

GOVERNMENT COLLEGE FOR WOMEN

(AUTONOMOUS)

KUMBakonam



Programme: *M.SC., APPLIED GEOGRAPHY*

Programme Code: PSGE

SYLLABUS

[2023 – 2024 onwards]

DEPARTMENT OF GEOGRAPHY

**GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS)
KUMBAKONAM**

(Curriculum – M.Sc., APPLIED GEOGRAPHY – 2023 - 2024)

Department : GEOGRAPHY

Programme Code : PSGE

Part	Course Type	Course Code	Title of the Course	Hrs/Week	Credits	Exam. Hrs.	Marks		
							Int	Ext	Total
SEMESTER – I									
I	CC I	P23GC101	Principles of Cartography	6	5	3	25	75	100
I	CC II	P23GC102	Applied Geomorphology	6	5	3	25	75	100
I	CC III	P23GC103 P	Practical-I Techniques of Mapping and Map Analysis	6	4	3	40	60	100
I	EC I	P23GDE1	Population and Settlement Geography	5	3	3	25	75	100
		P23GDE2	Transportation Geography						
I	EC II	P23GDE3	Principles of GIS	5	3	3	25	75	100
		P23GDE4	Urban Geography						
II	SEC I	P23G1SE1	Health and Well-being	2	2	2	25	75	100
Total				30	22				700
SEMESTER – II									
I	CC IV	P23GC204	Applied Climatology	6	5	3	25	75	100
I	CC V	P23GC205	Hydrology and Oceanography	6	5	3	25	75	100
I	CC VI	P23GC206 P	Practical-II Geospatial Lab	6	4	3	40	60	100
I	EC III	P23GDE5	Fieldwork and Mapping	5	3	3	25	75	100
		P23GDE6	Geospatial Statistics						
I	EC IV	P23GDE7	Remote Sensing and GNSS	5	3	3	25	75	100
		P23GDE8	Agricultural Geography						
II	SEC II	P23G2SE2	Remote Sensing and GIS	2	2	3	25	75	100
II	ECC I		Moocs/Swayam Courses		2/3				
			Internship / Industrial Activities*	-	-	-	-	-	-
Total				30	22				600

SEMESTER – III									
I	CC VII		Geographical Thought	6	5	3	25	75	100
I	CC VIII		Theoretical Economic Geography	6	5	3	25	75	100
I	CC IX		Core Industry Model-Geospatial Project Planning Management	6	5	3			100
I	CC X		Practical III - Remote Sensing and Modern Surveying	6	4	3	40	60	100
I	EC V		Geography of India and Resource Development	4	3	3	25	75	100
			Political Geography						
II	SEC III		Environmental Geography	2	2	3	25	75	100
II	ECC I		Moocs/Swayam Courses	-	2/3	-	-	-	-
II	AEC		Internship / Industrial Activities*	-	2	-	-	-	-
Total				30	26	-	-	-	600
SEMESTER – IV									
I	CC XI		Regional Planning	6	5	3	25	75	100
I	CC XII		Practical IV - Spatial Analysis and Modelling	6	5	3	40	60	100
I	CC XIII		Project Work with Viva Voce	8	5	-	-	-	100
I	EC VI		Natural Hazards and Disaster Management	5	3	3	25	75	100
			Geo Database Programming						
II	AEC II		Professional Competency Skill	5	2	3	-	-	-
II	EA		Extension Activity	-	2	-	-	-	-
Total				30	22	-	-	-	400

COURSE STRUCTURE ABSTRACT FOR

M.Sc. PROGRAMME 2023-2024 ONWARDS

Part	Course	Total No Papers	Hours	Credit	Marks
I	Core Course (CC)	12	72	57	1200
I	Core Project	1	8	5	100
I	Elective Course (EC)	6	29	18	600
II	Skill Enhancement Course (SEC)	3	6	6	300
II	Extra Credit Course (ECC)	1	-	2	-
II	Ability Enhancement Course (AEC)	2	5	4	100
II	Extension Activity	1	-	2	-
Total		26	120	92 + 2	2300

M.Sc. APPLIED GEOGRAPHY [2 YEARS]

PROGRAMME OBJECTIVES:

1. Orient the students towards identifying and analyzing different geographical processes and features.
2. Developing the students' ability to acquire basic skills for conducting field research
3. Intended to help students in learning the science and art of collecting, processing, and interpreting data.
4. Analyze various problems and resolve them through proper management, planning, and sustainability
5. To expose the students to the new technologies of Remote Sensing, GNSS, Geographical Information System (GIS) and GIScience.

PROGRAMME OUTCOMES:

1. Students will be oriented towards, learning, understanding, and analyzing geographical processes and provide spatial solutions
2. To expose students to the use of recent advancements in the field of Geospatial technologies and its application in geographical areas.
3. Development of ethical aptitudes and dispositions necessary to obtain and hold leadership positions within industry, government, and professional organizations.
4. Capability to undertake research in interdisciplinary studies or on issues or problems beyond the purview of geography.
5. Empowering students with knowledge and skills for spatial thinking and analysis, to navigate real world problems, and contribute to society in a meaningful way.

PROGRAMME SPECIFIC OUTCOMES:

1. Understand the major biophysical and social patterns in the planet, and the key drivers that give rise to those patterns.
2. Demonstrate profound knowledge of theories, concepts, techniques and technologies in human and physical geography and in geographic information science and technology using real-world applications at the local, regional, and global levels.
3. Apply systems thinking and critical thinking in socio-economic-ecological systems of the human-environment interface to analyze problems and potential solutions.
4. Practice to obtain, analyse, interpret complex geographic data and develop ethical aptitudes, dispositions necessary to acquire and hold leadership positions in industry, government, and professional organizations.
5. Capability to work with the latest geospatial technologies and handle modern instruments like drones, total stations, GPS and other field devices and also work effectively in interdisciplinary and multicultural real- world contexts to combine theory and practice in responding to local to global issues.

SEMESTER I

CORE COURSE

Course code:	CC1	PRINCIPLES OF CARTOGRAPHY			
		L	T	P	C
Core/Elective	Core - P23GC101				
Pre-requisite	Basic knowledge in Cartography				

COURSE OBJECTIVES:

- Exploring and defining principles of cartography, emerging trends in cartography and information age.
- Understanding the basics of geodesy and map projections
- Gaining skills in map symbols, cartographic design, representation and production of maps, and map composition.
- Critically assessing online resources, software and its uses for interactive mapping.
- Discussing the importance of web mapping and geospatial data policy.

UNIT-I FUNDAMENTALS OF CARTOGRAPHY

History and future of cartography - Information age and mapping, Cartography as language and communication -visual thinking and visual communication-spatial information system.

UNIT II- MAP PROJECTIONS AND COORDINATE SYSTEMS

Geodesy, coordinate systems, and map projections- geographical data – spatial objects and attributes – map scale and accuracy.

UNIT III- MAP DESIGN AND LAYOUT

Map compilation - levels of data measurement, generalization, cartographic design principles- map symbolization- Qualitative and Quantitative symbols - graphic communication – map elements and layout.

UNIT IV- TERRAIN AND SURFACE ANALYSIS

Production and Map output - Typography & Labelling - Thematic Map Forms - Animation – Isarithmic, choropleth & Surface mapping-map reproduction, Publishing, & Sharing – cartographic products.

UNIT V- ONLINE MAPPING AND WEB SERVICES

E-mapping, online map data sources - Geospatial web services- Dynamic/Interactive Mapping-cartography and spatial information policy.

