Parvatibai Chowgule College of Arts and Science
(Autonomous)
Accredited by NAAC with Grade 'A+'
Best Affiliated College-Goa University Silver Jubilee Year Award

DEPARTMENT OF GEOGRAPHY

SYLLABUS FOR VI – SEMESTER GEOGRAPHY SYLLABUS FOR THREE/FOUR YEAR UNDERGRADUATE DEGREE <u>HONOURS</u> OR <u>HONOURS WITH RESEARCH</u> PROGRAMME IN GEOGRAPHY

(Implemented from the Academic Year 2023-2024 onwards)

Annexure A

(Summary of changes incorporated in the syllabus)

Semester	Course Title	Existing (Indicate only the Module where the change is proposed)	Changes Proposed	Specify the reason for the change
VI	GEG-VI-C-8 Geography of Population growth	Practical's	Recent practical related to the course is suggested	Streamlining of practical syllabus as per theory course
	GEG-E-13 Introduction to regional planning	Practical's	Recent practical related to the course is suggested	Streamlining of practical syllabus as per theory course

*Enclosed course structure and course content

PARVATIBAI CHOWGULE COLLEGE OF ARTS & SCIENCE
DEPARTMENT OF GEOGRAPHY & RESEARCH CENTER
THREE YEAR BA DEGREE COURSE IN GEOGRAPHY
COURSE STRUCTURE
SEMESTER VI

SEMESTER	CORE		ELECTIVE			
I	GEG-I.C1: Introduction to Geography	GEG-I.C2: Fundamentals of Physical Geography				
II	GEG-II.C3: Basics of Human Geography	GEG-II.C4: Basics of Regional Geography				
III	GEG-III.C5: Cartography		GEG-E1:Basic Quantitative Techniques in Geography	GEG-E2:Field Survey in Physical Geography	GEG-E3: Participatory Rapid Appraisal Techniques in Human Geography	GEG-E4: Application of Computer in Geography
IV	GEG-IV.C6: Basics of Geomorphology		GEG-E5: Basics of Climatology	GEG-E6: Basics of Oceanography	GEG-E7: Regional Geography of India	GEG-E8: Regional Geography of USA
V	GEG-V.C7: Basics of Remote Sensing and GIS		GEG-E9: Geography of Tourism	GEG-E10: Geography of Urban Settlements	GEG-E11: Geography of Rural Settlements	GEG-E12: Basics of watershed management
VI	*GEG-VI.C8: Geography of Population Growth*		*GEG-E13: Introduction to Regional Planning*	GEG-E14: Fundamentals of Economic Geography	GEG-E15: Oceans: Issues and Challenges	GEG-E16: Geography of Climate Change

SYLLABUS FOR AUTONOMOUS COURSES IN GEOGRAPHY
BACHELOR OF ARTS
SEMESTER VI
(Implemented from the Academic Year 2023-2024 onwards)

CORE
Course Title: Geography of Population Growth (Practical)
Course code: GEG-VI.C-8
Marks: 25
Credits: 1
Duration: 15 Session of 2 hours each

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Unit	Topic	Practical Session	Marks
I	1. Calculating Life expectancy 2. Calculating Mean age of Marriage 3. Analysis of demographic transition 4. Calculating Population growth (Net Migration + Net Natural increase) 5. Calculating Net Migration Rate 6. Calculating Population growth rate at constant rate 7. Stochastic Population Model 8. Human Development Index 9. Gender Index 10. Analysis of Demographic transition based on the age structure 11. Representing population data using two variable(Scattered Diagrams) eg: fertility and education	15	25
		15	25

References:
Mandatory:
1. Chandna, R.C. (2016): Geography of Population : Concepts, Determinants and Patterns, Kalyani Publishers, New Delhi,.
2. Census of India Series – 1 India Provisional Population Tables, Published by Register General and Census Commissioner, India 2011.

