

Central University of Punjab



Ph.D. Geography

Academic Session: 2022

Graduate Attributes

The researchers of Geography programme are expected to formulate research problems in the field of geography and demonstrate research skills to apply their knowledge in finding solutions to the contemporary and emerging socio-geographical and geo-environmental problems. They will be able to apply their critical, creative, and evidence-based thinking to solve the real-world issues and future challenges. They will develop analytical and digital capabilities through the skill-based course work designed for them. They have ability to work effectively in a team and demonstrate leadership quality in academic as well as professional environment. They will also recognize the essential value systems including academic ethical practices, the moral dimensions of one's own decisions. They have respect for the diverse culture and pluralistic society and can demonstrate the ethical competency at all stages of life.

Department of Geography

| Syllabus for Ph.D. Course work in Geography | | | | | |
|---|--|--------------------|---------------------|----------|-----------|
| Course Code | Course Title | Course type | Credit Hours | | Cr |
| | | | L | P | |
| GEO.701 | Research Methodology in Geography | C | 4 | - | 4 |
| GEO.702 | GIS & GPS (Practical) | SBC | - | 4 | 2 |
| GEO.751 | Research and Publication Ethics | C | 2 | - | 2 |
| UNI.753 | Curriculum, Pedagogy and Evaluation | C | 1 | - | 1 |
| GEO.752 | Teaching Assistantship | SBC | - | 2 | 1 |
| Elective courses: Select any one of the specialized courses listed below | | | | | |
| GEO.704 | Population, Development, and Environment | DE | 4 | - | 4 |
| GEO.705 | Urban Geography and Environment | DE | 4 | - | 4 |
| GEO.706 | Paleoclimatology | DE | 4 | - | 4 |
| GEO.707 | Sustainable and Resilient city | DE | 4 | - | 4 |
| Total | | | 11 | 6 | 14 |

C: Core, **SBC:** Skill Based Course, **DE: Discipline Elective** **L:** Lecture, **T:** Tutorial, **P:** Practical, **Cr:** Credit

Evaluation Criteria

| Evaluation criteria for Examination – Theory Paper |
|---|
| End Semester Examination- 100 marks |

| Evaluation criteria for Practical Examination | | | |
|--|-----------------------|-------------|--------------|
| End Semester performance | Practical copy | Viva | Total |
| 60 | 20 | 20 | 100 |

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|--|---|----------|----------|----------|-------------------------|
| Course Title: Research Methodology in Geography | | L | T | P | C |
| Course Code: GEO.701 | | 4 | - | - | 4 |
| Total Hour: 60 Hours | | | | | |
| Course Learning Outcomes (CLO): On completion of this course, students will be able to: CLO1: Proficient to comprehend basic concepts, theory, and framework of Research paradigm in geography, CLO2: Proficient to explore the basic concepts, theory, and framework of research procedure in geography, CLO3: Proficient to explore methods of data collection and analysis in geographical research, CLO4: Proficient to explore the procedure of scientific thesis and paper writing. | | | | | |
| Hours/ Unit | Contents | | | | Mapping with CLO |
| 15 Hours/ Unit I | Research paradigm in geography Concept, theory and types of geographical research, Scientific research philosophy: Kuhn and David Harvey philosophy, Scientific reasoning: inductive and deductive, empirical and general; Geographical research: models and tools: Discipline-wise geographical research: A survey | | | | CLO1 |
| 15 Hours/ Unit II | Research procedure/Research design and methodology: Research approach: qualitative, quantitative and mixed, Research design: methods and tools, Research process: steps in scientific research, Research valuation: SWOT analysis, Cost-benefit analysis | | | | CLO2 |
| 15 Hours/ Unit III | Unit III: Methods of data collection and analysis Concept and types of data and information, Data collection instruments and process, Data sources and data collection ethics, Cloud-based and off-cloud data mining, Applied geostatistics: descriptive and inferential geostatistics | | | | CLO3 |
| 15 Hours/ Unit IV | Unit IV: Scientific thesis and paper writing Scientific thesis writing: methods and tools, Scientific paper writing: methods and tools, Bibliography, referencing and citation: methods and tools, Research ethics: copyright issues and plagiarism, Guideline for theme-based journal articles | | | | CLO4 |
| Transaction Mode: Lecture delivery using White Board and PPT, Problem Solving through Assignments. | | | | | |
| Suggested readings: 1. Amedeo, D. and Golledge, R.G. (1975). An introduction to scientific reasoning in geography, New York, Willey and Sons. 2. Berg, Bruce L. (2001). Qualitative Research Methods for Social Sciences. Boston: Allyn and Bacon. 3. Brent, E. E. (1990). Computer Applications in the Social Sciences. Philadelphia: Temple University Press. 4. Bryant, Christopher G. A. and David Jary (eds). (1991). Giddens' theory of structuration: a critical appreciation. London: Routledge. 5. Chakravarti, A.K. & Tiwari, R.C. (1990). A Basic Research Paradigm in Geography, Journal of Geography, 89:2, 53-57, DOI: 10.1080/0022134 90 08979595Sack, R. (1973). 6. Harvey, D. (1973). Explanation in Geography. Historical Methods Newsletter, 6(2), 68– | | | | | |