Expected Course Outcomes:		
On the successful completion of the course, student will be able to:		
1.	Understand the cartographic concepts, recent trends and the use of information technology	K1, K2
2.	Explain the fundamental importance of map scale and benefits and limitations of map projections	K2, K3
3.	Demonstrate cartographic techniques, generalisation regarding map design and layout, graphical and visual variables	K3, K6
4.	Obtain the skills in creating reference and thematic maps using hard copies and web maps	K4, K5
5.	Able to generate digital maps from open source data, analyse and interpret the interactive maps	K4, K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create		

REFERENCE BOOKS

1. Monkhouse, F.J. and Wilkinson, H.R. (1994) Maps and Diagrams, Methuen, London.
2. Robinson, A.H. et al. (1995) Elements of Cartography, John Wiley & Sons, U.S.A
3. Kraak M.J. (2010) Cartography: Visualization of Geospatial Data (3rd edition), Pearson Education Ltd., London.
4. Jennings, Ken. (2011). Map head: Charting the Wide, Weird World of Geography Wonks. New York: Scribner
5. Tyner, J.A. (2014) Principles of Map Design. New York, NY: Guilford Press.
6. Geovisualization (3rd edition), Pearson New International Edition (eBook).
7. Robinson, A.H., J.L.Morrison, P.C., Muehrcke, A.J.Kimerling and S.C.Guptill (1995). Elements of Cartography, 6th Edition. New York. John Wiley & Sons. USA.
8. <http://www.fes.uwaterloo.ca/crs/geog165/cart.htm>.
9. http://www.colorado.edu/geography/gcraft/notes/cartocom/cartocom_ftoc.html#3.0
10. <http://www.earthsensing.com/cart/resources/carthelp.html>

Mapping with Programme Outcomes (MPO)*					
MPO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	1	1	1	1	2
CO 2	1	1	3	1	1
CO 3	2	1	1	2	2
CO 4	1	1	2	1	1
CO 5	1	2	1	1	1
Map Course Outcomes (CO) for each Course with Programme Specific Outcomes (PSO) in the 3-Point scale of 1,2, 3 (Strong, Medium and Low)					

SEMESTER I**CORE COURSE**

Course code:	CC2	APPLIED GEOMORPHOLOGY	L	T	P	C
Core/Elective	Core - P23GC102					
Pre-requisite	Basic knowledge in Physical Geography					

COURSE OBJECTIVE:

- To introduce the concepts in Geomorphology in adequate manner, many facets of surface relief features and to understand various aspects of their growth and evolution on the Earth.
- To understand landscape evolution through time and space
- To understand the processes that shapes the landforms around us.
- To apply geomorphologic concepts to identify and analyze the environmental and resources issues for sustainable development
- To suggest the tools for reading in the landscape the signs of geomorphologic hazards and risks, human interference and geomorphologic resources.

UNIT-I SCOPE OF APPLIED GEOMORPHOLOGY

Definition – Nature and scope of applied geomorphology – Fundamental concepts in geomorphology – Geosynclines and mountain building process – Geological Time Scale - Geomorphic ideas of Davis, Penck and King

UNIT-II ENERGY FLOW IN GEOMORPHIC SYSTEM

System concepts in geomorphologic studies – Structure and composition of earth – Theories of Continental Drift – Plate Tectonics and Volcanism- climatic and tectonic changes and impacts

UNIT-III WEATHERING, MASS WASTING AND DEVELOPMENT OF HILL SLOPES

Weathering : Mechanical, Chemical and Biological weathering- structure, process and time in weathering- Soil: Soil formation - Mass wasting : causes and types of mass wasting – Planning and control measures

UNIT-IV PROCESS GEOMORPHOLOGY

Drainage: Drainage Basin – Basin morphometry – Fluvial system : erosion, sedimentation and structural adjustments in the fluvial system; Waves : Waves dynamics - evolution of shores and construction and destruction of coastal region; Arid landforms and its evolution- Karst and topography; Glacial process, erosion and depositional landforms.

UNIT-V APPLICATIONS OF GEOMORPHOLOGY

Mapping and statistical analysis : Landscape and land evaluation - Hazard analysis – application of geo-informatics in geomorphological mapping

and modelling – Geomorphology and its applications in Agriculture, Water resources, hazard, urban and mineral exploration.

Expected Course Outcomes:		
1	A clear understanding of the key concepts of geomorphology and dynamic aspects of landform development	K1, K2
2	Understand the relationship between geomorphologic processes, natural resources and environmental impacts	K2, K5
3	Ability to analyze the geomorphologic hazards and risks associated to geomorphic processes	K4, K5
4	Learn the various tools and techniques relevant to the applied aspects of Geomorphology in various fields.	K3, K5
5	Knowledge on landscape development and skill on the use of geomorphic process, features and event in resources and environmental planning and management	K3, K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create		

REFERENCE BOOKS

1. Sharma, H.S. (1990) Indian Geomorphology. Concept Publication Company.
2. Mc Geary, D. and Plummer, C. C., (1994) Earth Revealed, W. C. B. Publishers.
3. Huggett, R.J. (2007) Fundamentals of Geomorphology, Routledge.
4. Waugh D. (2005) Geography: An Integrated Approach, Nelson Thornes.
5. Robert, S.A. and Suzanne, P.A., (2010) Geomorphology – The mechanics and chemistry of landscapes. Cambridge University Press.
6. Richard John Huggett (2011), “Fundamentals of Geomorphology”, Routledge, Taylor & Francis, London.
7. Christopherson, R. W. and Birkeland, G. H., (2012) Geosystems: An Introduction to Physical Geography (8th edition), Pearson Education.
8. Bierman, P.R. and Montgomery, D.R., (2014) Key concepts in geomorphology, Freeman and Company Publishers.
9. Kale, V. and Gupta, A. (2018) Introduction to Geomorphology, Orient Black Swan
10. Thornbury, W.D. (2019) Principles of Geomorphology, Third Edition, New Age International Publishers.
11. Paul R.Bierman, David R.Montgomery (2020), “Key concepts in Geomorphology”, Macmillan Publications, New York.
12. <https://earthsurface.readthedocs.io/en/latest/>
13. <https://ocw.mit.edu/courses/earth-atmospheric-and-planetary-sciences/12-163-surface-processes-and-landscape-evolution-fall-2004/lecture-notes/>

Mapping with Programme Outcomes (MPO)*					
MPO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	1	1	2	1	1
CO 2	2	1	1	2	2
CO 3	1	2	1	1	1
CO 4	1	1	1	1	2
CO 5	1	2	1	1	1
Map Course Outcomes (CO) for each Course with Programme Specific Outcomes (PSO) in the 3-Point scale of 1,2, 3 (Strong, Medium and Low)					

SEMESTER I

CORE COURSE

Course code:	CC3	PRACTICAL-I: TECHNIQUES OF MAPPING AND MAP ANALYSIS	L	T	P	C
Core/Elective	Core - P23GC103P					
Pre-requisite	Basic knowledge for mapping and interpretation					

COURSE OUTCOMES:

- To introduce the concepts practically in mapping and map analysis.
- To understand the various aspects of map reading, interpretation and representation of various data through maps.
- To provide a basic understanding in the field of interpretation and interpolation.
- To understand the theoretical and practical methods pertaining to map making.
- To understand the concepts and importance of various analysis used in mapping.

UNIT I MAP AND INTERPRETATION

Map appreciation and interpretation: thematic, topographic and atlas maps- mapping and analysis: Relative relief and slope maps; height and hypsometric curves; stream Analysis.