Supplementary:
1. Singh Gopal (2010): Map Work and Practical Geography; Vikas Publishing House

Web Based:
1. http://ocw.jhsph.edu/courses/PopulationChange/PDFs/Lecture4.pdf
2. https://study.com/academy/lesson/net-migration-rate-definition-formula-statistics.html
3. https://www.cdc.gov/csels/dsepd/ss1978/lesson3/section3.html
4. *https://ec.europa.eu/eurostat/ramon/statmanuals/files/KS-CC-03-005-EN.pdf (demography)*
5. https://www.medindia.net/health_statistics/general/birth-rate-death-rate-india-statistics.asp#

6. https://www.statisticshowto.com/population-density-definition/
7. https://www.ibrc.indiana.edu/ibr/2006/summer/article1.html
8. https://sites.google.com/site/skillsa229/proportional-circles
9. http://maps.unomaha.edu/Peterson/geog1000/PopulationProjections/Population_Projections_ GEOG1000-Answers.pdf
10. https://sciencing.com/calculate-population-projections-8473012.html
11. https://owlcation.com/academia/How-to-Plan-a-Field-Trip
12. *Demography Book - Under Construction (demographytextbook.com)*

    https://demographytextbook.com/chapter01.php

SYLLABUS FOR AUTONOMOUS COURSES IN GEOGRAPHY
BACHELOR OF ARTS
SEMESTER VI
(Implemented from the Academic Year 2023-2024 onwards)

ELECTIVE
Course Title: Introduction to Regional Planning (Practical)
Course Code: GEG-E13
Marks: 25
Credits: 1
Duration: 15 session of 2 hours each

Unit		Topic	
I		1. Fixed method, multi variable and composite index method	(20 hours)
		2. Flow method analysis in demarcation of region (Range of Goods and services)	
		3. Gravity and spatial interaction(break point)	
		4. Social accounting matrices and social accounting analysis	
		5. Land use analysis (temporal data base)	
		6. Hierarchy of settlements (Functional classification)	
		7. Regional network analysis	
		8. Demarcation region and sub region in watershed area	
II	1.	Case study based on field work or secondary data , to formulate a regional planning (demographic , economic , resource management)	(10 hours)

References:
Mandatory:

Bhargava G (2001) Development of India's Urban, Rural and Regional Planning in 21st Century Policy Perspective , Gyan Publishing House, New Delhi

Kulshesthra S K (2012)Urban and Regional Planning in India: A Handbook for Professional Practice , SAGE Publication, New Delhi – India

Walter Isard, Iwan J. Azis, Matthew P. Drennan, Ronald E. Miller, Sidney Saltzman, Erik Thorbecke (2017) Methods of Interregional and Regional Analysis, Routledge, London
Xinhao Wang, Rainer Hof(2008) Research Methods in Urban and Regional Planning, Springer-Verlag Berlin Heidelberg

Supplementary:
1. Kumar, et. Al., (2016): urban and regional planning education-learning for India. Springer, Singapore
2. Matthew Dalbey, (2002): Decentralization And Regional Planning: Practical And Ideological Problems, Springer, U.S.
3. United States. National Resources Planning Board(1940), Is Planning Practical For Your Town?: New England Regional Planning Commission, Boston, Mass

Web Based:
1. https://planningtank.com/regional-planning/delineation-of-formal-regions
2. https://www.coursehero.com/file/31907522/REGIONALISATION-AND-THE-DELINEATION-OF-REGIONSdocx/
3. https://planningtank.com/regional-planning/delineation-of-functional-regions
4. https://rashidfaridi.com/2017/04/04/planning-regions-of-india-conceptclassification-and-delineation/
5. https://unacademy.com/lesson/regionalisation-and-delineation-of-formal-and-functional-regions/DAY7U2XX
6. ttps://www.researchgate.net/publication/313590912_The_regional_approach_and_regional_studies_method_in_the_process_of_geography_teaching

