwork and collect the authentic and appropriate data about the selected village and analyzed that data help with Microsoft Excel, worksheet and prepare the slide and the village report for presentation.

**1****Introduction to Microsoft Excel Work Book and Presentation Techniques:**

1. Microsoft Excel; Worksheets Workbooks & Worksheets, Data Analysis tools and Techniques, Development of Syntax on Formula Bar, Data Presentation Techniques.
2. Presentation Techniques; Introduction to Microsoft Office PowerPoint, Preparation of Slides, Maps, and Graphs import techniques for a slide show

**2****Data Analysis Techniques in Population Geography:**

1. Density; Arithmetic Density of Population, Economic Density of Population, Nutritional Density of Population, Agricultural Density of Population, Critical Density of Population
2. Measures; Fertility Rates, Birth Rates: Crude & Age Specific, Mortality Rate, Child-Women Ratio,
3. Sex Ratio: Sex Ratio of all groups of Population
4. Population Change: Annual or Decadal
5. Dependency Ratio
6. Religious Composition:

**3****Data Analysis Techniques in Rural And Urban Settlement Geography:**

1. Dispersion of Rural Settlements; Bernhard's method, Demangeon method, Debouvrie's method
2. Classification of Villages according to the size of Population
3. Growth Rate of Rural Population
4. Growth of Urban Population
5. Degree of Urbanization
6. Functional Classification of Towns by Thompson.

**4****Data Analysis Techniques in Agricultural Geography and Statistical**

	<p><b>Techniques:</b>  Proportion of Cropped Land, Crop Concentration by Bhatia, Crop Diversification by Bhatia, Crop Combination by Weaver's &amp; Doi's Methods, Correlation of Coefficient, Quartile Deviation, Standard Deviation, Coefficient of Variation, Calculation of 'r' values to draw circles.</p>
<p><b>5</b></p>	<p><b>Preparation of Following Maps:</b>  Density of Population, Concentration of Population, Sex Ratios, Proportion of Category Wise Population, Religion wise composition, Literacy Rate</p> <p><b>Cartographic Techniques in Rural Settlement Geography</b>  Classification of Rural Settlements according to size of Population, Proportion of Rural Population, Dispersion of Settlements,</p> <p><b>Cartographic Techniques in Population Geography</b>  Classification of Towns according to the size of Urban Settlement, Proportion of Urban Population, Degree of Urbanization, Functional Classification of Towns,</p> <p><b>Cartographic Techniques in Agricultural Geography</b>  Proportion of Crops, Crop Concentration, Crop Diversification, Crop Combination, Land use, and Land Classification</p>
<p><b>Suggested reading:</b></p> <ol style="list-style-type: none"> <li>1. R.B.Mandal: "Statistic for Geography and Social Science".</li> <li>2. Monkhouse: "Maps and Diagram".</li> <li>3. Masjid Husen ": Agricultural Geography".</li> <li>4. Hudson F.S. (1976): "Geography of Settlement".</li> <li>5. Yeats, M.H. (1974): "An Introduction to Quantitative Analysis in Human Geography".</li> <li>6. Sing J. and Dhillon (1984) "Agricultural Geography".</li> <li>7. Sing R.L. "Readings in Rural Settlement Geography".</li> <li>8. Michaele E. and E. Hurse: "Transportation Geography".</li> <li>9. Edward Arnold: "The Study of Urban Geography".</li> <li>10. George Omura: Mastering Auto CAD, BPB Publication, b14 Conneaut place, New Delhi</li> <li>11. Grini Courter and Annette Marquis (1999): "OFFICE 2000" BPB Publication.</li> </ol>	

**GG-205: PRACTICAL'S IN CLIMATOLOGY****Course Objectives:**

1. Knows the measurement principles of standard atmospheric instrumentation for pressure, air temperature, humidity, wind and precipitation
2. Knows the measurement principles of standard oceanographic instrumentation for temperature, salinity and ocean currents
3. Knows the relevance of choosing a representative measurement location
4. Knows the main error sources and typical accuracies of atmospheric and oceanographic instrumentation
5. Knows the development and limitations of present operational observing systems

**Course Outcomes:**

On completion of this (GG- 205) course, students are able to:

1. Introduce the student of a top sheet, weather map.
2. Understand the mechanism function of topographical maps.
3. Understand interpretation if weather images.
4. Get knowledge about Geo Statistical Methods.

<b>1</b>	<b>Weather Elements:</b> Processing of weather data; Instrumentation and measurement techniques of weather elements and processing of weather data (5-10 years data)
<b>2</b>	<b>Water balance - Principle and computation:</b> Computation of water balance for 4 stations in different rainfall zones and irrigation scheduling
<b>3</b>	<b>Preparation of Climatic Maps &amp; Diagrams:</b> Simple temperature and rainfall graph, Climatograph, Climograph, Hythergraph, Foster's Climograph, Wind Roses: Simple, Compound & Octagonal, Rainfall Dispersion.
<b>4</b>	<b>Station Model:</b> 1. Preparation of Station Model; Synoptic data: Coding, decoding and plotting of synoptic data, Use of weather data with the help of symbols. 2. Estimation of Potential Evapotranspiration by Thornwaite's; Method and Construction of graphs showing Surplus, Deficit Water Budget, and their Analysis.
<b>5</b>	<b>Indian Daily Weather Report (IDWR):</b> 1. Study of Indian Daily Weather Report 2. Analysis of Indian Daily Weather Report; Temperature, Air Pressure, Humidity, Wind, Rainfall, etc. for various stations. 3. Weather forecasting

**Suggested reading:**

1. WMO No. 8 (1983): Guide to meteorological instruments and methods of observations
2. Thornthwaite, C. W. & Mather, J. R. (1957): Instructions and Tables for computing potential evapo - transpiration and water balance, Drexel Institute of Technology, Laboratory of Climatology.
4. Indian Daily Weather Report, IMD, Pune.
3. Oliver, John E. (1973): Climate and Man's Environment, John Wiley and Sons, New York.
4. Critchfield, H.J., General Climatology, Prentice Hall, N.J., 1975.



5. Frederick K. and Edward J. Tarbuck, *The Atmosphere: An Introduction to Meteorology*, Prentice Hall of India Pvt. Ltd., New Delhi, 1995.
7. Strahler, A.N., *Modern Physical Geography*, John Wiley and Sons, New York, Singapore, 1987.
6. Trewartha, G.T. (1980): *An Introduction to Climate*, McGraw Hill, New York, Fifth Edition (International Student Edition).
7. Thompson Russell D., *Applied Climatology - Principles & Practice*, John Willey, New York, 1997.
8. Barry & Perry., *Synoptic Climatology*.
9. Blair, T.A., *Climatology-General and Regional*.
10. Chorley, R.J. & Barry, R.G., *Atmospheric Weather and climate*.
11. Donn, W.L., *Meteorology*.
12. Jackson, I.J., *Climate, Water and Agriculture in the Tropics*, 1977.
13. Kendrew, W.G., *Climates of the Continents*.
14. Lal, D.S., *Climatology*.
15. Mather, J.R., *Climatology: Fundamental and Applications*, 1974.
16. Patterson., *Introduction to Meteorology*.