72. doi:10.1080/00182494.1973.10593999

- Robert, A. (2002). Epistemology: A Contemporary Introduction to the Theory of Knowledge. London: Routledge

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|---|--|----------|----------|----------|--------------------------------------|
| Course Title GIS & GPS – P | | L | T | P | C |
| Course Code: GEO.703 | | - | - | 4 | 2 |
| Total Hour: 60 Hours | | | | | |
| Course Learning Outcomes (CLO): After completion of the course the students will learn: CLO1: theoretical framework in geographical information system CLO2: Types of datasets CLO3: Extraction, generation, and analysing of data. CLO4: digital cartography CLO5: Learning of GIS software | | | | | |
| Hours | Exercises | | | | CLO |
| 60 hours | Georeferencing Maps/Images, Digitization of Raster Map: Point, Line and Polygon Features, Preparation of Attribute Tables, Editing and Joining Tables, Analyzing Attribute Data: Calculating Area, Perimeter, and Length. Spatial Representation: Mapping Techniques, Spatial Representation: Symbolizing and Map Layouts, Basic Analysis in GIS: Buffering, Overlay and Query Building, GPS Applications, User interface with global positioning receivers, Collection of ground control points using handheld GPS receiver, DGPS, wide area augmentation system (WAAS), Transferring data from GPS receiver to PC. | | | | CLO1 CLO2 CLO3 CLO4 CLO5 |
| Transaction Mode: Lecture, demonstration, tutorial, hands on exercise, problem solving. | | | | | |
| <ol style="list-style-type: none"> 1. Bhatta, B. (2011). Remote sensing and GIS, 2nd edition, New Delhi, Oxford University Press. 2. Harvey, F. (2016). A primer of GIS: Fundamental geographic and cartographic concepts, 2nd edition, New York, The Guilford press. 3. Hofmann-wellenhof, B., Lichtenegger, H., Collins, J., Hofmann-wellenhof, B. (2013). GPS global positioning system: Theory and practice 5th edition, New Delhi, Springer (India) private limited. 4. Kennedy, M. (2013). Introducing geographic information systems with arcgis: A workbook approach to learning GIS, 3rd edition, New Jersey, A John Wiley & Sons publications 5. Liu, Jian Guo & Mason, Philippa J. (2016). Image processing and GIS for Remote Sensing, Techniques and applications, 2nd edition Publication, United Kingdom, Wiley Blackwell. <p>Van Sickle, J. (2008). GPS for land surveyors, 3rd edition, London, CRC press</p> | | | | | |