UNIT II CLIMATE AND HYDROLOGY

Climate and Hydrology: climograph and climatograph; rainfall variability, intensity maps temperature and rainfall profiles; deviation and dispersion graph; aridity and water balance graphs.

UNIT III POPULATION AND ECONOMIC DATA MAPPING

Population and economic data mapping: dot maps, density maps - colour and grey scale patterns; index of concentration and diversification; crop combination technique, spatial interaction, measures of transport network analysis.

UNIT IV QUANTITATIVE SYMBOLISATION AND LOCATION MAP

Quantitative symbolisation and location Maps: located representation of tourism and facilities; point and line pattern analysis; cartograms and 3D maps.

UNIT V MAPPING AND INTERPOLATION

Choropleth and isorhythm maps - class interval selection methods - unipolar and bipolar graphs and colour patterns - interpolation methods.

Expected Course Outcomes:		
1	Understanding the importance of various mapping techniques in geographical study	K1, K2
2	Understand the procedures and steps involved in the interpretation of thematic, topographic and atlas maps etc.	K2, K3
3	Learn the quantitative applications involved in mapping and interpolation.	K3, K6
4	Ability to analyze and perform analysis like network analysis, stream analysis, point and line pattern analysis.	K4, K5
5	Capable of creating maps based on appropriate cartographic knowledge.	K5, K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create		

REFERENCE BOOKS:

1. Lawrence, G.R.P. (1971). Cartographic Methods, Methuen & Co., Canada
2. Tamaskar, B. G., Deshmukh, V. M. (1974): Geographical Interpretation of Indian Topographical Maps, Orient Longman Ltd., Bombay.
3. Monkhouse, F.J., and Wilkinson, H.R. (1976): Maps and Diagrams, Methuen & Co., London.
4. Chrisman, N. (1997): Exploring Geographic Information systems, John Wiley & Sons., New York
5. Singh, R.L., Singh, R.P.B. 2008. Elements of Practical Geography, Kalyani Publishers.
6. Kimerling, A.J., Buckley, A.R., Muehrcke, P.C., Muehrcke, J.O. 2011. Map Use: Reading, Analysis, Interpretation, 7th ed, Esri Press.
7. Sarkar, A. 2015. Practical Geography: A Systematic Approach, 3rd ed, Orient Blackswan Private Ltd.
8. www.sevenoaks.wa.edu.au/linkpage/geog/copy.html
9. <http://www.esri.com/>
10. www.gisdevelopment.net/books/mapping/bmap0010.html

Mapping with Programme Outcomes (MPO)*					
MPO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	1	1	2	1	1
CO 2	1	1	1	1	2
CO 3	1	1	1	1	2
CO 4	2	1	1	1	1
CO 5	1	2	3	1	1
Map Course Outcomes (CO) for each Course with Programme Specific Outcomes (PSO) in the 3-Point scale of 1,2, 3 (Strong, Medium and Low)					

SEMESTER I

ELECTIVE COURSE

Course code:	EC	POPULATION AND SETTLEMENT GEOGRAPHY	L	T	P	C
Core/ Elective	Elective - P23GDE1					
Pre-requisite	Basic knowledge in population and settlement geography					

COURSE OBJECTIVES:

- understanding of nature, scope and evolution of population geography through spatial and temporal
- It also helpful in knowing various kinds of demographic problems.
- Study of population is an essential component in planning of various human related issues.
- To explain the arguments and assumptions of dominant theories of population change in time and space.
- Population Geography also deals in population policies in developed & developing countries

UNIT I SCOPE OF POPULATION GEOGRAPHY

Concepts, scope and methodology of population geography, Sources of population data (census, sample surveys and vital statistics, data reliability and errors). World Population Distribution (measures, patterns and determinants), World Population Growth (prehistoric to modern period). Demographic Transition, Theories of Population Growth (Malthus, Sadler, and Ricardo).

UNIT II WORLD DISTRIBUTION OF POPULATION

World distribution of population – over population, under population and optimum population- growth of population – migration: Internal and international.

UNIT III POPULATION COMPOSITION AND CHARACTERISTICS

Fertility and Mortality Analysis (indices, determinants and world patterns). Migration (types, causes and consequences and models), Population Composition and Characteristics (age, sex, rural-urban, occupational structure and educational levels), Population Policies in Developed and Developing Countries.

UNIT IV MORPHOLOGY OF RURAL SETTLEMENTS

Nature, scope and development of settlement geography – site, situation, types, size, spacing and internal morphology of rural settlements

UNIT V MORPHOLOGY OF URBAN SETTLEMENTS

Urban Settlements: Origin of Cities – Stages of Urban Growth - Site, Situation and Types – Urban Morphology - Urbanization.

Expected Course Outcomes:		
On the successful completion of the course, student will be able to:		
1	Understand population policies & its importance, Population distribution and its problems.	K1, K2
2	Assessment of vital statistics of population data	K2, K3
3	Acquire and interweave theoretical foundation for addressing research issues related to population dynamics in the real world	K3, K6
4	Acquiring, handling and analysing population data both at the grassroots level and secondary sources	K4, K5
5	Recollect types and patterns of urban and rural settlement	K4, K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create		

REFERENCE BOOKS:

1. Clark J.1 (1965). Population Geography, Permagon Press, New York, 1965.
2. Gosh, B.N (1987)– Population Geography, Streling Publications.
3. Beaujeu-Garnier, J. (1966). Geography of Population (Translated by Beaver, S.H.) Longmans, London.
4. Singh, R.Y. (2002). Geography of Settlements. Rawat Publication, New Delhi.
5. Chandna,R.C (2012)-Geography of Population, Kalyani Publishers,Ludhiana
6. Maurya, S.D. (2012). Human Geography. Prayag Publications, Allahabad.
7. Debjani Roy (2015)-Population Geography,Books and Allied Private Limited, Kolkata.
8. Mohammad Izhar Hassan (2020). Population Geography: A Systematic Exposition, Routledge, India.
9. <https://ncert.nic.in/ncerts/1/legy201.pdf>
10. <https://www.amyglenn.com/geog-regional/geog1303population.htm>
11. https://www.bdu.ac.in/cde/slm/slm_sample/msc-geography.pdf
12. <https://mu.ac.in/wp-content/uploads/2021/04/t.v.b.a.-paper-7-population-and-economic-geography-e.pdf>
13. <https://ncert.nic.in/ncerts/1/legy201.pdf>

Mapping with Programme Outcomes (MPO)*					
MPO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	1	1	2	1	2
CO 2	1	1	3	1	1
CO 3	1	2	1	1	1
CO 4	1	1	1	1	1
CO 5	1	1	1	2	2

Map **Course Outcomes (CO)** for each Course with **Programme Specific Outcomes (PSO)** in the 3-Point scale of **1,2, 3 (Strong, Medium and Low)**

SEMESTER I**ELECTIVE COURSE**

Course code:	EC	TRANSPORTATION GEOGRAPHY	L	T	P	C
Core/Elective	Elective - P23GDE2					
Pre-requisite	Basic knowledge in geography					

COURSE OBJECTIVES:

- Understand the purpose and importance of Transportation Geography
- Explain the spatial organization of transport systems
- Examine the role of transportation system in energy, environment and economy
- Discuss the modes of transportation and trade and urban transportation
- Apply and evaluate the concepts in planning and policy for sustainable development

UNIT I INTRODUCTION

Scope and significance of Transportation Geography- basic concepts- Physical Environment and Transportation - The Emergence of Mechanized Transportation Systems- Setting of Global Transportation Systems.