**SYLLABUS**  
M.A / M.Sc. Applied Geography  
**SEMESTER – III**

<b>GG-301: GEOGRAPHY OF RESOURCES</b>		
	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. To acquaint the pupils with the living conditions of men in different parts of the globe.</li> <li>2. To enable the pupils to acquire a knowledge of natural resources.</li> <li>3. To develop in pupils an understanding of how the environment and climatic factors have influenced our life.</li> </ol> <p><b>Course Outcomes:</b> On completion of this (GG-301) course, students are able to:</p> <ol style="list-style-type: none"> <li>1. Develop an idea about resource.</li> <li>2. Understand the concept of different types of resources.</li> <li>3. Acquire knowledge about different types of power resources.</li> <li>4. Explain population - resource relationship and different types of population resources.</li> </ol> <p>Therefore, GG-301 will provide insight to students to use this knowledge in building their career.</p>	
<b>Unit 1</b>	<p><b>Introduction to Resource Geography</b> Meaning and Definition of Resource, Importance of the study of resources, Components of resources, natural and human. <b>Classification of Resources</b> Basis of Classification: renewable and non-renewable resources, Importance of biotic and abiotic renewable resources, Importance of biotic and abiotic non-renewable resources.</p>	<b>10 L</b>
<b>Unit 2</b>	<p><b>Forest Resources</b> Use of forest resources, Environmental significance of forests, Distribution of Forest resources in Maharashtra and India, Meaning causes, significance, and utilization of forest and effects of deforestation, Remedial measures to conserve forest resources, Methods of conservation of Forest resources. <b>Water Resources</b> Water as a resource, Sources of water, significance and utilization of water resources, Distribution of water resources in Maharashtra and India, Uses of water resources – i) domestic, ii) agriculture, iii) industry, iv) transportation, v) tourism, etc., Methods of conservation of water resources. <b>Land Resources</b> Significance and utilization of land resources, Distribution of land resources in Maharashtra and India, Use of land resources: agriculture, forest, mining, settlements &amp; other, Land degradation due to agriculture, and deforestation. Methods of conservation of land resources.</p>	<b>15 L</b>
<b>Unit 3</b>	<p><b>Mineral Resources</b> World distribution and production of iron ore, bauxite in major Countries, Distribution and production of iron ore, bauxite in India, Distribution, and production of iron ore, bauxite in Maharashtra. <b>Energy Resources;</b> Distribution and production of coal, petroleum and natural gas in World, India &amp; Maharashtra, Significance and utilization of solar, wind and nuclear energy resources in World, India, and Maharashtra. <b>Human Resources</b> Population as a resource, World distribution of population, Population distribution in India, Population distribution in Maharashtra, Concepts of over, optimum and under population.</p>	<b>15 L</b>
<b>Unit 4</b>	<b>Resources and Economic development</b>	<b>10 L</b>

	Role of land resources in economic development, Role of water resources in economic development, Role of mineral resources in economic development, Role of energy resources in economic development, Role of human resources in economic development.	
<b>Unit 5</b>	<b>Planning and Management of Resources.</b> Concept of resource planning, Need for resource planning, Resource planning with reference to Maharashtra and India.	<b>10 L</b>
<b>Suggested reading:</b>		
<p>10. Chempremave J. D. (1989) : Geography and Energy, Longman Scientific and Technical Series. U. K.</p> <p>11. Daji J. A., Kadam J. R. and Patil, N. D. (1996) : A Textbook of Soil Science, Media Promoters &amp; Publishers Pvt. Ltd. Bombay.</p> <p>12. Gurjar &amp; Jat (2008): Geography of Water Resources, Rawat Publications, Jaipur.</p> <p>13. Negi B. S. (1997) : Geography of Resources, Kedarnath Ramnath, Meerut.</p> <p>14. Owen S. and Owens P.L. (1991) : Environment Resources and Conservation, Cambridge University Press, New York.</p> <p>15. Ray S. (2008) : Natural Resources, Organization &amp; Technology Linkages, Rawat Publication, Jaipur.</p> <p>16. Saxena H. M. (2006) : Environmental Geography, Rawat Publications, Jaipur.</p> <p>17. Singh S. (2004) : Environmental Geography, Prayag Pustak Bhawan, Allahabad.</p> <p>18. Skinner B. J. (1969) : Earth Resources, Prentice-Hall, Englewood Cliffs, N. J.</p> <p>19. World Resources Institute (WRI) 1994: World Resources 1994-95, Oxford University Press, New York.</p> <p>20. Zimmerman E. W. (1951) : World Resources &amp; Industries.</p>		

<b>GG-302 (A): URBAN GEOGRAPHY</b>		
	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. To produce original, innovative scholarship in urban geography, smart urbanism, and postcolonial urban theory by extending the research to the much neglected but dynamic context of 'small cities'</li> <li>2. To critically learn from how State, urban authorities and citizens of small cities living through rapid and radical urban transformations imagine and realize new urban futures.</li> <li>3. To produce a detailed evidence base and learn from innovative practices within the three cities that can be communicated widely to policy-makers, practitioners, municipal authorities, civil society organizations and community groups.</li> <li>4. To build research capacity on smart cities and urban futures in India and elsewhere. Societal partners are key to the formation, execution, and dissemination of this project through access to their networks and their role in the delivery of pathways to impact activities.</li> <li>5. To develop evidence-based policy interventions on smart cities and urban futures in India and elsewhere.</li> </ol> <p><b>Course Outcomes:</b></p> <p>On completion of this (GG-302 A) course, students are able to:</p> <ol style="list-style-type: none"> <li>1. Critical understanding of the key approaches (theoretical frameworks) used in the study of urbanization and urban change.</li> <li>2. Concepts and debates in urban studies.</li> <li>3. Critical understanding of current urban policies and programs</li> <li>4. Collect, display and analyze geographical data using a variety of techniques.</li> <li>5. Explain the concepts and models of the development, function, and distribution of cities.</li> <li>6. Analyze the internal structure of cities using appropriate techniques, models, and theories.</li> <li>7. Analyze the processes of suburbanization and gentrification and their contemporary characteristics.</li> <li>8. Explain how public and private sector organizations influence the planning and development of cities.</li> </ol>	
<b>Unit 1</b>	<p><b>Introduction</b> Nature and scope, Significance, Relation to other disciplines.</p> <p><b>Urbanization</b> Concept and Process; Meaning of Urban settlement and urbanization, Criteria used to distinguish urban settlements, Behavioral, the structural and demographic concept of urbanization, Brief review of spatial-temporal variations in urbanization in the world, Urbanization curve, Contemporary factors of urbanization.</p>	<b>10 L</b>
<b>Unit 2</b>	<p><b>Urban Morphology</b> Models of urban structure; Park and Burgess Model, Homer Hoyet Model, Harris and Ullman Model, Characteristics and demarcation of CBD.</p> <p><b>Urban Classification</b> Various approaches to classification, Urban function, Functional classification of towns and cities by C.D. Harris and H. J. Nelson.</p>	<b>15 L</b>
<b>Unit 3</b>	<p><b>Urban Demography</b> Characteristics and methods of demarcation; Growth of urban population, Urban explosion in developing countries, Density of population in cities, Age, sex and</p>	<b>10 L</b>

	occupational structure. <b>City and its Region</b> Concept, characteristics, and demarcation; Concepts of city region and various, synonymous terms used, Criteria used to demarcate the cityRegion, Nature of urban influence.	
<b>Unit 4</b>	<b>Central place concepts</b> Central place theory and urban Hierarchy; Christaller's Central Place Theory, Rank-size relationship and rank-size rule, Hierarchy of urban settlements <b>Contemporary urban issues</b> Nature of issues; Price of land and vertical and horizontal growth of cities, Urban sprawl, Scarcity of housing and growth of slums, Problems of civic amenities, Urban transport problem, Environmental pollution.	<b>15 L</b>
<b>Unit 5</b>	<b>Urban development policies and planning</b> Policies of Urban development, Need of city planning, Elements of city plan, Master plan of towns, New towns, Urban development, and urban policy in India.	<b>10 L</b>
<b>Suggested reading:</b>		
<ol style="list-style-type: none"> <li>1. Bhattacharya: Urban development in India, Shree publication.</li> <li>2. Brian.R.K. (1996): Landscape of Settlement Prehistory to the present, Routledge, London</li> <li>3. Carter (1972): The Study of Urban Geography, Edward Arnold,.London.</li> <li>4. Hall P. (1992) Urban and Regional Planning, Routledge, London</li> <li>5. Johnson: Urban Geography</li> <li>6. K. Siddharth and S. Mukherji: Cities, Urbanizations and Urban Systems.</li> <li>7. Kundu, A. (1992): Urban Development and Urban Research in India, Khanna Publication.</li> <li>8. Mayer and Kohn: Readings in Urban Geography</li> <li>9. Northam: Urban Geography</li> <li>10. Raj Bala: Urbanization in India.</li> <li>11. Roy Turner: Indian's Urban Future.</li> <li>12. Shah Manzoor Alam: Urbanization in Developing Countries</li> <li>13. Singh. K. and Steinberg. F.(eds) (1998): Urban India in Crisis. New Age Interns,</li> <li>14. Urban Geography: Tim Hall</li> <li>15. Verma: Urban Geography, Rawat, Jaipur</li> </ol>		