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|--|----------|----------|----------|-----------|
| Course Title: Research and Publication Ethics | L | T | P | Cr |
| Course Code: GEO.751 | 2 | 0 | 0 | 2 |
| Total hour: 30 Hours | | | | |
| Course Learning outcome (CLO): Students will be able to: CLO1: Demonstrate research integrity and publication ethic. CLO2: Judge the misconduct, and plagiarism in research. CLO3: Identify predatory journals | | | | |

| CLO4: Utilize various online literature data base and software to analyze their research output. | | |
|--|---|-------------------------|
| Hours/ Unit | Content | Mapping with CLO |
| 3 Hours/ Unit I | Philosophy and Ethics Introduction to Philosophy: definition, nature and scope, content, Branches, Ethics: definition, moral philosophy, nature of moral judgements and reactions | CLO1 |
| 5 Hours/ Unit II | Scientific Conduct Ethics with respect to science and research, Intellectual honesty and research integrity, Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP), Redundant publications: duplicate and overlapping publications, salami slicing, Selective reporting and misrepresentation of data | CLO1 CLO2 |
| 7 Hours/ Unit III | Publication Ethics Publication ethics: definition, introduction and importance, best practices/ standards setting initiatives and guidelines: COPE, WAME, etc., Conflicts of interest | CLO1 CLO4 |
| 4 Hours/ Unit IV | Open Access publishing Open access publications and initiatives, SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies, Software tool to identify predatory publication developed by SPPU, Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer, Journal Suggester. | CLO3 |
| 4 Hours/ Unit V | Publication Misconduct Group Discussions: Subject specific ethical issues, FFP, authorship; conflicts of interest; complaints and appeals: examples and fraud from India and abroad, Software tools: Use of plagiarism software like Turnitin Urkund and other open-source software tools | CLO3 |
| 7 Hours/ Unit VI | Databases and Research Metrics Databases: Indexing databases; Citation database: Web of Science, Scopus etc., Research Metrics: Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score; Metrics: h-index, g-index, i10 index, almetrics | CLO4 |

| Course Title: Curriculum, Pedagogy and Evaluation | L | T | P | Cr |
|---|----------------|----------|----------|-------------------------|
| Course Code: UNI.753 | 0 | 0 | 2 | 1 |
| Total hour: 15 | | | | |
| Course Learning outcome (CLO): After completion of the course, scholars shall be able to: CLO1: analyze the principles and bases of curriculum design and development CLO2: examine the processes involved in curriculum development. CLO3: develop the skills of adopting innovative pedagogies and conducting students' assessment CLO4: develop curriculum of a specific course/programme | | | | |
| Hours/ Unit | Content | | | Mapping with CLO |

| | | |
|----------------------|--|------|
| 4 Hours/ Unit I | Bases and Principles of Curriculum Curriculum: Concept and Principles of curriculum development, Foundations of Curriculum Development. Types of Curriculum Designs- Subject centered, learner centered, experience centered and core curriculum. Designing local, national, regional and global specific curriculum. Choice Based Credit System and its implementation. | CLO1 |
| 4 Hours/ Unit II | Curriculum Development Process of Curriculum Development: Formulation of graduate attributes, course/learning outcomes, content selection, organization of content and learning experiences, transaction process, Comparison among Interdisciplinary, multidisciplinary and trans-disciplinary approaches to curriculum. | CLO2 |
| 3 Hours/ Unit III | Curriculum and Pedagogy Conceptual understanding of Pedagogy, Pedagogies: Peeragogy, Cybergogy and Heutagogy with special emphasis on Blended learning, Flipped learning, Dialogue, cooperative and collaborative learning, Three e- techniques: Moodle, Edmodo, Google classroom | CLO3 |
| 4 Hours/ Unit IV | Learners' Assessment Assessment Preparation: Concept, purpose, and principles of preparing objective and subjective questions, Conducting Assessment: Modes of conducting assessment – offline and online; use of ICT in conducting assessments. 3. Evaluation: Formative and Summative assessments, Outcome based assessment, and scoring criteria. | CLO4 |

Mode of Transaction: Lecture, dialogue, peer group discussion, workshop.

Evaluation criteria: There shall be an end term evaluation of the course for 50 marks for duration of 2 hours. The course coordinator shall conduct the evaluation.

Suggested readings:

Allyn, B., Beane, J. A., Conrad, E. P., & Samuel J. A., (1986). Curriculum Planning and Development. Boston: Allyn & Bacon.