Annexure B
B.A GEOGRAPHY
THREE YEARS AND FOUR YEARS HONOURS LIST OF COURSES 2023-24 UNDER NEP 2020 COURSE STRUCTURE

SEMESTER	COURSE CODE	TITLE OF THE COURSE	NOMENCLATURE/TYPE OF COURSE	CREDITS
I	UG-GEG-DSC-101	Introductory Physical Geography	DSC	4
	UG-GEG-MDC-101	Geography and Development Models	MDC	3
	UG-GEG-VAC-101	Exploring Diversity of India	VAC	2
	UG-GEG-SEC-101	Participatory Rapid Appraisal Techniques for Social Sciences	SEC	3
II	UG-GEG-DSC-102	Basics of Human Geography	DSC	4
	UG-GEG-MDC-102	Geography of Sustainable Development	MDC	3
	UG-GEG-VAC-102	Environmental Studies	VAC	2
	UG-GEG-SEC-102	Introduction to Digital Mapping	SEC	3
III	UG-GEG-DSC-201	Basics of Geomorphology	DSC	4
	UG-GEG-DSC-202	Basics of Regional Geography	DSC	4
	UG-GEG-MDC-201	Geography of South Asia	MDC	3
	UG-GEG-SEC-201	New Perspectives of Tourism	SEC	3
IV	UG-GEG-DSC-203	Basics of Climatology	DSC	4

	UG-GEG-DSC-204	Geomorphology of Landforms	DSC	4
	UG-GEG-DSC-205	Basics of Cartography	DSC	4
	UG-GEG-DSC-206	Regional Geography of India	DSC	4
V	UG-GEG-DSC-301	Geography of Population Growth	DSC	4
	UG-GEG-DSC-302	Geography of Regional planning	DSC	4
	UG-GEG-DSC-303	Coastal and Fluvial Geomorphology	DSC	4
VI	UG-GEG-DSC-304	Applied Climatology	DSC	4
	UG-GEG-DSC-305	Economic Geography	DSC	4
	UG-GEG-DSC-306	Oceanography	DSC	4
	Project	Project	DSC	4
VII	UG-GEG-DSC-401	Applied Geomorphology	DSC	4
	UG-GEG-DSC-402	Statistical Application in Geography	DSC	4
	UG-GEG-DSC-403	Applied Human Geography	DSC	4
	UG-GEG-DSC-404	Research Methodology	DSC	4
VIII	UG-GEG-DSC-402	Geography in the 21st Century	DSC	4
	Dissertation	Dissertation	DSC	4

* Implementation of fourth year (semester VII & VIII) is subject to approval from DHE

Annexure B
COURSE STRUCTURE
SYLLABUS FOR THREE/FOUR YEAR UNDERGRADUATE DEGREE <u>HONOURS</u>
PROGRAMME IN B.A GEOGRAPHY
(Implemented from the Academic Year 2023-2024 onwards)

SEMESTER	MAJOR CORE	MINOR/ VOCATIONAL	MULTIDISCIPLINARY COURSE (MDC)	VALUE ADDED COURSES (VAC)	ABILITY ENHANCEMENT COURSE (AEC)	SKILL ENHANCEMENT COURSE (SEC)
I	UG-GEG-DSC-101: Introductory Physical Geography	-	UG-GEG-MDC-101: Geography and Development Models	UG-GEG-VAC-101: Exploring Diversity of India	-	UG-GEG-SEC-101: Participatory Rapid Appraisal Techniques for Social Sciences
II	UG-GEG-DSC-102: Basics of Human Geography	-	UG-GEG-MDC-102: Geography of Sustainable Development	UG-GEG-VAC-102: Environmental Studies	-	UG-GEG-SEC-102: Introduction to Digital Mapping
III	UG-GEG-DSC-201: Basics of Geomorphology		UG-GEG-MDC-201: Geography of South Asia		-	UG-GEG-SEC-201: New Perspectives of Tourism
	UG-GEG-DSC-202: Basics of Regional Geography					
IV	UG-GEG-DSC-203: : Basics of Climatology	-				
	UG-GEG-DSC-204: Geomorphology of Landforms					
	UG-GEG-					