UNIT II TRANSPORTATION, ENERGY, ENVIRONMENT, ECONOMY AND SOCIETY

Transportation and Economic Development- Transportation and Energy- Transportation and Environmental justice- Sustainability and Decarbonization -Transportation and Society- Transport Costs- Demand of Transportation Services.

UNIT III TRANSPORTATION MODES AND TRADE

Road, Rail and Pipelines, Maritime and Air Transport-Intermodal Transportation and Containerization-Transport Terminals and Hinterlands-Port, Rail and Airport Terminals- Trans-border and Cross-border Transportation- Globalization and International Trade- Freight Transportation and Value Chains- Transport hubs.

UNIT IV URBAN LAND USE, TRANSPORTATION AND PLANNING

Urban Land Use and Transportation- Urban Mobility- Urban Transport Challenges-Transport Policy-Transport Planning and Governance- Transport Safety and Security- Transportation Disruptions and Resilience- Geospatial technology and spatial transport planning.

UNIT V URBAN LAND USE, TRANSPORTATION AND PLANNING

Urban Land Use and Transportation- Urban Mobility- Urban Transport Challenges-Transport Policy-Transport Planning and Governance- Transport

Safety and Security- Transportation Disruptions and Resilience- Geospatial technology and spatial transport planning.

Expected Course Outcomes:

1	Understand the basics of spatial structure of transportation network	K2, K6
2	Analyse the transport systems and problem from a spatial perspective.	K2, K3
3	Assess the environment, energy and other socio-economic dimensions with reference to transportation development	K2, K5
4	Evaluate different modes of transportation and trade for sustainable developmental activities	K4, K2
5	Evaluate the role of transportation in affecting current patterns of economic development and spatial planning	K1, K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create		

REFERENCE BOOKS:

1. Eliot Hust M.E. (1974) Transportation Geography, McGrawhill.
2. Garrison W. Berry B.J.L, et,al (1959) Studies of Highway, Development and Geographic Change, University of Washington, Seattle.
3. Grossman W.L. (1959) Fundamentals of Transportation, New York.
4. Ullman, E.L. (1980) Geography as Spatial Interaction, University of Washington Press, Seattle.
5. Taaffe, E.J., H.L. Gauthier and M.E. O'Kelly (1996) Geography of Transportation, 2nd Edition, Prentice Hall, New Jersey.
6. Haggett, P. (2001) Geography: A Modern Synthesis, 4th Edition, New York: Prentice Hall.
7. Black, W. (2003) Transportation: A Geographical Analysis. New York: Guilford
8. Rodrigue, J.P., Claude C. and Brian S. (2006) The Geography of Transport Systems, Routledge, New York.
9. Newman, M. (2010) Networks: An Introduction. Oxford University Press, Oxford.
10. Tapas Pal (2015) Industrial Geography an Indian Perspective, Bridge Centre, Buzau.
11. <https://transportgeography.org/>
12. https://cbpbu.ac.in/userfiles/file/2020/STUDY_MAT/GEO/null.pdf
13. <https://unece.org/transport>

Mapping with Programme Outcomes (MPO)*					
MPO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	1	1	1	1	1
CO 2	1	3	3	2	1
CO 3	2	2	1	2	2
CO 4	1	2	1	2	1
CO 5	3	1	1	1	2

Map **Course Outcomes (CO)** for each Course with **Programme Specific Outcomes (PSO)** in the 3-Point scale of **1,2, 3 (Strong, Medium and Low)**

SEMESTER I**ELECTIVE COURSE**

Course code:	EC	PRINCIPLES OF GIS	L	T	P	C
Core/Elective	Elective - P23GDE3					
Pre-requisite	Basic knowledge in GIS					

COURSE OBJECTIVES:

- Understanding the basic spatial concepts, approaches, history and development of GIS
- Obtain an understanding of spatial and non-spatial data models
- Understanding of data capturing methods and data accuracy and accessing publicly available data sets
- Teaching basic spatial operations skills necessary to work with GIS project
- Develop a project requiring GIS as a management, analytical, and/or visualization tool using spatial analysis methods

UNIT I BASIC CONCEPTS OF SPATIAL SCIENCE AND GIS

Basic concepts of spatial science and GIS: geographic spaces, spatial data and information, reference systems and datums, GIS definition, approaches and components; history and development of GIS.

UNIT II DATA MODELS AND MANAGEMENT

Data models and management: spatial data models – vector and raster data models; data models – object based – oriented data models – coding and encoding.

UNIT III Data Capture and Geoprocessing

Data Capture and geoprocessing: sources of geographic data, capturing methods, topology, geometric transformation, reprojection, scales in GIS, precision and accuracy of geographical data.

UNIT IV GIS: Spatial Operations

Spatial operations: basic operations and set theory basics - buffer, overlay, network, view shed and watershed analysis, interpolation, 3D visualization.

UNIT V SPATIAL MODELLING AND ITS APPLICATIONS

GIS modeling - multi-criteria analysis - network applications - LBS - geocoding - suitability modelling - location allocation modeling - applications and case studies.

Expected Course Outcomes:		
1	Developing an understanding of spatial concepts and spatial and non-spatial data models	K1, K2
2	Learning skills in creating spatial data models using GIS software	K2, K6
3	Gaining ability to access data in the GIS, compile, analyse, and present geospatial data	K3, K4
4	Performing GIS functions and demonstrate the skills in modelling	K4, K5
5	Developing the ability to analyze and solve spatial problems using modelling approaches	K3, K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create		

REFERENCE BOOKS:

1. Aronoff, S. (1991). Geographic Information Systems: A Management Perspective, WDL Publications, Ottawa, Canada.
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Mapping with Programme Outcomes (MPO)*					
MPO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	1	2	1	2	2
CO 2	1	1	1	1	2
CO 3	1	1	1	1	1
CO 4	1	1	2	1	1
CO 5	2	1	3	1	1
Map Course Outcomes (CO) for each Course with Programme Specific Outcomes (PSO) in the 3-Point scale of 1,2, 3 (Strong, Medium and Low)					

SEMESTER I**ELECTIVE COURSE**

Course code:	EC	URBAN GEOGRAPHY	L	T	P	C
Core/Elective	Elective - P23GDE4					
Pre-requisite	Basic knowledge in urban geography					

COURSE OBJECTIVES:

- To understand the nature and development of urban geography along with prospects and problems of urbanization.
- To understand the patterns of land use and comparative models of internal structure of cities

UNIT I- INTRODUCTION TO URBAN GEOGRAPHY

Nature and scope of urban geography – development of urban geography - recent trends - origin and growth of urban settlements – urbanization - classification of urban settlements

UNIT II-GROWTH AND THEORIES OF URBAN

Urban growth and theories - Primate City – Rank-size rule – Settlement hierarchy - Central Place Theory of Christaller - August Losch theory of market centers - Urban economic base: Basic and non-basic functions

UNIT III URBAN MORPHOLOGY

Urban morphology and land use structure - CBD - Umland and periphery - urban expansion – Theoretical models: Concentric zone model, Sector model and Multiple Nuclei model – Social area analysis – Applications

UNIT IV-CONTEMPORARY ISSUES OF URBAN

Contemporary urban issues - urban poverty, urban renewal, urban sprawl, slums and transportation - urban infrastructure - environmental pollution: air, water, noise and solid waste - urban crime - issues of environmental health

UNIT V-URBAN POLICY AND PLANNING

Urban policy and planning - city planning - Smart City- urban policy - contemporary issues in urban planning - globalization and urban planning in the Third World - urban land use planning