<b>GG-302 (B): MEDICAL GEOGRAPHY</b>		
	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. To introduce the students to the special features of the development and the research areas of the science of health geography.</li> <li>2. To present the indicators, values, and characteristics that can be used to describe, compare and contrast the state of health of the population.</li> <li>3. To present the development, the main trends and research activities of this area of science.</li> <li>4. We also intend to prove the interdisciplinary nature of health geography by showing the connections between different disciplines as well as raise interest about health geography as the area of science that deals with current social and environmental issues.</li> </ol> <p><b>Course Outcomes:</b> On completion of this (GG-302 B) course, students are able to:</p> <ol style="list-style-type: none"> <li>1. Understand the Ecology and epidemic Deciles.</li> <li>2. Find out the Geographical Background of Diseases.</li> <li>3. Create Awareness o malnutrition and hygiene.</li> <li>4. Understand the Process of health care planning in India.</li> <li>5. Function of WHO, UNICEF and RED CROSS.</li> </ol>	
<b>Unit 1</b>	<p><b>Introduction</b> Definition, development and significance, Dualism between Medical and Health Geography</p>	<b>08L</b>
<b>Unit 2</b>	<p><b>Human ecology of disease</b></p> <ol style="list-style-type: none"> <li>1. Landscape epidemiological approaches.</li> <li>2. Social and spatial epidemiological perspectives.</li> <li>3. Health transition.</li> </ol>	<b>10 L</b>
<b>Unit 3</b>	<p><b>Health Geography</b> Disease and Wellbeing; Approaches to the Study of Health Geography: Ecological, Social and Spatial;</p> <ol style="list-style-type: none"> <li>1. Approaches to the Study of Wellbeing: Need-based, Relative Standard and Capability; Geographical Factors affecting Human Health and Wellbeing.</li> <li>2. Diseases and their Typology: WHO Classification of Diseases and their Major Types: Genetic; Communicable and Non- communicable; Occupational and Deficiency Diseases; Epidemics and Pandemic.</li> </ol>	<b>15 L</b>
<b>Unit 4</b>	<ol style="list-style-type: none"> <li>1. Geographical perspective on health care provisions in developed and developing countries, Spatial aspects of health care planning</li> <li>2. Indian health care delivery system: public and private sectors, reproductive and child health, millennium development goals</li> <li>3. Climate change and public health, adaptation, and mitigation</li> </ol>	<b>12 L</b>
<b>Unit 5</b>	<ol style="list-style-type: none"> <li>1. Global Patterns of Human Health and Wellbeing Ecology, Etiology, Diffusion and Distribution Pattern of Malaria, Tuberculosis, Hepatitis, AIDS, Glycemia and Cardiovascular Diseases; Poverty; Food Security; Nutrition Deficiency; Health and Sanitation Facilities.</li> <li>2. International and National Concerns: Role of WHO, UNICEF, Red Cross; Indian Health Care Planning: Child and Family Health Welfare, Immunization, Rural Health and Health for All Programmes, National Health Care Infrastructure; Health GIS.</li> </ol>	<b>15 L</b>
<p><b>Suggested reading:</b> 17. Brown, T., McLafferty, S., Moon, G. (2010): A Companion to Health and Medical</p>		

18. Curtis, S. (2004): Health and Inequality: Geographical Perspectives, Sage Geography, Wiley Blackwell, UK
19. Hazra, J. (Ed.) (1997): Health Care Planning in Developing Countries, University of Calcutta, Calcutta
20. May, J. M. (1959): Ecology of Human Diseases, M.D. Publications, New York
21. Pati, B. and Harrison, M. (2009): The Social History of Health and Medicine in Colonial India, Routledge, London
22. Philips, D. R. (1990): Health and Health Care in Third world, Longman, London Publications, London
23. Stamp, L. D. (1964): Geography of Life and Death, Cornell University, Ithaca
24. May, J.M. (1970). The World Atlas of Diseases, National Book Trust, New Delhi.
25. Narayan, K.V. (1997). Health and Development: Inter-sectoral linkages in India, Rawat Pub., Jaipur.
26. Rais, A. and Learmonth, A.T.A., (1986 ): Geographical Aspects of Health and Diseases in India, Concept Publishing Company, New Delhi. 22. Izhar, N. (2004).
27. Geography and Health; A study in Medical Geography, Saujanya Books, Delhi.
28. [http://en.wikipedia.org/wiki/Health\\_geography](http://en.wikipedia.org/wiki/Health_geography)
29. <http://www.esri.com/industries/health/geomedicine/index.html>

<b>GG-303: GEOINFORMATICS - II</b>		
	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. Maximizing the efficiency of planning and decision making</li> <li>2. Integrating information from multiple sources</li> <li>3. Facilitating complex querying and analysis</li> <li>4. Eliminating redundant data and minimizing duplication</li> </ol> <p><b>Course Outcomes:</b></p> <p>On completion of this (GG-303) course, students are able to:</p> <ol style="list-style-type: none"> <li>1. Understand the modern techniques in geography under this course such as remote sensing and aerial photography.</li> <li>2. Examining the history, basic theories of EMR, and other concepts.</li> <li>3. Understand and get the knowledge about the fundamental concept, types of aerial photography, characteristics of aerial photographs and aerial camera.</li> <li>4. Review on development of Indian remote sensing and functions of IRS.</li> <li>5. To understand the types of remote sensing and types of platforms in remote sensing.</li> <li>6. To get knowledge about satellite sensor and types of sensors, and their functions and characteristics</li> <li>7. Understand the data product, types of data product and its applications and uses in remote sensing.</li> </ol>	
<b>Unit 1</b>	<p><b>Introduction to Remote Sensing (RS)</b></p> <ol style="list-style-type: none"> <li>1. Principles of RS; Definition, Historical Perspective-National &amp; International Scenario.</li> <li>2. Electromagnetic Spectrum; Spectrum, Spectral Quantities, Theories of EMR, Laws of Radiation, Concept of Blackbody radiation, Spectral Signatures.</li> <li>3. Data sources; Primary and Secondary; Fieldwork and Surveys, Published data and Reports and maps, Remotely sensed data, GPS coordinates.</li> </ol>	<b>10L</b>
<b>Unit 2</b>	<p><b>Interaction of EMR</b></p> <p>Atmosphere and Surface;</p> <ol style="list-style-type: none"> <li>1. Scattering, Absorption, Refraction, Path Radiance Reflection, Transmission, Absorption Scattering.</li> <li>2. Surfaces, Atmospheric Windows and Types of RS.</li> </ol> <p><b>Satellite RS</b></p> <p>Platforms Orbits Scanning Sensors;</p> <ol style="list-style-type: none"> <li>1. Group – base, Air-borne, Spaceborne.</li> <li>2. Geosynchronous, Susynchronous.</li> <li>3. Across- track and Along –track.</li> <li>4. Spectral, Spatial, Radiometric and Temporal characteristics.</li> <li>5. Types of Sensor</li> </ol> <p>Landsat: MSS, TM, ETM, SPOT,; HRV, IRS: LISS,PAN, WiFS, OCM.</p>	<b>15 L</b>
<b>Unit 3</b>	<p><b>Aerial Photography</b></p> <p>Basics of Ariel Photography, Ariel Camera;</p> <ol style="list-style-type: none"> <li>1. Scale, Resolution, Projection, Flight Planning, Overlaps.</li> <li>2. Optical accepts – Spherical Aberrations, Astigmatism, Chromatic Aberrations Components of camera.</li> </ol> <p><b>Measurement</b></p> <ol style="list-style-type: none"> <li>1. Geometric characteristics of Ariel Photography, Measurement of scale and height on Ariel Photography.</li> </ol>	<b>10 L</b>