	DSC-205: Basics of Cartography				
	UG-GEG-DSC-206: Regional Geography of India				
V	UG-GEG-DSC-301: Geography of Population Growth	-			
	UG-GEG-DSC-302: Geography of Regional planning				
	UG-GEG-DSC-303: Coastal and Fluvial Geomorphology				
VI	UG-GEG-DSC-304: Applied Climatology	-			
	UG-GEG-DSC-305: Economic Geography				
	UG-GEG-DSC-306: Oceanography				
	UG-GEG-PRJ: Project				
VII	UG-GEG-DSC-401: Applied Geomorphology				
	UG-GEG-DSC-402:				

	Statistical Application in Geography					
	UG-GEG-DSC-403: Applied Human Geography					
	UG-GEG-DSC-404: Research Methodology					
VIII	UG-GEG-DSC-405: Geography in the 21st Century					
	UG-GEG-DIS: Dissertation					

Annexure B

SEMESTER I

DISCIPLINE SPECIFIC CORE COURSE

Course Title: **Introductory Physical Geography (Theory)**
Course Code: **UG-GEG-DSC-101**
Credits : **03**
Marks: **75**
Duration: **45 hours**

Prerequisite Courses: Nil

Course Objectives:
1. The course aims to introduce fundamental concepts of physical geography.
2. The course focuses of various spheres of the earth and their related concepts.

Course Outcomes: At the end of this course, students will be able to:

CLO1: Understand fundamentals of systems of Geography.
CLO2: Understand Basic concepts of Geography with special reference to physical Geography
CLO3: Analyze processes related to geomorphology, climatology and oceanography
CLO4: Interpret data related to physical geography.

Module	Topic	Course Content	
I	**1) Concept and Nature** **2) Layers of the Earth**	• Introduction to geography ,Branches of geography • Physical systems of the earth- Lithosphere, Atmosphere, Hydrosphere and Biosphere. • Orders of Relief • Lithospheric system: Interior of the earth Earth's movement-Endogenetic and Exogenetic forces. • Rocks -formation and rock cycle. • Soil- definition and profile.	(15 hours)
II	**Basic concepts of climatology**	• Definition and scope of climatology • Earth-Rotation, revolution • Seasons. • Concept of Weather and climate, climatic regions of the world • Insolation and Heat budget • Hydrological cycle	(15 hours)
III	**Introduction to oceanography**	Definition, Development of oceanography as a discipline, Significance and scope of oceanography Distribution of Seas and oceans Bottom relief of ocean. Geographical terms in ocean studies.	(15 hours)

References:
Mandatory:
1. Bloom, Arthur L., 2008: Geomorphology – A Systematic Analysis of Late Cenozoic Landforms, Prentice Hall, Engle Wood Cliff, New Jersey.
2. Dayal, P. (2nd edition) 2006: A Textbook of Geomorphology, Shukla Book Depot, Patna
3. Lal, D.S , 2004: Oceanography,PrayagPustakBhavan,Allahabad
4. Singh, S. 2005: Physical Geography,PrayagPustakBhawan, Allahabad
5. Strahler, A.N., 2005: Physical Geography, 3rd Ed., Wiley Publications

Supplementary:
1. Ahmed, E., 2005: Geomorphology, Kalyani Publishers, New Delhi
2. Chorley, Richard J., 2002: Spatial Analysis in Geomorphology, Harper and Row Publishers, New York, London.
3. Oxford, 2020, Oxford School Atlas – 36th Edition. Oxford University Press;
4. Sharma, H.S. (ed), 2002: Perspective in Geomorphology, Vol. I & IV, Concept, New Delhi.
5. Sharma, V.K., 2006: Geomorphology, Earth Surface Processes and Forms, Tata Mc. Graw Hill, New Delhi.
6. Sharma, V.K., 2006: Geomorphology, Earth Surface, Process and forms, Tata McGraw Hill, New York
7. Sparks, B.W., 2000: Geomorphology, Longman, London, 2nd edition.
8. Thornbury, W.D., 1969: Principles of Geomorphology, 2nd Ed., Wiley International Edition, Wiley Eastern Reprint, 2004
9. Wooldridge, S.W. and Morgan, R.S., 2008: The Physical Basis of Geography, Longman (First published in 1937)
10. Worcestor, P.G., 2005: A Textbook of Geomorphology, Van Nostrand, 2nd Ed., East West Edition, New Delhi.