Expected Course Outcomes:		
1	Students will gain knowledge of basic characteristics of urban environments	K2, K6
2	Analyse and identifying the urban theories	K2, K3
3	Assess the morphology and structure of urban	K2, K5
4	Evaluate issues of urban	K4, K2
5	Identify the structural features of cities to make analysis and compare them the present and plan for the future.	K1, K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create		

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- Dickinson, R.E. (1964) - City and Region, Routledge, London.
- Urban Geography, An Introductory Analysis, 2nd Edition, Authors: James H. Johnson, Editors: W. B. Fisher, eBook ISBN: 9781483181547.
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- Mandal, R.B., (2000), Urban Geography, Concept Publishing Company, New Delhi.
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- Richa Mehta (2014) Population geography, Srishti book distributors, New Delhi.
- UrvijaShanker (2014) Population pattern and urban development, Rajesh publications.
- <https://transportgeography.org/>
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- <https://unece.org/transport>

Mapping with Programme Outcomes (MPO)*					
MPO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	1	1	1	1	1
CO 2	1	3	3	2	1
CO 3	2	2	1	2	2
CO 4	1	2	1	2	1
CO 5	3	1	1	1	2

Map **Course Outcomes (CO)** for each Course with **Programme Specific Outcomes (PSO)** in the 3-Point scale of **1,2, 3 (Strong, Medium and Low)**

SEMESTER I**SEC**

Course code:	SEC 1	HEALTH AND WELL BEING	L	T	P	C
SEC	Skill Enhancement Course - P23G1SE1					
Pre-requisite	Basic knowledge in health for human					

COURSE OBJECTIVES:

- *The social, built and natural environments affect our health and well-being in ways that are directly relevant to health policy. Geography and Health are intrinsically linked.*
- *The application of spatial aspects to health related data will help students to understand the environmental risks as well as many other health effects in an effective way.*

UNIT I- PERSPECTIVES ON HEALTH

Perspectives on Health - Linkages with Environment - Development and Health - Human Activities and Environmental Pressure - Food Production and Nutrition

UNIT II-DYNAMICS OF HEALTHH

Driving Forces in Health and Environment: Population Dynamics, Urbanization, Poverty and Inequality

UNIT III-EXPOSURE AND HEALTH RISKS

Exposure and Health Risks: Air Pollution – Household Waste – Water Pollution – Housing and Workplace

UNIT IV-DISEASES AND THEIR REGIONAL PATTERN

Types of Diseases and their Regional Pattern - Health and Disease Pattern in India (Communicable and Lifestyle related diseases) - Biological Disease Agents

UNIT V-CLIMATE CHANGE TO HUMAN HEALTH

Climate Change and Human Health: Changes in Climate System – Problems in Heat and Cold Areas – Micro-climate changes and health

Expected Course Outcomes:		
1	Upon studying the course, the student will generate awareness about the driving forces of health and wellbeing	K1, K2
2	Driving forces in health and environment	K2, K6
3	Students will be able to explain the relationships among housing, lifestyle, occupation, environment and health	K4, K5
4	Students will become competitive to identify linkages between global environmental change, micro climate, heat and cold wave and human health	K3, K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create		

REFERENCE BOOKS

1. Akhtar Rais (Ed.), 1990: Environment and Health Themes in Medical Geography, Ashish Publishing House, New Delhi.
2. Phillips, D. and Verhasselt, Y., 1994 Health and Development, Routledge, London.
3. Christaler George and Hristopoles Dionissios, 1998: Spatio Temporal Environment Health Modelling, Boston Kluwer Academic Press.
4. Gatrell, A., and Loytonen, 1998: GIS and Health, Taylor and Francis Ltd, London.
5. Avon Joan L. and Jonathan A Patzed. 2001: Ecosystem Changes and Public Health, Baltimin, John Hopling Unit Press(ed)

Mapping with Programme Outcomes (MPO)*					
MPO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	1	2	1	2	2
CO 2	1	1	1	1	2
CO 3	1	1	1	1	1
CO 4	1	1	2	1	1
CO 5	2	1	3	1	1
Map Course Outcomes (CO) for each Course with Programme Specific Outcomes (PSO) in the 3-Point scale of 1,2, 3 (Strong, Medium and Low)					

SEMESTER II**CORE COURSE**

Course code:	CC4	APPLIED CLIMATOLOGY	L	T	P	C
Core/Elective	Core - P23G204					
Pre-requisite	Basic knowledge in Physical Geography					

COURSE OBJECTIVES:

- Gaining basic knowledge about weather elements
- Learning patterns of global wind circulation
- Understanding world climatic classification, climate change and global warming
- Acquiring skills in micro level climate, weather forecasting methods and weather measurement technique
- Demonstrate applicable solutions for climate change.

UNIT I NATURE AND SCOPE OF APPLIED CLIMATOLOGY

Nature and scope of applied Climatology- the development of applied climatology Atmosphere: Its composition (gaseous) and structure; Insolation and Radiation, heating of land and water; temperature and pressure: variations in temperature and pressure; temperature zones, heat balance, and pressure belts.

UNIT II GLOBAL WIND SYSTEMS

Global wind circulation: Tricellular meridional circulation; trade winds, easterlies and westerlies and polar winds; Air masses: continental and maritime; fronts and their types; clouds; precipitation: thunderstorms, cyclones (tropical and temperate) and anti-cyclones

UNIT III CLIMATE CHANGE AND GLOBAL WARMING

Climatic classifications; Indian climates and climatic zones; micro climates, agro-climates and urban climates; urban air pollution problems- global climate change; global warming and their likely impacts on human life- El Nino, La Nino.

UNIT IV URBAN CLIMATE

Urban climate and global environment change - the nature of the global environmental change, urban climates, impact of the urban climate on GEC

UNIT V WEATHER FORECASTING

Weather forecasting: short range and long-range forecasting – weather satellites and sensors – sounding techniques – weather maps – field instruments in forecasts.

Expected Course Outcomes:		
1	To recall weather elements and its importance	K1, K2
2	Discuss various wind around the world	K5, K3
3	To compare climatic classification for global and regional level	K3, K4
4	Apply various weather forecasting methods	K4, K5
5	Analyzing the Characteristics of Urban Heat Island	K5, K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create		

REFERENCE BOOKS:

1. Mather, J. R. (1974): Climatology: Fundamentals and Applications, Mc Graw Hill, New York
2. Howard J. Critch field (1995); General Climatology; Prentice, Hall of India Pvt. Ltd., New Delh.
3. Thompson, R. D. and Allen, P. (1997): Applied Climatology: Principles and Practice, Routledge, London and New York
4. Perry, Allen, and Russell Thompson. Applied climatology: principles and practice. Routledge, 2013. Thompson, R. (1997). Applied climatology: principles and practice. Psychology Press.
5. Kelkar, R. R. (2007). Satellite meteorology. BS Publications
6. Ahrens, C. D. (2011). Essentials of meteorology: an invitation to the atmosphere. Cengage Learning
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8. Hartmann, D. L. (2015). Global physical climatology (Vol. 103). Newnes
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13. https://metnet.imd.gov.in/phps/imdweb_imdnews.php
14. <https://www.un.org/en/climatechange/speeches>
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Mapping with Programme Outcomes (MPO)*					
MPO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	1	1	2	1	1
CO 2	1	1	1	1	2
CO 3	3	1	1	1	1
CO 4	1	2	2	1	2
CO 5	1	1	1	2	1

Map **Course Outcomes (CO)** for each Course with **Programme Specific Outcomes (PSO)** in the 3-Point scale of **1,2, 3 (Strong, Medium and Low)**

SEMESTER II

CORE COURSE

Course code:	CC5	HYDROLOGY AND OCEANOGRAPHY	L	T	P	C
Core/Elective	Core - P23G205					
Pre-requisite	Basic knowledge in Physical Geography					

COURSE OBJECTIVES:

- To Understand the stages of Hydrological cycle
- To introduce a sound scientific knowledge of how water cycles through the Earth's atmosphere, surface and groundwater systems.
- To Understand Significance of oceanography and hydrology in earth and atmospheric science, Configuration of the ocean floor and variation of temperature and salinity of oceans and seas.