- Brady, L. (1995). Curriculum Development. Prentice Hall: Delhi. National Council of Educational Research and Training.
- Deng, Z. (2007). Knowing the subject matter of science curriculum, Journal of Curriculum Studies, 39(5), 503-535. <https://doi.org/10.1080/00220270701305362>
- Gronlund, N. E. & Linn, R. L. (2003). Measurement and Assessment in teaching. Singapore: Pearson Education
- McNeil, J. D. (1990). Curriculum: A Comprehensive Introduction, London: Scott, Foreman/Little
- Nehru, R. S. S. (2015). Principles of Curriculum. New Delhi: APH Publishing Corporation.
- Oliva, P. F. (2001). Developing the curriculum (Fifth Ed.). New York, NY: Longman
- Stein, J. and Graham, C. (2014). Essentials for Blended Learning: A Standards-Based Guide. New York, NY: Routledge.

Web Resources

- https://www.westernsydney.edu.au/__data/assets/pdf_file/0004/467095/Fundamentals_of_Blended_Learning.pdf
- <https://www.uhd.edu/academics/university-college/centers-offices/teaching-learningexcellence/Pages/Principles-of-a-Flipped-Classroom.aspx>
- <http://leerwegdialogo.nl/wp-content/uploads/2018/06/180621-Article-The-BasicPrinciples-of-Dialogue-by-Renate-van-der-Veen-and-Olga-Plokhooij.pdf>

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|--|-----------|----------|----------|
| Course title: Teaching Assistantship | Cr | T | P |
| Course code: GEO.752 | 1 | - | 2 |
| Total hour: 30 | | | |
| Course Learning outcome (CLO): Learning Outcome: At the end of this skill development course, the scholars shall be able to (1) familiarize themselves with the pedagogical practices of effective classroom delivery and knowledge evaluation system (2) manage large and small classes using appropriate pedagogical techniques for different types of content | | | |
| Activities and Evaluation: | | | |
| <ul style="list-style-type: none"> The scholars shall attend Master degree classes of his/her supervisor to observe the various transaction modes that the supervisor follows in the class room delivery or transaction process one period per week. The scholars shall be assigned one period per week under the direct supervision of his/her supervisor to teach the Master degree students adopting appropriate teaching strategy(s). The scholars shall be involved in examination and evaluation system of the Master degree students such as preparation of questions, conduct of examination and preparation of results under the direction of the supervisor. At the end of the semester, the supervisor shall conduct an examination of teaching skills learned by the scholar as per the following evaluation criteria: The scholars shall be given a topic relevant to the Master degree course of the current semester as his/her specialization to prepare lessons and deliver in the class room before the master degree students for one hour (45 minutes teaching + 15 minutes interaction). The scholars shall be evaluated for a total of 50 marks comprising content knowledge (10 marks), explanation and demonstration skills (10 marks), communication skills (10 marks), teaching techniques employed (10 marks), and classroom interactions (10). | | | |

Thematic Papers (Select anyone)

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|---|--|----------|----------|------------|
| Course Title: Population, Development and Environment | L | T | P | C |
| Course Code: GEO.704 | 4 | | | 4 |
| Total Hour: 60 Hours | | | | |
| Course Learning Outcomes (CLO): After completion of the course the students will learn: CLO1: The conceptual framework of Population, development, and environment interactions CLO2: To analyse the population dynamic CLO3: To understand the Issues of population, development, and environment interaction at different scales CLO4: To formulate research ideas and write synopsis, research proposals. | | | | |
| Hours/Unit | Content | | | CLO |
| 15 Hours/ Unit I | Basic Concepts: Conceptual development and theoretical framework of population, environment and development interactions, Patterns of interaction. Learning activities: Group discussion | | | CLO1 |