Web-based:
1. https://www.nationalgeographic.org/media/earths-interior/
2. https://www.nationalgeographic.org/encyclopedia/rock-cycle/
3. http://www.geo.hunter.cuny.edu/~fbuon/GEOL_231/Lectures/Weathering%20and%20Mass%20Wasting%20Part%202.pdf
4. http://ncert.nic.in/textbook/pdf/kegy209.pdf
5. https://www.ukessays.com/essays/geography/history-significance-oceanography-9589.php

Course Title: Introductory Physical Geography (Practical)
Course Code: UG-GEG-DSC-101
Marks: 25
Credits: 1
Duration: 30 hours

Module   Title

I
1) Geographic Grids-Latitude & longitude and time.   (30 hours)
2) Methods of Representation of Relief features
3) Contours diagrams for slopes with cross sections-gentle slope, steep slope, concave and convex slope
4) Contours diagrams for hills, plateaus, cliff
5) Contours diagrams for V-shaped valley, waterfall, rapids, river terraces
6) Mapwork – identification of features related to ocean
7) Calculation of mean, average, range of temperature.
8) Calculation of lapse rate and Relative Humidity.

References:
Mandatory:
1. Chorley, Richard. J. (ed.), 2009: Water, Earth and Man, Methuen & Co., London
2. King, C.A.M., 2006: Techniques in Geomorphology, Edward Arnold, London
3. Monkhouse, F.J. and Wilkinson, H.R., 2009: Maps and Diagrams, B.I. Publications Pvt. Ltd., New Delhi
4. Singh, R.L. and Singh Rana P.B., 2008, Elements of Practical Geography, Kalyani Publishers, New Delhi

Supplementary:
1. Goudie, Andrew, et al. (eds), 2001: Geomorphological Technique, George Allen &Unwin, London
2. Gregory, K.J. and Walling, D.E., 2003: Drainage Basin – Form and Process, Edward Arnold, London
3. Leopold, L.B, Wolman, M.G. and Miller, J.P., 2004: Fluvial Processes in Geomorphology, Freeman, San Francisco
4. Misra, R.P. and Ramesh, A., 2009: Fundamentals of Cartography, Concept Publishing Co., New Delhi

Web-based:
1. http://www.brainkart.com/article/Methods-of-Representing-Relief-Features_33844/
2. https://www.slideshare.net/gauravlath1997/contour-diagrams
3. https://geo.libretexts.org/Bookshelves/Ancillary_Materials/Laboratory/Book%3A_Laboratory_Manual_For_Introductory_Geology_(Deline%2C_Harris_and_Tefend)/03%3A_Topographic_Maps/3.6%3A_Drawing_Contour_Lines_and_Topographic_Profiles
4. https://sciencing.com/calculate-mean-annual-temperature-7236109.html
5. https://eesc.columbia.edu/courses/ees/climate/lectures/atm_phys.html

Multidisciplinary Course (MDC)

Course Title: Geography and Development Models
Course Code: UG-GEG-MDC-101
Credits: 03
Marks: 75
Duration: 45 hrs

Pre-requisite Courses: Nil
Course Objectives:
1. To enable students to understand the concept of development and indicators of development.
2. This course focuses on application of development models in different disciplines of social sciences .

Course Learning Outcomes:
After successful completion of the course the students will be able to
   CLO1: Understand the concept of development in its holistic term.
   CLO2: Appreciate the application of models in different disciplines of social sciences.
   CLO3: Evaluate different methods of development by taking case studies of countries of the world.