<b>Unit 4</b>	<b>Visual Interpretation and GPS</b> 1. Elements; Factors governing the interpretability, Elements of Interpretation of satellite images and aerial photographs. 2. Fundamental Concepts of GPS; Space Segment, Control Segment and User Segment, Components and Types, GPS Signals.	<b>10 L</b>
<b>Unit 5</b>	<b>Earth Resource Satellites</b> 1. Introduction, the early history of space imaging, platforms (ground, aerial and space) and sensors. 2. Indian Remote Sensing Programs: Aryabhata, Bhaskara I and II programs, IRS satellite missions and their capabilities. 3. Overview and scope of the future IRS Missions.	<b>15 L</b>
<p><b>Suggested reading:</b></p> <ol style="list-style-type: none"> <li>1. Virginia (1966): Manual of Photogrammetry (3rd ed.) American Society of Photogrammetry.</li> <li>2. Virginia (1975): Manual of Remote Sensing, American Society of Photogrammetry.</li> <li>3. Avery, T. E. and G. L. Berlin (1983, 1992): Fundamentals of Remote Sensing and Airphoto Interpretation, 5th ed., MacMillan Publishing Co. New York.</li> <li>4. Curran, P. J. (1988): Principles of Remote Sensing, Longman, ELBS edition, Hong Kong. 5. Kellaway, George P. (1956): Map Projection, Methuen &amp; Co., London.</li> <li>5. Lillesand, T. M., and Kieffer, R. W. (1979): Remote Sensing and Image Interpretation, John Wiley and Sons, New York.</li> <li>6. Sabins, F. F. (Jr.) (1987): Remote Sensing Principles and Interpretation, 2nd ed., W.H. Freeman and Co., New York.</li> <li>7. Steers, J. A. (1957): Map Projections, University of London Press, London.</li> <li>8. Manual of Remote Sensing (1980): Vol I and II, American Society of Photogrammetry. 4<sup>th</sup> Ed., Falls Church.</li> <li>9. Avery, T.E. and G.L. Berlin (1985): Interpretation of Aerial Photographs, 4th Ed., Bergess Minneapolis, Minn.</li> <li>10. Bruno Marcolongo and Franco Mantovani (1997): Photogeology and Remote Sensing Applications in Earth Science, Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi.</li> <li>11. Pandey S.N. (1987): Principles and Applications of Photogeology by, Wiley Eastern.</li> <li>12. W.G. Rees (1990): Physical Principles of Remote Sensing, Cambridge University Press.</li> <li>13. Sabins, F.F. (1986): Remote Sensing Principles and Interpretations by, 2nd Ed. W.H. Freeman and Company, New York.</li> <li>14. Verbyia D. (1995): Satellite Remote Sensing for natural resources, Lewis Publishers, Boca Rotaon, F.L.</li> <li>15. Wolf P.R. (1983): Elements of Photogrammetry, McGraw-Hill, New York.</li> </ol>		

**GG-304: PRACTICALS IN REMOTE SENSING AND IMAGE PROCESSING.**

	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"><li>1. To provide exposure to students in gaining knowledge on concepts and applications leading to the modeling of earth resources management using Remote Sensing</li><li>2. To acquire skills in storing, managing digital data for planning and development.</li><li>3. To acquire skills in advance techniques such as hyperspectral, thermal and LiDAR scanning for mapping, modeling, and monitoring.</li></ol> <p><b>Course Outcomes:</b></p> <p>On completion of this (GG-304) course, students are able to:</p> <ol style="list-style-type: none"><li>1. Understand the important principles of remote sensing, spectral measurements, and remote sensing systems</li><li>2. Understand the need for image pre-processing and will be able to assess the pros and cons of different methods</li><li>3. Understand the use of remote sensing data in biophysical and biochemical product generation</li><li>4. Be confident in your use of image processing software to apply routine pre-processing and image analysis steps in a rigorous and self-reflective manner</li><li>5. Have developed your skills in critical assessment of published papers, particularly their choice of image pre-processing and processing methods.</li></ol>
1	<p><b>Photogrammetry</b></p> <p>Stereoscopic Vision Test, Format and stereoscopic Orientation of Aerial Photographs, Determination of scale and Stereoscopic area, Determination of Principal Point and Conjugate, Principal Point Direction of Flight line and Air Base, Calculation of traffic Speed through Aerial Photographs, Calculation of Photographic coverage for a Planning Area.</p>
2	<p><b>Satellite Images</b></p> <p>Interpretation; Visual interpretation of LISS, PAN, WiFS and Merged Images, A WiFS and High-Resolution Satellite, Data, Cartosat Data, IKONOS, and Quick Bird, etc.</p>
3	<p><b>Digital Image Processing</b></p> <p>Enhancement; Linear – Contrast Enhancement, Non-Linear – Square, Square root, Cube, Cube root, Spatial Filtering –Mean &amp; Median, Band Ratioing, NDVI Computation.</p>
4	<p><b>Image Processing</b></p> <p>Introduction of image processing, forms of mages, different image processing techniques, computer image processing, digital image processing, image restoration image enhancement, edge enhancement, ratio images.</p>
5	<p><b>Software based</b></p> <p>Image Processing GIS; Image Registration, Enhancement, Supervised Classification Unsupervised Classification, Georeferencing of the scanned raster image, Digitization (vectorization), Rasterization, Attribute data linking, Thematic Layer Generation.</p>
<p><b>Suggested reading:</b></p> <ol style="list-style-type: none"><li>1. Virginia (1966): Manual of Photogrammetry (3rd ed.) American Society of Photogrammetry.</li><li>2. Virginia (1975): Manual of Remote Sensing, American Society of Photogrammetry.</li><li>3. Avery, T. E. and G. L. Berlin: Fundamentals of Remote Sensing and Airphoto Interpretation, 5th ed., New York, MacMillan Publishing Co., 1983, 1992.</li><li>4. Curran, P. J.: Principles of Remote Sensing, Longman, ELBS edition, Hong Kong, 1988.</li><li>5. Kellaway, George P.: Map Projection, Methuen &amp; Co., London, 1956.</li><li>6. Steers, J. A.: Map Projections, University of London Press, London, 1957.</li></ol>	

**GG-305: PRACTICAL'S IN GIS & GPS TECHNIQUES WITH HELP OF COMPUTER.**

	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"><li>4. Have a basic, practical understanding of GIS concepts, techniques, and real-world applications.</li><li>5. Have an understanding of the technical language of GIS.</li><li>6. Understand the basic concepts of geography necessary to efficiently and accurately use GIS technology.</li><li>7. Understand basic GIS data concepts.</li><li>8. Have an ability to perform basic GIS analysis of concepts.</li><li>9. Have demonstrated a practical application of GIS.</li><li>10. Have practical experience using basic GIS tools.</li><li>11. Have an understanding of GIS and its relationship to mapping software development.</li><li>12. Have an appreciation of GIS career options and how to pursue them.</li></ol> <p><b>Course Outcomes:</b></p> <p>On completion of this (GG-305) course, students are able to:</p> <ol style="list-style-type: none"><li>1. Understand the introduction of GIS software's special reference of ILWIS, to examining the types of GIS software and applications, the introduction of menu, tools, page layout and setting, scanning image, import of image in the software.</li><li>2. To study and understand the image registration and its analysis done in software.</li><li>3. To understand and prepare the topology of point, line, and polygon and understand nonspatial data analysis.</li><li>4. To prepare the different kinds of the map using GIS software and also create the profile of relief representation.</li><li>5. To understand the GPS and its functions, work, types and components for a field survey and make project report using both GPS and GIS software.</li><li>6. Investigate the components and function of GIS</li><li>7. Study GIS Data models.</li><li>8. Introduce GPS and Its Functions.</li><li>9. Make to use GIS &amp; GPS software.</li></ol>
1	<p><b>Introduction to GIS</b></p> <ol style="list-style-type: none"><li>1. Introduction to GIS software ILWIS and Arc GIS and GPS etc.</li><li>2. Applications of ILWIS software; Introduction to Menu, main windows, tools, navigation bar, catalogue, operation tree, command box, domain and attribute tables.</li><li>3. Introduction of GPS, data collection and mapping by using GPS Software.</li></ol>
2	<p><b>Applications of ILWIS software –</b></p> <ol style="list-style-type: none"><li>1. Geo-referencing; Import scanned/digital image, Coordinate system, Geo-referencing.</li><li>2. Creation of layers; Concepts: point, segment, and polygon layers, Point layers: Settlements and Wells, Segments layers: Contours, boundaries, rivers and roads, Polygon layers: village, farm, and forest.</li><li>3. Attribute data; Tabulation and attachments.</li></ol>
3	<p><b>Overview of ArcGIS</b></p> <p>Arc Map, Arc Catalog, Arc Toolbox, Help, etc.</p> <p><b>Geodatabase in Arc catalog</b></p> <p>Feature dataset, feature classes, import of data, spatial data formats, Shape/coverage files and layers, data frames, maps, managing TOC, displaying qualitative/ quantitative values, labeling features.</p> <p><b>Working with layers</b></p>