| | | |
|--|--|------|
| 15 Hours/ Unit II | Elements of population dynamics Fertility, mortality, migration and their relationship with Development, poverty, and resource inequalities. Learning activities: Group discussion | CLO2 |
| 15 Hours/ Unit III | Interaction of Population, development, and environment Human development: Component, measurement, distribution, health inequalities, Population vs. environment with reference to climate change and global warming, water resources, food security, Natural hazard & Disaster, Land Use Land Cover Change. Learning activities: Assignment | CLO3 |
| 15 Hours/ Unit IV | Research in Population, development, and environment Quantitative and qualitative measurement of population, environment and development interactions, Data source, Remote sensing and GIS based study on the population, environment, and development interactions. Learning activities: case study | CLO4 |
| Transaction Mode: Lecture, demonstration, tutorial, problem solving. | | |
| Suggested readings: | | |
| <ol style="list-style-type: none"> Bhargava, R.N., Rajaram, V., Olson, Keith, Tiede, Lynn (2019). Ecology and Environment. CRC Press Hunter, Lori M., Gray, Clark, Véron, Jacques (2022). International Handbook of Population and Environment. Springer. James, Helen (2019). Population, Development, and the Environment: Challenges to Achieving the Sustainable Development Goals in the Asia Pacific. Palgrave Macmillan. Kiessling, K.L. and Landberg, Hans (1997). Population, Economic Development, and the Environment. OUP Oxford. Lakshmana, C.M. (2013). Population, development, and environment in India. Chinese Journal of Population Resources and Environment. Vol. 11, No. 4, 367–374, http://dx.doi.org/10.1080/10042857.2013.874517 Myers, N. (1993). Population, environment, and development. Environment Conservation. 20(3):205-16. doi: 10.1017/s0376892900022980 Sarre, Philip (1991). Environment, Population and Development. Hodder & Stoughton Educational Division. Sinha, BRK (2009). Population, Environment & Development: A Global Challenge for the 21st Century. New Century Publications. | | |

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|--|-----------------|----------|----------|----------|------------|
| Course Title: Urban Geography and Environment | | L | T | P | C |
| Course Code: GEO.705 | | 4 | | | 4 |
| Total Hour: 60 Hours | | | | | |
| Course Learning Outcomes (CLO): After completion of the course the students will learn: | | | | | |
| CLO1: Theories and approaches of urbanisation | | | | | |
| CLO2: Different urban environmental issues of various scales | | | | | |
| CLO3: National schemes/policies of urban development | | | | | |
| CLO4: Describe urban environmental condition in India | | | | | |
| CLO5: Themes of research in urban geography | | | | | |
| Hours/ Unit | Contents | | | | CLO |

| | | |
|-----------------------|---|--------------|
| 15 hours/ Unit I | Basic Concepts of Urban/Urbanization Nature and Scope of Urban Geography; Concept and theories, Approaches to the study of Urban Geography, Origin and growth of the cities, Urban Environment: Concept, Components and Levels of Analysis, Approaches to the study of Urban Environment; Global context of Urbanization and urban change. Learning activities: Group discussion | CLO1 |
| 15 hours/ Unit II | Emerging Issues Trends and Patterns of Urbanization in India: Pre- and Post-Independence Period, Functional Classification of Towns, Urban Problems and Environmental Degradation in India; Microclimate of Cities; Urban Pollution (Air, Water and Noise) and Health Impacts, Rural-urban migration, Housing the urban poor, Poverty, power and politics, Urban development policies of India Learning activities: Assignment | CLO2 CLO3 |
| 15 hours/ Unit III | Urban Environment Urban environment problems: Global and national; Concept of Urban Sustainability and Urban Environmental Conservation Strategies, Traffic and transport problems, Urban governance. Towards the city of the future. Learning activities: Assignment | CLO4 |
| 15 hours/ Unit IV | Research Methods in Urban Geography Models for Internal Structure, Hierarchy and Spacing of Cities; Urban Sprawl; Urban Poverty and Slums; Use of Remote Sensing Data for Urban Land uses and Change Detection; GPS and GIS for Urban Mapping, Socio-economic and Environmental Surveys for Urban Themes. Learning activities: Case study | CLO5 |

Mode of Transaction: The course will be taught with a combination of lectures, discussion, and presentations, assignments, group learning exercise

Suggested readings:

1. Burgess, R., Marisa C., and Thed K. (1977). The Challenge of Sustainable Cities, Zed Books, New Jersey.
2. Carter, H. (1972). The Study of Urban Geography, Edward Arnold, London.
3. Choley, R.J.O. and Haggett, P. (1966). Models in Geography, Methuen, London.
4. Gibbs, J.P. (1961). Urban Research Methods, Princeton, New Jersey.
5. Goudie, A. (1993). The Human Impact on Natural Environment, Blackwell, USA.
6. Hall, P. (1992). Urban and Regional Planning, Routledge, London.
7. Knox, P. (1994). Urban Social Geography- An Introduction, Longman, U.K.
8. Nangia, S. (1976). Delhi Metropolitan Region: A Study in Settlement Geography, Rajesh Publications.
9. Pacione, M. (2009). Urban Geography: A Global Perspective. Routledge; 3 edition.
10. Ramachandran, R. (1997). Urbanization and Urban Systems in India. OUP India.
11. Yamagata, Y. and Yang, P. (2020). Urban Systems Design: Creating Sustainable Smart Cities in the Internet of Things Era. Elsevier Science Publishing Co Inc; 1 edition.
12. Yang, X. (2011). Urban Remote Sensing: Monitoring, Synthesis and Modelling in the Urban Environment. John Wiley and Sons Ltd.

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|--|---|----------|----------|------------|
| Course Title: Paleoclimatology | L | T | P | Cr |
| Course Code: GEO.706 | 4 | - | - | 4 |
| Total Hour: 60 Hours | | | | |
| Course objective: The goal of this course is to present an overview of the methods used to reconstruct the earth's climate history and the techniques used to determine the timing of environmental changes. Paleoclimate data from proxy records, such as ice cores or tree rings, provides a longer perspective on climatic variability than is possible from instrumental or historical records. Particular emphasis will be given to the climatic changes during the late Cenozoic – the time of the ice ages. | | | | |
| Course Learning outcome (CLO): The students would be able to identify climate forcing and responses over longer time scale. CLO1: To discuss the various components of Earth's climate system, such as the cryosphere, atmosphere, biosphere, and hydrosphere. CLO2: To discuss tools and techniques used to interpret changes in Earth's climate through geologic time. CLO3: To recognize and critique modern paleoclimate studies through the use of primary literature in climate science. CLO4: To examine the variable time scales upon which different climate processes occur and understands as residence time, and periodicity. | | | | |
| Hours/ Unit | | | | CLO |
| 15 hours/ Unit I | Fundamentals of Paleoclimate Introduction and Why Study Paleoclimate, Overview of Climate Sciences, Earth's Climate System Today, Climate Archives, Data and Models | | | CLO1 |
| 15 hours/ Unit II | Tectonic & Orbital-Scale Climate Change Tectonic Scale Climate Change, CO ₂ and Long-Term Climate, Gaia Hypothesis and Snowball Earth, Plate Tectonic Drivers, Greenhouse Climates, Greenhouse to Icehouse, Paleoclimate Evidence from Oxygen Isotope Measurements Orbital-Scale Climate Change Long term changes in the Earth's Orbit, Orbital Parameters, Changes in Insolation, Ice ages, Ice Cores and Insolation Control of Ice Sheets, North Hemisphere Ice Sheet History, Orbital-Scale interactions | | | CLO2 |
| 15 Hours/ Unit III | Glacial/Deglacial & Human Climate Change Glacial/Deglacial & Human Climate Change: The Last Glacial Maximum, Climate Change since the last Deglaciation, Millennial Oscillations of Climate Human Climate Change: Early Humans and Climate Change, Climate Change over the last 1,000 years, Climate Change since 1850, Current and Future Climate Change | | | CLO3 |
| 15 Hours/ Unit IV | Techniques of Paleoclimate Research Introduction to geochronology techniques, Theory and Applications of Luminescence Dating, Theory and Applications of Dendrochronology Dating, Essential field techniques used in Paleoclimate research, including remote sensing, surveying, mapping, and sediments/sample collections & coring. | | | CLO4 |
| Transaction mode: Lecture, Demonstration, Problem solving, Tutorial, Seminar, Local field visit discussion. Tools used: PPT, video, animation movie, whatsapp and Expert's Video Conferencing lectures from JNU, New Delhi, PRL-Ahmedabad, IUAC-Delhi, BSIP-Lucknow | | | | |
| International to National to Local reachability: The course will be further enhanced with | | | | |