UNIT I- HYDROLOGIC CYCLE

Hydrological cycle and its sub-cycle; Man's interference on hydrological cycle - elements of hydrological cycle: precipitation - intensity and duration; evaporation; infiltration, surface runoff, urban flooding

UNIT II-CHARACTERISTICS AND FUNCTIONS OF FLUVIAL MORPHOLOGY

Drainage basin characteristics: human impact on hydrological system - morphometric analysis – fluvial process and analysis

UNIT III AQUIFERS AND GROUNDWATER

Ground water - occurrence and types: movement - quality and quantity measures - Principles of water balance and their application, - its relevance in crop geography; water pollution, need for water management.

UNIT IV-MORPHOLOGY OF OCEAN FLOOR

Relevance of oceanography in earth and atmospheric sciences: Surface configuration of the ocean floor, continental shelf, continental slope, abyssal plain, mid-oceanic and oceanic trenches - relief of Atlantic, Pacific and Indian oceans - distribution of temperature and salinity of oceans and seas.

UNIT V MOVEMENT OF OCEAN WATER

Circulation of oceanic waters: waves, tides and currents; currents of the Atlantic, Pacific and Indian oceans. Marine deposits and coral reefs; coastal environment - Oceans as storehouse of resources for the future.

Expected Course Outcomes:		
1	Recall hydrological cycle, surface runoff and urban flooding	K1, K2
2	Knowledge on fluvial process and morphometry of drainage basin	K2, K5
3	Explain groundwater occurrence, types, movement, pollution and need for water management	K3, K5
4	Recall ocean waters movements, ocean deposits, coastal environment and coral reefs and discuss the global warming and Sea level rising	K5, K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create		

REFERENCE BOOKS:

1. Addison, H. (1961). Land Water and Flood, Chapman and Hall, London.
2. Sharma, R.C. Vatel M (1970). Oceanography for Geographers, Chetnya Publishing House, Allahabad
3. Cracknell, A. P. (1981). Remote sensing in meteorology, oceanography and hydrology.
4. Diaz, H. F. (2000). El Niño and the Southern Oscillation: multiscale variability and global and regional impacts. Cambridge University Press
5. Lal, D.S., (2005) Oceanography, Sharda Pustak Bhawan, Allahabad.
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15. <https://www.usgs.gov/special-topic/water-science-school/science/what-hydrology>
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Mapping with Programme Outcomes (MPO)*					
MPO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	1	1	1	1	2
CO 2	1	2	1	1	1
CO 3	1	1	2	1	1
CO 4	1	1	1	1	1
CO 5	1	1	3	2	2
Map Course Outcomes (CO) for each Course with Programme Specific Outcomes (PSO) in the 3-Point scale of 1,2, 3 (Strong, Medium and Low)					

SEMESTER II**CORE COURSE**

Course code:	CC 6	PRACTICAL- II: GEOSPATIAL LAB	L	T	P	C
Core/Elective	Core - P23G206P					
Pre-requisite	Prior knowledge in Geography					

COURSE OBJECTIVES:

- To introduce the concepts of Geographic Information Systems practically and to understand the various aspects of map reading, design and evaluation of digital maps
- To understand the theoretical and practical concepts pertaining to map making.
- To obtain a comprehensive understanding of the spatial models, applications and tools currently available in the field of GIS.
- To apply the GIS concepts to create, analyse and interpret the spatial maps in the field of geospatial technology.
- To suggest tools and techniques for execution of spatial operations.

UNIT I FUNDAMENTALS OF MAPPING AND EXPLORATION

Map exploration - Georeferencing – map projection and transformation – spatial entity creation – digitization – symbolization - attribute data editing – labelling and annotation – map design and layout - editing and topology: building topology, topology error rectification – edge matching – rubber sheeting.

UNIT II SPATIAL DATA EDITING AND ANALYSIS

Attribute data management and thematic mapping: quantitative and qualitative mapping, dot map, located pie chart and bar chart – proximity analysis – overlay analysis.

UNIT III SPATIAL ANALYSIS AND SPATIAL STATISTICS

Network analysis – geocoding - location and allocation models; spatial statistics: measurement- mean center, median center, standard distance

UNIT IV TERRAIN AND SURFACE ANALYSIS

Surface analysis and Interpolation techniques: creation of contours, slope, aspect, kriging, spline, inverse distance weighted (IDW) – 3D visualization: DEM, TIN and visibility analysis.

UNIT V SPATIAL APPLICATIONS AND MODELLING

Multi criteria analysis and Ground truth support: GPS with field data attributes - geotagged photographs - Suitability analysis and

modelling: habitat suitability – house hunting – noise pollution modelling – hydrological modelling.

Expected Course Outcomes:		
1	A clear understanding in key concepts of cartography, GIS and the aspects in reading, designing, and evaluating digital cartographic maps	K1, K2
2	Understand the relationship between map projections, coordinate systems and geospatial layers including map algebra and spatial statistics.	K2, K3
3	Learn the skills in data collection, storage, analysis and interpretation of spatial data in GIS interface.	K3, K6
4	Ability to analyse and evaluate the maps and perform spatial operations like overlay analysis, landscape analysis, terrain analysis, suitability analysis and spatial modelling.	K4, K5
5	Create tools and models for developing and solving complex geospatial problems in GIS	K4, K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create		

REFERENCE BOOKS:

1. Chrisman, N. (1997). Exploring Geographic Information systems, New York: John Wiley & Sons., Inc.
2. Bernhardsen, T. (2002). Geographic information systems: an introduction. John Wiley & Sons
3. Kang-tsung Chang (2002). Introduction to Geographical Information Systems, Tata McGraw-Hill Publishing Company Limited, New Delhi.
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8. Zhu, X. (2016). GIS for environmental applications: a practical approach. Routledge.
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12. <http://www.esri.com/>
13. <https://www.le.ac.uk/ar/arccgis>

Mapping with Programme Outcomes (MPO)*					
MPO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	1	1	2	1
CO 2	1	2	1	1	1

CO 3	1	1	1	1	2
CO 4	2	1	1	1	1
CO 5	1	1	3	1	1
Map Course Outcomes (CO) for each Course with Programme Specific Outcomes (PSO) in the 3-Point scale of 1,2, 3 (Strong, Medium and Low)					

SEMESTER II

ELECTIVE COURSE

Course code:	EC	FIELDWORK AND MAPPING	L	T	P	C
Core/Elective	Elective - P23GDE5					
Pre-requisite	Basic knowledge in Field work					

COURSE OBJECTIVES:

- To impart knowledge about basic principles of field surveying procedures and practices.
- Geospatial applications and also to impart knowledge on advanced surveying, photogrammetry, remote sensing, and Geographic Information Systems (GIS).
- The purpose of fieldwork is to prepare students for a professional career by providing them with a "real world" experience.
- Writing report papers on the structure demonstrated analytical and research talents.

UNIT I-PLAN AND SCHEDULE

This course work contains - Plan and schedule of the work carried out and comprehensive report on the field work.