	Building templates, classification, map creation.
4	<p><b>Georeferenced data</b> coordinate systems, datum conversions, Map projections, types, storing-viewing projection information.</p> <p><b>Editing data</b> Selecting features, simple editing functions, creating new features, modifying, schema changes.</p> <p><b>Spatial and aspatial data</b> Spatial: Linking features &amp; attributes. geodatabase data format, ways to view data, metadata, etc. Aspatial: Understanding tables, field types, table manipulations, table relationships, join and relates, creation of graphs and reports.</p>
5	<p><b>Spatial analysis</b> Query: Identifying, measuring, query by location/attribute. Spatial Analysis: Geoprocessing wizard, spatial analysis functions.</p> <p><b>Network analysis</b> Network utility, creating network model, shortest path.</p>
<p><b>Suggested reading:</b></p> <ol style="list-style-type: none"> <li>1. Agarwal C.S.and Garg P.K. (2002): Text Book on Remote Sensing, Wheeler Publishing New Delhi.</li> <li>2. ArcGIS 9, Building A Geodatabase by Andrew Perencsik, Simon Woo, Bob Booth, Scott Crosier, Jill Clark, Andy MacDonald, 1999-2004, USA.</li> <li>3. ArcGIS 9, Geodatabase Workbook by Bob Booth, Jeff Shaner, Andy MacDonald, Phil Sanchez, Rhonda Pfaff, 2004, USA.</li> <li>4. ArcGIS 9, Using ArcCatalog by Aleta Vienneau, Jonathan Bailey, Melanie Harlow, John Banning, Simon Woo, 2003-2004, USA.</li> <li>5. Bernhardsen, Tor (1999): Geographic Information System, An Introduction, John Wiley &amp; Sons.</li> <li>6. Burrough, P. A. and McDonnell, R. A. (1998): Principles of Geographical Information Systems, Oxford University press Inc., New York</li> <li>7. Burrough, P.A. (1986): Principles of Geographical information System for Land Resources Assessment, Oxford University Press.</li> <li>8. Chang, K. T. (2008): Introduction to Geographic Information Systems, Avenue of the Americas, McGraw-Hill, New York</li> <li>9. Chang, Kang-taung (2000): Introduction to Geographic information System, Tata McGraw Hill.</li> <li>10. Clarke ,Keith C. (1999): Getting Started with Geographic Information System , Prentice Hall.</li> <li>11. Demers, Michael N. (2000): Fundamentals of Geographic Information System ,John Wiley.</li> <li>12. Environment System Research Institute (1993): Understanding GIS , The Arc Info Method.</li> <li>13. Environmental Systems Research Institute, Inc. (1998): Understanding GIS: The ARC/INFO Method, ESRI Press, Redlands</li> <li>14. GIS Education Solutions from ESRI, Introduction to ArcGIS- I, Course Lectures, 2003 Published by ESRI.</li> <li>15. Haywood, Ian (2000): Geographical Information System, Longman.</li> <li>16. Lillesand, Thomas M. &amp; Kiefer Ralph (2000): Remote Sensing and Image interpretation, Jonh Wiley. Manual, Locate Press LLC, USA</li> <li>17. Prithvish Nag and M. Kudrat (1998): Digital remote Sensing, Concept Publishing Company, New Delhi.</li> <li>18. Quantum GIS User Guide, <a href="http://docs.qgis.org/1.8/pdf/QGIS-1.8-UserGuide-en.pdf">http://docs.qgis.org/1.8/pdf/QGIS-1.8-UserGuide-en.pdf</a></li> <li>19. The ESRI guide to Geodatabase design by Michael Zeiler 1999.</li> <li>20. Thiede, R., Sutton, T., Duster, H. and Sutton, M. (2013): The Quantum GIS Training</li> <li>21. William Jonathan (1995): Geographic information from Space: Processing and applications of Geocoded Satellite Images, John Wiley &amp; Sons.</li> </ol>	

**AC- 303: RAINWATER HARVESTING**

	Demonstration of Success stories, Practicing Rainwater Harvesting and visit to Rainwater Harvesting structure.
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**AC- 304: GEO-TOURISM**

	Assignment to evaluate the potential of given tourism site. Students has to study and submit the report on site.
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**SEMESTER – IV**

<b>GG-401: WATERSHED MANAGEMENT</b>		
	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. Improvement and restoration of soil quality and thus, raising productivity rates.</li> <li>2. Supply and securing of clean and sufficient drinking water for the population.</li> <li>3. Improvement of infrastructure for storage, transport and agricultural marketing.</li> <li>4. To manage the watershed for beneficial developmental activities like domestic water supply, irrigation, hydropower generation, etc.</li> <li>5. To minimize the risks of floods, droughts, and landslides.</li> <li>6. To develop rural areas in the region with clear plans for improving the economy of the regions.</li> </ol> <p><b>Course Outcomes:</b></p> <p>On completion of this (GG-401) course, students are able to:</p> <ol style="list-style-type: none"> <li>1. Understand the fundamentals concepts related to the watershed, significances of watershed development, demarcation of the watershed, types of watershed according to area and shape</li> <li>2. Study about the physical parameters of the watershed, channel geometry, and basin morphology.</li> <li>3. Understand the hydrological parameters, rainfall, aerial precipitation, evaporation and transpiration, infiltration, runoff, and drainage.</li> <li>4. Understand the watershed development planning and a sample of watershed management and planning for appropriate development of watershed management for water conservation and development.</li> </ol>	
<b>Unit 1</b>	<p><b>Introduction To Watershed</b></p> <p>Concept of the watershed, characteristic of watershed and classification of the watershed, Significance of watershed development, Demarcation of the watershed, Types of watershed according to area and shape.</p>	<b>10 L</b>
<b>Unit 2</b>	<p><b>Physical parameters of watershed –</b></p> <ol style="list-style-type: none"> <li><b>1. Channel geometry &amp; basin morphology;</b> Hydraulic geometry at channel cross-section &amp; along the channel, Channel cross-section pattern, Channel types.</li> <li><b>2. Basin morphology;</b> Drainage network &amp; watershed boundary, Drainage frequency, drainage density &amp; constant of channel maintenance, Basin morphology. i) Horton's form factor. ii) Millar's circularity ratio. iii) Schumm's elongation ratio. iv) Strahler's ruggedness index. v) Strahler's hypsometric integral.</li> <li><b>3. Landuse;</b> Measurement &amp; data sources, Use of land: i) Total geographical area. ii) Area under forest. iii) Area under agricultural. iv) Area under cultural waste. v) Area under natural waste.</li> <li><b>4. Terrain analysis;</b> Terrain analysis on the basis of i) Relief characteristics. ii) Slope. iii) Dissection index. iv) Drainage characteristics: Spatial distribution of drainage frequency and drainage density. v) Soil.</li> </ol>	<b>15 L</b>
<b>Unit 3</b>	<p><b>Hydrological parameters</b></p> <ol style="list-style-type: none"> <li><b>1. Rainfall:</b> a) Intensity &amp; duration, b) Measurements.</li> <li><b>2. Aerial precipitation:</b> a) Thiessen polygons, b) Isohytal method.</li> <li><b>3. Evaporation &amp; transpiration:</b> a) Methods, b) Instruments.</li> <li><b>4. Infiltration:</b> a) Methods, b) Instruments.</li> <li><b>5. Runoff:</b> a) Measurement, b) Selection, criteria of gouging station.</li> </ol>	<b>15 L</b>

	<b>6. Discharge:</b> a) Measurements, b) Unit hydrograph.	
<b>Unit 4</b>	<b>1. Ground Water;</b> Definition, Aquifer types, Water table, Porosity, Groundwater movement, Recharge & discharge. <b>2. Water management;</b> Rainwater harvesting, Percolation tanks & pits, Sprinkle irrigation. <b>3. Development programmes;</b> Artificial recharge of groundwater, Dams & weirs, Interlinking of rivers.	<b>10 L</b>
<b>Unit 5</b>	<b>Sample of Watershed Management and Planning</b> <b>1. Types of Survey for watershed development;</b> Physical survey, Hydrological, Land use, Survey of Resources. <b>2. Advance Techniques for watershed development;</b> Remote sensing data analysis, Application of GIS software.	<b>10 L</b>