the advice of experts from following international to national organizations

- Queens University, Belfast, Northern Ireland (U.K.) (World Famous lab of Carbon Dating)
- Department of Marine, Earth and Atmospheric Sciences, North Carolina State University (US)
- Johannes Gutenberg University, Mainz (Germany)
- Physical Research Laboratory, Deptt. Of Space, Ahmedabad (India)
- Birbal Sahni Institute of Palaeosciences, DST, Lucknow (India)
- Jawaharlal Nehru University, New Delhi (India)
- National Institute of Hydrology, Roorkee (India)
- Inter-University Accelerator Centre (IUAC), New Delhi (India)

Suggested Readings:

- Cronin, Thomas M. (1999). Principles of Paleoclimatology. Columbia University Press.
- Gornitz, Vivien. (2009). Encyclopaedia of Paleoclimatology and Ancient Environments. Springer Netherlands.
- Gilbert, Loren (2012). Paleoclimatology: Understanding Past Climate.
- Bradley, Raymond S. (2014). Paleoclimatology: Reconstructing Climates of the Quaternary: Third Edition.

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|---|---|-----------|----------|----------|------------|
| Course title: Sustainable and Resilient city | | Cr | T | P | Cr |
| Course code: GEO.707 | | 4 | - | - | 4 |
| Total hour: 60 | | | | | |
| Course objective: to introduce concept, planning framework and instrument and to explore the role of remote sensing and GIS for sustainable and resilient city. To develop student as urban planning professionals for competitive global job opportunities. | | | | | |
| Course Learning outcome (CLO): On completion of this course, students will be able to: CLO1: Proficient to comprehend basic concepts, theory, and framework of sustainable city, CLO2: Proficient to explore the basic concepts, theory, and framework of resilient city, CLO3: Proficient to explore geoinformation science to analyse sustainable city, CLO4: Proficient to explore geoinformation science to analyse resilient city. | | | | | |
| Hours/ Unit | | | | | CLO |
| 15 Hours/ Unit I | Introduction to Sustainable City Concept and theory of sustainable city, Planning framework for sustainable city, Indicators of sustainable city, Sustainable city at local to global context | | | | CLO1 |
| 15 Hours/ Unit II | Introduction to Resilient City Concept and theory of resilient city, Planning instruments for resilient city, Climate resilient city, Resilient city at local to global context | | | | CLO2 |
| 15 Hours/ Unit III | Sustainable City Introduction of Geoinformation science for sustainable city, Geoinformation database management for sustainable city, Geo-statistics for sustainable city, GIS-Based models for sustainable city | | | | CLO3 |

| | | |
|--|--|------|
| 15 Hours/ Unit IV | Resilient City Geoinformation science for resilient city, Geoinformation database management for resilient city, Geo-statistics for resilient city, GIS-Based multi-scenario models for resilient city | CLO4 |
| Mode of Transaction: methods of transaction are lecture, audio-video, discussion which will be followed in teaching using ppt, WhatsApp etc. | | |
| Suggested readings: <ul style="list-style-type: none"> • Kemp, R. & et al. (2005). Governance for sustainable development: moving from theory to practice, <i>Int. J. Sustainable Development</i>, 8(1/2), 12-30. • Ness, B. & et al. (2007). Categorising tools for sustainability assessment, <i>Ecological Economics</i>, 60, 498–508. • Sharifia, A., & Yamagata, Y. (2014). Resilient Urban Planning: Major Principles and Criteria, <i>Energy Procedia</i>, 61, 1491-1495. https://doi.org/10.1016/j.egypro.2014.12.154. • Zhang, X. & Li, H. (2018). Urban resilience and urban sustainability: What we know and what do not know? <i>Cities</i>, 74(A), 141-148. https://doi.org/10.1016/j.cities.2017.08.009 | | |