UNIT II-FIELD DATA COLLECTION

The Student should prepare an individual report based on primary and secondary data collected during field work. Field and digital techniques for map making including use of GIS, GPS, and digital tablets.

UNIT III-REPORT WRITING

The maximum length of the report should not exceed 12000 words, excluding figures, tables, photographs, maps, references and appendices.

UNIT IV-FIELD WORK

The students will go for a field work in the Second and Fourth semester, which is compulsory and on the basis of that, each student has to submit a field work report as part of the second and fourth semester course work

UNIT V-SUBMISSION

Each report must be accompanied by field notebook, a fair copy of map, related cross sections and other relevant documents.

Expected Course Outcomes:		
1	Understand various methods of Geospatial surveying	K1, K2
2	Estimate the observation outcomes based on field truth verification and getting exposure in field work documentation.	K2, K5
3	Calculate area and volume and to generate various cartographic techniques.	K3, K4
4	Adopt appropriate survey method to address various field problems.	K5, K6
5	In this course, students will perform credible and original geographical research.	K4, K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create		

REFERENCE BOOKS:

1. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House.
2. Punmia BC et al: Surveying Vol. I, II, Laxmi Publication
3. M. Chandra, Plane Surveying, New Age International.
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SEMESTER II**ELECTIVE COURSE**

Course code:	EC	GEOSPATIAL STATISTICS	L	T	P	C
Core/Elective	Elective - P23GDE6					
Pre-requisite	Prior knowledge in statistics					

COURSE OBJECTIVES:

- To introduce basic statistical procedures to the students
- To indicate the assumptions, limitations and interpretation of these procedures and results
- To train the students to handle these statistics towards analysing the geographical problems
- To understand the Statistical Techniques, Numerical data in Geography
- To familiarize about Probabilistic Treatment, Parametric Statistics and Regression Analysis

UNIT I- STATISTICS, GEOGRAPHY AND STATISTICS

Significance of Statistics in geographical studies; Types of Data; levels of data measurement. Sampling: basic concepts, sample UNITS and design, sampling frame and procedures, standard error and sample size, testing the adequacy of samples

UNIT II- MEASURES OF CENTRAL TENDENCY AND THEIR SIGNIFICANCE

Centro graphic techniques: mean centre, median centre and standard distance. Measures of dispersion and concentration: Range, quartile deviation, mean deviation, standard deviation; coefficient of variation, Lorenz Curve and Gini's Coefficient; location Quotient.

UNIT III-BIVARITE ANALAYSIS

Forms of relation and measuring the strength of association and relation-construction and meanings of scatter diagram; Spearman's Rank Difference and Karl Pearson's Product Moment Correlation Coefficients.

UNIT IV-REGRESSION ANALYSIS

Regression equations, construction of regression line interpolation, prediction, explanation; residual-statistical tests of significance of the estimates; computation of residuals and mapping.

UNIT V-HYPOTHESIS TESTING

Needs and types of hypotheses-goodness of fit and significance and confidence levels-parametric and non-parametric procedures: contingency tables, Chi-square test, t -test, Mann-Whitney U test, Analysis of Variance (ANOVA).

Mapping with Programme Outcomes (MPO)*					
MPO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	1	1	1	2
CO 2	1	2	1	1	1
CO 3	2	3	1	1	1
CO 4	1	1	2	2	3
CO 5	1	2	1	1	1

Map **Course Outcomes (CO)** for each Course with **Programme Specific Outcomes (PSO)** in the 3-Point scale of **1,2, 3 (Strong, Medium and Low)**

Expected Course Outcomes:

1	Explain the role of quantitative information in geographic research and applications.	K2, K1
2	Demonstrate an understanding of basic descriptive statistics and regression methods as they apply to problem solving in Geography.	K2, K4
3	Evaluate the roles of probability theory and sampling distributions in drawing inferences about populations based on samples	K3, K5
4	Perform basic data manipulation, statistical calculations and graphical presentation by hand, and using computer spreadsheets or statistical software (e.g., Excel, SPSS).	K4, K6
5	Acquired skills to assemble, collect and manage big data resources so that they facilitate both statistical as well as geographical studies.	K3, K6

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

REFERENCE BOOKS:

1. Hammond, R. and McCullagh, P.S. (1974), Quantitative Techniques in Geography: An Introduction, Clarendon Press, Oxford.
2. David M. Smith (1975), Patterns in Human Geography, Penguin, Harmons worth
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8. <https://swayam.gov.in/course/266-quantitative-methods>
9. <http://www.sethspielman.org/courses/geog5023/>
10. https://www.colorado.edu/geography/class_homepages/geog_4023_s08/
11. http://www.oxfordbibliographies.com/view/document/obo_9780199874002/obo-9780199874002-0053.xml
12. <https://searchworks.stanford.edu/view/923805>

Mapping with Programme Outcomes (MPO)*					
MPO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	1	1	2	1	2
CO 2	1	1	3	1	1
CO 3	1	2	1	1	1
CO 4	1	1	1	1	1
CO 5	1	1	1	2	2
Map Course Outcomes (CO) for each Course with Programme Specific Outcomes (PSO) in the 3-Point scale of 1,2, 3 (Strong, Medium and Low)					

SEMESTER II**ELECTIVE COURSE**

Course code:	EC	REMOTE SENSING, AND GNSS	L	T	P	C
Core/Elective	Elective - P23GDE7					
Pre-requisite	Basic knowledge in Remote sensing					

COURSE OBJECTIVES:

- Understand the purpose and importance of RS, GIS & GNSS
- To provide background knowledge and understanding of principles of RS and GNSS Systems
- To enhance student's capacity to interpret images and extract information on the earth surface from multi-resolution imagery at multi-scale level.

UNIT I-INTRODUCTION TO REMOTE SENSING

Remote Sensing Process - Analog to Digital data – Digital image data formats - Image processing system characteristics - Initial statistical extraction: histograms, univariate and multivariate statistics – Scientific visualization – Image Pre-processing: calculating radiance from DN's - atmospheric, radiometric and geometric correction.

UNIT II-IMAGE ENHANCEMENT

Contrast enhancement: linear, non-linear and level slicing – Spatial feature enhancement: spatial filtering, edge enhancement and Fourier and wavelet transform – multi-image enhancement – band rationing, principal component analysis, vegetation indices, IHS and texture transformations and image fusion

UNIT III-IMAGE CLASSIFICATION

Supervised classification: classification algorithm and training site selection - Unsupervised classification – Hybrid classification – Classification of mixed pixels: spectral mixture analysis and fuzzy classification – Post classification smoothing – Ancillary data - Classification accuracy assessment - Artificial Neural Networks – Contextual Classification – Object-Oriented Classification

UNIT IV-BASICS OF GNSS

Introducing Global Navigation Satellite System: GNSS Components, Satellite Orbit, Satellite Position on Orbital Plane, Signals, Reference System and Observation Techniques

UNIT V-AERIAL AND SATELLITE REMOTE SENSING

Film and Orientation –Photo scale - Parallax – Stereo model - Flight planning – Marginal information – Interpretation keys - LIDAR – Drone Satellite Remote Sensing: Satellite – Types, Orbits and Sensors – Resolution: types - aspects of LANDSAT, SPOT, IRS, IKONOS, QUIKBIRD and recent satellites – Marginal information and Interpretation – Applications of Microwave and Thermal Remote Sensing.