**Suggested reading:**

1. **Basudeb Bhatta:** Remote Sensing and GIS, 2nd ed., Oxford university press, Printed by-Radha press, New Delhi.
2. **Brooks, K. N., Folliott, P. F. and Magner, J. A. (2012):** Hydrology and the Management of Watersheds, Wiley-Blackwell, Oxford
3. **Cech, T. V. (2003):** Principles of Water Resources: History, Development, Management, and Policy, John Wiley and Sons, New York
4. **Chanda B., Dattaa D., Mujumdar (2001):** Digital Image Processing and Analysis, Prentice-Hall of India.
5. **Heathcote, I. W. (2009):** Integrated Watershed Management: Principles and Practice, John Wiley and Sons, New York
6. **M. Anji Reddy:** Text book of Remote Sensing and GIS, 3rd Ed., BS Publications, Hydrabad.
7. **Murthy J.V.S. (1994):** Watershed Management in India, Wiley Eastern Ltd. New Delhi.
8. **Mutreja K.N. (1990):** Applied Hydrology, Tata Mc Graw Hill Pub. Co. Ltd. New Delhi.
9. **Paranjape S. and Other (1980):** Water based Development, Bharat Gyan Vigyan Samithi, New Delhi.
10. **Prithvish Nag and M. Kudrat (1998):** Digital Remote Sensing, Concept Publishing Co. New Delhi.
11. **Shing R.J. (2000):** Watershed planning and Management, Yash Publishing House, Bikaner.

<b>GG-402 (A): AGRICULTURAL GEOGRAPHY</b>		
	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>9. To examine the spatial distribution of crops, livestock and other agricultural activities.</li> <li>10. To ascertain the spatial concentration of agricultural phenom-ena.</li> <li>11. Crop associations and crop-livestock combinations change in space and time.</li> <li>12. The performance of various crops in a country or region is not uniform. There are inter-regional, intra-regional, intra-village and intra-farm variations in the production and productivity of different crops.</li> <li>13. The agricultural geographers have to diagnose at the micro-level (household and field level) the causes of existing agricultural backwardness, and then to suggest suitable strategies to enhance productivity.</li> </ol> <p><b>Course Outcomes:</b></p> <p>On completion of this (GG-402 A) course, students are able to:</p> <ol style="list-style-type: none"> <li>1. Examining the introduction to agriculture, nature, scope, significance, and development of agriculture geography approaches to study.</li> <li>2. Understand the fundamental concept, land use, crops, agricultural production, and envelopment and study the determinants of agricultural activities, physical determinants, and socio-economic determinants.</li> <li>3. To understand the agricultural system its meaning and concept, Whittlesey's classification of agricultural system, types of agricultural, study of the following types of agricultural in respect of the area, salient features, and their problems.</li> <li>4. Understand the agricultural regionalization and modes in agricultural geography and their classification of agricultural models and some theories.</li> <li>5. Understand the agricultural statistics &amp; land use survey techniques and agrarian revolution, meaning &amp; merit and demerit of the green revolution and white revolution.</li> </ol>	
<b>Unit 1</b>	<p><b>Introduction to Agricultural Geography</b></p> <ol style="list-style-type: none"> <li>1. Definition, Nature, Scope and Approaches, Origin and dispersal of agriculture, significance and development of agricultural geography.</li> <li>2. Approaches to the study of agricultural geography; Environmental, Regional, Commodity, and Behavioral approach.</li> <li>3. Significance of Agriculture - Place of agriculture in Different Economies.</li> <li>4. Significance of agriculture in world regions.</li> <li>5. Importance of agriculture in the Indian Economy.</li> </ol>	<b>10 L</b>
<b>Unit 2</b>	<p><b>Fundamental concepts in agricultural geography</b></p> <p><b>A. Meaning and explanation.</b></p> <ol style="list-style-type: none"> <li>1. Crops; i) Cropping pattern, ii) Crop rotation, iii) Intensity of cropping, iv) Crop concentration, v) Crop diversification, vi) Crop combination.</li> <li>2. Agricultural Production and Development; i) Agricultural efficiency, ii) Agricultural productivity, iii) Agricultural labor productivity, iv) Marginal land, v) Agricultural development, vi) Sustainable Agricultural development.</li> </ol> <p><b>B. Determinants of Agricultural Patterns</b></p> <p>Influence of Physical, Economic and Technological Factors;</p> <ol style="list-style-type: none"> <li>1. Altitude, Relief, Climate, Soil.</li> <li>2. Size of Landholding, Land Tenancy, Marketing facilities, Transport, Irrigation, Mechanization and Equipment, Biochemical inputs, Government policies, Capital and Labor, Religion.</li> </ol>	<b>15 L</b>



<b>Unit 3</b>	<b>Agricultural Types and Characteristics</b> Study of the following types of agriculture in respect of areas, salient features, and their problems; Shifting cultivation, Intensive subsistent farming, Mixed farming, Plantation agriculture, Commercial grain farming, Dairy farming.	<b>15 L</b>
<b>Unit 4</b>	<b>A) Land Use Concepts</b> General Land use, Agricultural Land use, Arable land, Net sown area, Gross cropped area, Land reform, and Land tenure. <b>B) Agricultural Statistics &amp; Land use Survey techniques</b> Sources of agricultural statistics; i) Primary Sources of Agricultural data observation, interview, questionnaire & schedule) ii) Secondary Sources of agricultural data (Indian Agricultural Statistics, Agricultural seasons and crop reports, crop statistics, irrigation statistics, agricultural prices, World Agricultural Statistics & other statistics).	<b>10 L</b>
<b>Unit 5</b>	<b>A) Agricultural regionalization Methods of Regionalization</b> 1. Views of Baker Whittles Hann. 2. Crop combination techniques - Weaver and Thomas method. 3. Agricultural efficiency - Kendall"s ranking coefficient, Bhatia"s method. 4. Agricultural location models: Von Thunen and Losch Models & its modifications. 5. Agricultural regions of India. <b>B) Problems &amp; Prospects of Agriculture in India</b> - Semi-arid & arid regions in India 1. Definition and characteristics of arid and semi-arid regions. 2. Droughts and famines 3. Role of irrigation and dry farming. <b>C) Contemporary Issues In Indian Agriculture</b> - 1. Nutrition, Malnutrition, and Hunger; 2. Rural poverty and unemployment; 3. Poverty alleviation strategies; 4. Food aid and nutrition programmes; 5. Food security and its components.	<b>10 L</b>
<p><b>Suggested reading:</b></p> <ol style="list-style-type: none"> <li>8. <b>Singh. J. &amp; Dhillon S.S.</b> (1994) – Agricultural Geography, Tata McGraw Hill, Publishing Co. Ltd.</li> <li>9. <b>Grigg. D.G.</b> (1964) – An Introduction to Agricultural Geography Hutchinson &amp; Co.Ltd.,</li> <li>10. <b>Morgan. W.B. &amp; S.C. Monton</b> (1971) – Agricultural Geography Methuen, London.</li> <li>11. <b>Symons Leslie</b> (1970) – Agricultural Geography, G. Belt and Sons Ltd., London.</li> <li>12. <b>Tarrent, J. R.</b> (1970) – Agricultural Geography, David and Charles, Newton Abbot.</li> <li>13. <b>Grigg. D. G.</b> (1974) – The Agricultural Systems of the world An Evolutionary Approach.</li> <li>14. <b>Illbery, B.W.</b> (1985) – Agricultural Geography, Social &amp; Economic Analysis, Oxford University Press.</li> <li>15. <b>Husain M.</b> (1979) : Agricultural Geography; Inter India Publishers; New Delhi.</li> <li>16. <b>Randhawa M. S.</b> (1980) – An History of Agriculture in India Vols. I, II, III,IV ICAR, New Delhi.</li> <li>17. <b>Majid Husain</b> (2010) – Systematic Agricultural Geography , Rawat Publications, Jaipur.</li> <li>18. <b>Grigg, D. B.</b> (1974.) : The Agricultural Systems of the World. Cambridge University Press, New York.</li> <li>19. <b>Morgan, W.B.</b> (1978) : Agriculture in the Third World - A Spatial Analysis. West view Press, Boulder.</li> <li>20. <b>Tarrant, J. R.</b> (1974.) : Agricultural Geography. Wiley, New York</li> </ol>		

<b>GG-402 (B): OCEANOGRAPHY</b>		
	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. To introduce students to basic concepts of Oceanography.</li> <li>2. To understand the chemical, physical, geological and biological processes which act on the surface of the ocean and to recognized the submarine forms, the seawater composition, and properties.</li> <li>3. Study of the marine environment and its interactions with the earth, the biosphere, and the atmosphere</li> <li>4. To apply these basic physical principles to develop an understanding of specific ocean phenomena and processes.</li> <li>5. To help understand why physical oceanography is important in the earth system and to learn about the interactions with other components of the system, particularly the atmosphere.</li> </ol> <p><b>Course Outcomes:</b></p> <p>On completion of this (GG-402 B) course, students are able to:</p> <ol style="list-style-type: none"> <li>1. Understand the importance of the ocean.</li> <li>2. Knowledge about the effect of ocean Currents.</li> <li>3. Understand human impacts on Ocean.</li> <li>4. Study about types of tides.</li> <li>5. To make aware about jadeites use of water.</li> <li>6. To understand Watershed management and water harvesting Structure.</li> </ol>	
<b>Unit 1</b>	<p><b>Introduction</b></p> <p>Nature and Scope; Definition and Meaning of Oceanography, Foundation of Modern Oceanography, Contribution of Oceanographers in the subject, Post-war Oceanography, Modern Trends.</p>	<b>08 L</b>
<b>Unit 2</b>	<p><b>Origin of the Ocean Basins</b></p> <p>Global Plate Tectonics; Continental Drift, Seafloor Spreading, Plate Tectonics, World Oceans, and their formations.</p> <p><b>The Ocean Floor</b></p> <p>Relief of the Ocean Bottom; Continental Margin, Oceanic Ridges and Rises, Abyssal Plains, Oceanic Trenches, Volcanoes, Coral Reefs, and Atolls.</p>	<b>15 L</b>
<b>Unit 3</b>	<p><b>Properties of Sea Water</b></p> <ol style="list-style-type: none"> <li>1. Temperature; Factors affect the temperature on water and distribution.</li> <li>2. Density; Factors affecting density.</li> <li>3. Salinity; Origin and composition of sea salt and residence time.</li> <li>4. Dissolved gases; Carbon dioxide and carbonate cycles.</li> <li>5. Other physical properties; Viscosity, Surface tension.</li> </ol>	<b>10 L</b>
<b>Unit 4</b>	<p><b>Waves &amp; Tides</b></p> <ol style="list-style-type: none"> <li>1. Waves characteristics and properties; Ideal sea waves, Wave height, length and period, Formation of the sea and swell, Capillary, gravity, shallow water and deep, Water waves, Internal and standing waves, Seismic waves (Tsunami) and storm surges, Wave reflection, refraction, and diffraction, Breaking of waves.</li> <li>2. Tide generating forces, Equilibrium Theory of Tides, Dynamical Theory of Tides, Spring Tides, Neap Tides, Tidal Currents and their Channels, Tidal Bores, Tidal effects in coastal areas.</li> </ol>	<b>15L</b>
<b>Unit 5</b>	<p><b>Ocean Currents and Marine Sediments</b></p> <ol style="list-style-type: none"> <li>1. Ocean Circulation, Their causes, and effects; Types of Currents, drift currents,</li> </ol>	<b>12 L</b>

<p>geostrophic Currents, thermohaline circulation, Factors responsible for ocean currents, Ocean current in Pacific, Atlantic and the Indian Ocean.</p> <p>2. Sediments on the ocean floor; Lithogenous particles (Derived from Rocks), Biogenous particles (derived from organisms), Hydrogenous particles (derived from water), Distribution of sediment deposits, Oceanic ooze, Correlation and age determination.</p>
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**Suggested reading:**

1. Basu S.K. (2003) (ed): Handbook of Oceanography, Global Vision, Delhi
2. Davis Richard A. (1972): Oceanography, Addison Wesley Publishing Co.
3. Garrison Tom (1999): Oceanography, Brooks/ Cole Wadsworth, New York
4. Garrison Tom (2004): Essentials of Oceanography. Thompson, Australia
5. Grant Gross M. (1982): Oceanography, Prentice hall, Ince, New Jersey
6. King Cuchlain A. M (1962): Oceanography for Geographers (ED) Edward Arnold
7. Sharma & Vatal (1962): Oceanography for Geographers. Chaitanya Publishing House, Allahabad
8. Thurman Harold V. (1985): Introductory Oceanography. Bell & Howell Co. London
9. Weisberg J. and Howard P. (1974): Introductory Oceanography. McGraw Hill, Kogakusha, Tokyo.

<b>GG-403: DISASTER MANAGEMENT</b>		
	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. To familiarize the students with the concepts, terminologies, and developments in the field of Disaster Management.</li> <li>2. To help the students learn about the nature and characteristics of major natural disasters and how to mitigate the risk involved with such disasters.</li> <li>3. To help the Student learn what interventions the Government is doing in the field of Disaster Management.</li> </ol> <p><b>Course Outcomes:</b></p> <p>On completion of this (GG-403) course students will be able to:</p> <ol style="list-style-type: none"> <li>1. Capacity to integrate knowledge and to analyze, evaluate and manage the different public health aspects of disaster events at a local and global level, even when limited information is available.</li> <li>2. Capacity to describe, analyze and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.</li> <li>3. Capacity to work theoretically and practically in the processes of disaster management (disaster risk reduction, response, and recovery) and relate their interconnections, particularly in the field of the Public Health Aspects of the disasters.</li> <li>4. Capacity to manage the Public Health Aspects of the disasters.</li> <li>5. Capacity to obtain, analyze, and communicate information on risks, relief needs and lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios with the ability to clearly present and discuss their conclusions and the knowledge and arguments behind them.</li> </ol>	
<b>Unit 1</b>	<p><b>Introduction</b></p> <ol style="list-style-type: none"> <li>1. Natural Disaster; Introduction Ancient and Modern methods of disaster planning and Preparedness, Pre-disaster, During disaster and Post disasters. Causes, Pre, During, Post-disaster Management of i. Physical, Earthquake, Volcano, Landslides, Tsunami, ii. Atmospheric, Cyclone, Flood, Drought.</li> <li>2. Manmade Disaster; Cause, Management of Fire, Terrorism, Food Poisoning, Strike and Lockouts, Accident, Fair and Festivals, Domestic disaster – Food Poisoning, Fire, Gas leakages, Industrial – Fire, Explosion, Electrical, Gas Leakages, Industrial effluents (Discharge) causes and effects.</li> </ol>	<b>10 L</b>
<b>Unit 2</b>	<p><b>Pollution and War: Causes, effects remedies</b></p> <ol style="list-style-type: none"> <li>1. Air, Water, Noise, Solid waste, Biological war, Chemical war, Atomic war.</li> <li>2. Biological Aspects, Waterborne, Airborne, Foodborne diseases, epidemic.</li> <li>3. Medical Aspect – First Aid, Preventive Measures, Public Awareness.</li> </ol>	<b>10 L</b>
<b>Unit 3</b>	<p><b>Manifesting the Mitigation</b></p> <ol style="list-style-type: none"> <li>1. Resources planning and mobilization; Immediate survival kit, Medical Kit to provide for injuries, Rescue equipment, Permanent infrastructures, Financial resources.</li> <li>2. Working out the requirement of the Medical team.</li> <li>3. Establishing a control center.</li> <li>4. Schematic layout of a control center.</li> <li>5. The function of a control center.</li> <li>6. Forming and deploying of rescue teams.</li> <li>7. Security; Disposal of dead and records, Casualty evacuation, Records.</li> </ol>	<b>15 L</b>

<b>Unit 4</b>	<b>Evolution of Disaster Risk Management</b> 1. Temporary and Permanent measures in the post-disaster period. 2. Disaster Management; Action plan, Zonation Mapping, Risk Analysis, Damage Assessment, Need Analysis. 3. Factor related to disaster management. 4. Environmental Impact Assessment of disaster. 5. Stress Management.	<b>10 L</b>
<b>Unit 5</b>	Role of Government and NGO in Disaster Management. 1. Role of local bodies, civilians and NGO's in disaster. 2. Role of Armed forces in disaster. 3. Role of Para Military forces in disasters. 4. Role of government organization in disaster. 5. Role of Police force in disaster.	<b>10 L</b>