Aerial Remote Sensing: Aerial photographs: Classifications based on Camera,	
Expected Course Outcomes:	
1	Understand the basics of spatial structure of transportation network K2, K6
2	Gain insights on processing methods and techniques for handling radiometric and geometric properties of remotely sensed K4, K5
3	Developing data processing automation skills necessary to analyze high level remote sensing and GIS Products. K3, K6
4	Familiarize with principles and methods of multi-resolutions and multi-spectral data fusion, multi- temporal processing and accuracy assessment. K1, K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create	

REFERENCE BOOKS:

1. Jain, Anil K. Fundamentals of digital image processing. India, Prentice Hall, 1989.
2. Campbell, James B. Introduction to Remote Sensing. United Kingdom, Taylor & Francis, 2002. Joseph, George. Fundamentals of Remote Sensing. India, Universities Press, 2005.
3. Michael N. DeMers, 2009, GIS For Dummies, Wiley Publishing, Inc., ISBN: 978-0-470-23682-6
4. Ian Heywood, Sarah Cornelius and Steve Carver, An Introduction to Geographic Information System, 2010, third edition, Pearson Education Ltd
5. Peter A. Burrough and Rachael A. McDonnell, 2011, Principles of Geographic Information Systems, Oxford University Press.
6. Ka ng – Tsung Chang, 2018, Introduction to Geographical Information System, New York: McGraw-Hill Education, ISBN 9781259929649

Mapping with Programme Outcomes (MPO)*					
MPO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	1	1	2	1	2
CO 2	1	1	3	1	1
CO 3	1	2	1	1	1
CO 4	1	1	1	1	1
CO 5	1	1	1	2	2
Map Course Outcomes (CO) for each Course with Programme Specific Outcomes (PSO) in the 3-Point scale of 1,2, 3 (Strong, Medium and Low)					

SEMESTER II

ELECTIVE COURSE

Course code:	EC	AGRICULTURAL GEOGRAPHY	L	T	P	C
Core/Elective	Elective - P23GDE8					
Pre-requisite	Basic knowledge of agriculture					

COURSE OBJECTIVES:

- To understand the different approaches in agricultural geography to study agricultural productivity, land use planning and agricultural systems
- To learn about factors, causes and problems of regionalization of agriculture.

UNIT I-INTRODUCTION TO AGRICULTURE

Nature, Scope and significance of agricultural geography – Approaches - Agricultural types and their Characteristics - Determinants of Agriculture – Physical, Economic, Social Institutional and technological factors – Green Revolution – First and Second - Implications.

UNIT II-STATISTICS AND SAMPLING USED TO AGRICULTURE

Agricultural Statistics and Sampling: Geographical, Agricultural, Land Utilization, Crop, Irrigation, Indian and World Agricultural Statistics – Techniques and Methods of Sampling: Random, Purposive, Systematic, Stratified and Multistage

UNIT III-AGRICULTURAL PRODUCTIVITY

Agricultural productivity – Determinants - Measurements - Cropping Pattern – Crop combinational Analysis: Weaver’s, Doi’s and Rafiullah’s Method. Crop diversification – Bhatia.

UNIT IV-AGRICULTURAL MODELS

Von Thunen’s model - Modification and Application of Von Thunen’s theory – Land use - Types – Land Evaluation and GIS Land use Planning - Land capability classification – Remote sensing in land use analysis.

UNIT V-AGRICULTURAL SYSTEMS

Agricultural systems of the World, India – Whittlessey’s agricultural classification – Agro-Ecological Regions in India

Expected Course Outcomes:		
1	Understand the determinants of agriculture and agricultural productivity	K1, K2
2	Appraise various agricultural land use models	K2, K3
3	Familiarize with the agricultural types in the world	K3, K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create		

REFERENCE BOOKS:

- Hussain, M. (2004) – Agricultural Geography, Rawat Publications, New Delhi
- Morgan, W.B & Muntan, R.J.C. – Agricultural Geography
- Singh Jasbir, and Dhillon - Agricultural Atlas of India - A Geographical Analysis, Vista Publishers, Krukshetra.
- Symons, I – Agricultural Geography, G. Bells & Sons, London.
- Savindra Singh and Dhillon - Agricultural Geography.
- Dr. Alka Gautam (2016) – Sharda Pustak Bhavan, Allahabad.

Mapping with Programme Outcomes (MPO)*					
MPO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	1	2	1	2	2
CO 2	1	1	1	1	2
CO 3	1	1	1	1	1
CO 4	1	1	2	1	1
CO 5	2	1	3	1	1
Map Course Outcomes (CO) for each Course with Programme Specific Outcomes (PSO) in the 3-Point scale of 1,2, 3 (Strong, Medium and Low)					

SEMESTER II**SEC**

Course code:	SEC II	REMOTE SENSING AND GIS	L	T	P	C
SEC	Skill Enhancement Course - P23G2SE2					
Pre-requisite	Basic knowledge in remote sensing and gis					

COURSE OBJECTIVE:

- The objective of this course is to introduce the basic concepts of image acquisition systems, image processing and the working principles of GIS.

UNIT I-INTRODUCTION TO REMOTE SENSING

Introduction: Aerial remote sensing, Photogrammetry, Remote Sensing: active and passive, GIS and GNSS - historical development - emerging trends - multidisciplinary nature

UNIT II-AERIAL REMOTE SENSING

Terrestrial and Aerial Remote Sensing: Basic principles - Elements of EMR - Energy interaction in atmosphere - Terrestrial interaction - Spectral signature - Spectral reflectance curves - Aerial photography - Types of photographs - Aerial triangulation - Photogrammetry - Visual interpretation: Equipment's - Elements of image interpretation

UNIT III-SATELLITE REMOTE SENSING

Satellite Remote Sensing: Platforms - Sensors - FOV and IFOV - Pixel - Resolution: spatial, spectral, radiometric and temporal - Earth observation satellites: weather satellites, land and marine observation satellites - Image pre-processing - Image enhancement - Image classification - Accuracy assessment

UNIT IV-GIS

Geographical Information System: Definition - Components of GIS - Raster and vector data structures - RDBMS - Spatial referencing - Spatial data input and editing - GIS analysis

UNIT V-APPLICATIONS OF REMOTE SENSING AND GIS

Applications of Remote sensing and GIS - Resource Mapping - Land and Water Resources, Urban Studies, Disaster Management and Land Use Planning.

Expected Course Outcomes:

1	The students can understand the principles of remote sensing	K1, K2
2	To understand and visual interpretation of aerial remote sensing	K2, K3
3	To understand and visual interpretation of satellite remote sensing	K3, K6
4	They can differentiate components of GIS .	K4, K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create		

REFERENCE BOOKS

1. Lillisand T.M and R.W. Kiefer (1994) Remote Sensing and Image Interpretation. John Wiley & Sons, New York.
2. Burrough, P. A., & McDonnell, R., (2000) Principles of Geographical Information Systems, Oxford Press, London.
3. Jensen, J.R., (2006). Introductory Digital Image Processing: A Remote Sensing Perspective, Prentice-Hall Inc., New Jersey.
4. Jensen, J. R., (2007). Remote Sensing of the Environment: An Earth Resource Perspective, Prentice-Hall Inc., New Jersey & Wasle, (2008) Global Navigational Satellite Systems, Springer Wien New York.
5. Gomasasca, M. A. (2009) Basics of Geometrics, Springer Science, New York

Mapping with Programme Outcomes (MPO)*

MPO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	2	1	2	2
CO 2	1	1	1	1	2
CO 3	1	1	1	1	1
CO 4	1	1	2	1	1
CO 5	1	1	3	1	1

Map **Course Outcomes (CO)** for each Course with **Programme Specific Outcomes (PSO)** in the 3-Point scale of **1,2, 3 (Strong, Medium and Low)**