**Suggested reading:**

11. Agarwal, A. and Narain S. (Ed) (1999): State of India's Environment. The Citizens Report, Centre for Science and Environment, New Delhi
12. Bryant Edward (2000): Natural Hazards, Cambridge University Press
13. Daly, H.E. (1996): Beyond Growth, Beacon Press, Boston
14. Daly, H.E and Twonseed K.N. (Ed) (1993): Valuing the earth – Economics, Ecology and Ethics, MIT Press, London
15. Dupont, R.R. Baxter, T.E. and Theodore, L. (1998): Environmental Management: - Problems and Solutions, CRC Press
16. Hart M. G. (1986): Geomorphology, Pure and Applied, George Allen and Unwin, London
17. Morrisawa M (Ed) (1994): Geomorphology and Natural Hazards, Elsevier, Amsterdam
18. Singh Savindra (2000): Environmental Geography, ParagPustakBhavan, Allahabad
19. Smith, K. (2001): Environmental Hazards: Assessing Risk and Reducing Disaster, Routledge
20. Turk J. (1985): Introduction to Environmental Studies, Saunders, College Publication, Japan
21. Saptarshi PG, More JC, Ugale VR, (2009): Geography and Natural Hazads, (Marathi), Diamond Publishing
22. Musmade AH, More JC (2014): Geography of Disaster Management, (Marathi), Diamond Publication, Pune

**GG-404: PRACTICAL IN SURVEYING**

	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"><li>3. To determine the relative position of any objects or points of the earth.</li><li>4. To determine the distance and angle between different objects.</li><li>5. To prepare a map or plan to represent an area on a horizontal plan.</li><li>6. To develop methods through the knowledge of modern science and technology and use them in the field.</li><li>7. To solve measurement problems in an optimal way.</li></ol> <p><b>Course Outcomes:</b></p> <p>On completion of this (GG-404) course students will be able to:</p> <ol style="list-style-type: none"><li>1. Understand the different surviving techniques.</li><li>2. Knowledge about the preparation of layout.</li><li>3. Understand the socio-economic condition of the villages.</li><li>4. Acquire knowledge of preparation of drawing of profile with the help of Dumpy level.</li></ol>
1	<p><b>Introduction to Surveying</b></p> <p>Definitions and methods, Benchmarks, Spot heights, Reduced levels, Interpolation, and contouring.</p>
2	<p><b>Dumpy/Auto level</b></p> <ol style="list-style-type: none"><li>1. Various components and common terms used in dumpy level survey.</li><li>2. Collimation method and Rise and Fall method.</li><li>3. Profile drawing and block contouring.</li></ol>
3	<p><b>Transit Theodolite</b></p> <ol style="list-style-type: none"><li>1. Various components and common terms used in Theodolite.</li><li>2. Intersection method and Tachometric method.</li></ol>
4	<p><b>Total Station</b></p> <ol style="list-style-type: none"><li>3. Various components and common terms used in Total Station.</li><li>4. Area and profile drawing.</li></ol>
5	<p><b>Field Visit</b></p> <p>Dumpy level/Theodolite /Total Station Survey of a Beach, River Profiles and Slope.</p>
<p><b>Reference books</b></p> <ol style="list-style-type: none"><li>1. AsisSarkar (2015): Practical Geography, A Systematic Approach, Orient Black Swan</li><li>2. Duggal, S.K. (2013): Surveying Vol. 2, McGraw Hill Publication, New York.</li><li>3. Kanetkar, T.P. and Kulkarni, S.V. (2010): Surveying and Leveling Vol. II, Pune Vidyarthi Publication, Pune.</li><li>4. Maslov, AV., Gordeev, A.V. and Batrakov, Yu.G. (1984): Geodetic surveying, Mir Publishers, Moscow.</li><li>5. Rangwala, S.C. (2011): Surveying and Leveling, Charotar Publishing House Pvt. Ltd. Anand, (Gujarat), India.</li><li>6. Punmia, B.C., Jain A. and Jain A. (2011): Surveying, Vol. II. and III, Laxmi Publication - New Delhi.</li></ol>	

**GG-405: DISSERTATION**

	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>6. To complete a major and worthwhile piece of research work, with some guidance, but largely self-motivated;</li> <li>7. To write an academic paper that is well-organized and which clearly and concisely communicates its contents to its readers;</li> <li>8. To apply knowledge of statistics and probability theory gained through coursework to a specific area of study, to demonstrate the ability to acquire further knowledge of additional statistical methodologies as required by the topic, and to show the ability to acquire a good understanding of the underlying scientific problem.</li> <li>9. To identify and formulate a scientific problem and to show evidence of skills of inquiry, logical reasoning, probabilistic modeling and statistical analysis in addressing that problem.</li> </ol> <p><b>Course Outcomes:</b></p> <p>On completion of this (GG-405) course students will be able to:</p> <ol style="list-style-type: none"> <li>1. Recognize the importance of planning and preparation required to undertake a research project.</li> <li>2. Develop a thorough understanding of the chosen subject area.</li> <li>3. Demonstrate the ability to collate and critically assess/interpret data.</li> <li>4. Develop an ability to effectively communicate knowledge in a scientific manner.</li> <li>5. Provide recommendations based on research findings.</li> </ol>
1	<p><b>Research Techniques and Methodology</b></p> <p>Introduction to Project Report, Selection of Topic, sources of data collection and types of data, Data feeding techniques, Research techniques and methodology, Data Analysis techniques, Cartographic techniques, Guidance for report writing, checking and to prepare the students for examination, Total five Seminars (two hours per seminar) of students on selected topic and guidance to develop the communication skill of the students.</p>
2	<p><b>Research Methodology;</b> i. Meaning and objectives of the research; research types; the significance of the research; research process. ii. Research problem: Selection and techniques. Research Design, meaning, need and features of good design. iii. Measurements in research, scales; techniques of developing measurement tools.</p>
3	<p><b>Students should prepare an individual project report on any one topic from the list of the following subjects with the help of concern guide</b></p> <ol style="list-style-type: none"> <li>1. Physical Geography – i) Geomorphology, ii) Climatology, iii) Oceanography, iv) Soil Geography, v) Environmental Geography, vi) Plant Geography, vii) Animal Geography, viii) Bio-Geography or any other related to Physical Geography.</li> <li>2. Human Geography – i) Economic Geography – a) Agriculture Geography, b) Resources Geography, c) Industrial Geography, d) Trade and Transport Geography, e) Travel and Tourism Geography, f) Commercial Geography, g) Marketing Geography, h) Regional Geography. ii) Social Geography – a) Population Geography, b) Settlement Geography, c) Social Geography, d) Cultural Geography, e) Rural Geography, f) Urban Geography, g) Geography of Health, h) Criminal Geography, i) Behavioral Geography.</li> <li>3. Analytical Techniques in Geography - i) Cartography, ii) GIS and Computer mapping, iii) Remote Sensing Techniques, iv) Quantitative Techniques.</li> </ol>
4	<p><b>While preparing the project students should follow the guidelines cited as below</b></p>

	<ol style="list-style-type: none"> <li>1. Research methodology should be adopted.</li> <li>2. Data should be analyzed through M.S. Excel worksheet or Access, Minitab, SPSS for data calculation.</li> <li>3. All maps should be prepared by using GIS Software.</li> </ol>
5	<p><b>The final report should cover the following aspects.</b></p> <ol style="list-style-type: none"> <li>1. Introduction to the Problem, Aims, and objectives of the study, Methodology, Analysis, description and interpretation, Results, Conclusions, References.</li> <li>2. Every table, figure, photograph should have a caption, The list of references should be given at the end and all the references should be complete in all respects (author(s)) name, year, title of the article or book, name of the journal, name of the publisher of the book and place of publication, volume of journal and page numbers).</li> <li>3. The total number of pages should be minimum 50, including text, figures, tables, photographs, references, and appendices.</li> <li>4. At the time of viva-voce presentation may be given with the help of equipment which are available in the respective department.</li> </ol>



### **AC- 403: Surveying and Instrumentation**

Surveying is the heart of the Earth Sciences. Assignments regarding Surveying and Instrumentation will be given for technical skill development.

### **AC- 404: WATERSHED MANAGEMENT**

Seminar and Review articles for promoting and spreading awareness about watershed management.