Module	Topic	Sub-Topic	
I	**Fundamental Concepts and Development**	• Meaning of development • Concept of sustainable development • Distinction between growth, development and sustainable development • Indicators of development: Economic, social and environmental. Human development	(15 hours)
II	**Development Models**	• Economic models: Lewis Structural Change Model, Rostow's Model • Human Development : Human Development Index , Gender Index , socio- cultural theory of social development • Social models : Democratic-Socialist Model of Development • Theory of regional Development : Freidman's and Krugman's Model of development	(15 hours)

III	**New Perspectives in Development**	• Changing concept of development, concept of underdevelopment; efficiency-equity debate
		  • Globalisation and new order of development
		  • Geopolitics of development
			(15 hours)

References:
Mandatory:
1. Colman Ronald (2009) Measuring Progress towards Gross National Happiness: From GNH indicators to GNH national accounts: Centre for Bhutan Studies and GNH , Thimpu (https://www.grossnationalhappiness.com/gross-national-happiness-practice-and-measurement/)
2. Hussian Masjid (2016) Models in Geography, Rawat Publication , New Delhi
3. Pierre-Philippe Combes, et.al(2008)Economic Geography: The Integration of Regions and Nations, Princeton University Press, New York
4. Saxena H M (2013) Economic Geography, Rawat Publications , New Delhi
5. Siddhartha K(2016)Models & Theories In Geography, Kitab Mahal, New Delhi

 Supplementary:
1. Majid Husain (2016), Models In Geography, Rawat publications, New Delhi
2. Siddhartha K (2014) Models and Theories in Geography, Kisalaya Publications Pvt.
3. **Sustainable Development in Norway on the example of government pension fund global: (JulitaFiedorczuk)**
Web References:
1. Sociocultural Theory: Understanding Vygotsky's Theory (verywellmind.com)https://www.verywellmind.com/what-is-sociocultural-theory-2795088
2. Lessons from Norway, the world's most inclusive economy | World Economic Forum (weforum.org)
3. https://www.oecd.org/cfe/_Norway.pdf
4. https://www.chathamhouse.org/2020/06/expert-perspectives-norways-energy-future-0/2-challenges-and-opportModuleies-norway

VALUE ADDED COURSE (VAC)

Course Title: Exploring the Diversity of India (Theory)
Course Code: UG-GEG-VAC-101
Marks: 50
Credits: 2
Duration: 30 lectures of 1 hour each

Prerequisite Courses: Nil

Course Objectives:
1. To introduce the diversity in India.
2. To address the contemporary challenges confronting Indian society.
3. This will provide a perspective towards amalgamation of various cultural identities.

Course Outcomes: At the end of this course, students will be able to:
CLO1:	Understand various cultures, religions and practices.
CLO2:	Comprehend various facets of India's diversity.
CLO3:	Evaluate and assess diversity of India.

Module	Topic	
I	1. Introduction of Diversity in India	(15 hours)
	2. Geopolitical factors: Strategic location, accessibility and resources.	
	3. Evolution of India as a Nation, Federal and Fiscal system.	
	4. Globalization and India- A new perspective.	
II	Forms of Diversity in India:	(15 hours)
	a. Physical diversity: Deserts, forests, soils, rivers, mountains, coasts and plains.	
	b. Climatic Integration: Monsoon	
	c. Cultural diversity: Religious and Linguistic- Issues and Challenges.	

References:
Mandatory:

1. Gujjar Sulekha (2022) Moduley in Diversity,Notion Press Media Pvt Ltd No,50 ,Chettiyar Agaram Main Road , Vanagaram , Chennai – 600095.
2. Basumatary R. (2022) Multiculturalism in the 21st century with a special reference to India, Notion Press Media Pvt Ltd No,50 ,Chettiyar Agaram Main Road , Vanagaram, Chennai – 600095.
3. David H. & Jarman F. (2017) India Diversity, Om Publications Pvt. Ltd.
4. Gore M.S. (2015) Moduley in Diversity: The Indian Experience in Nation-Building, Rawat Publications Pvt. Ltd.
5. Matane P. (2007) Cultural Diversity of India, CBS Publishers & Distributors Pvt. Ltd.
6. Matane P. & Ahuja M.L. (2004) India: A Splendour in Cultural Diversity, Anmol Publications Pvt. Ltd.

Supplementary:
1. Sharma S., Kanaujia S.S., Awasthi S., Vishwakarma S. and Chand M. (2022) Institutions Information Processes & Policies Multiculturalism and Diversity in India and Europe, Bio Green Pvt. Ltd.
2. Jodhka Surinder S. (2012) Village Society, Orient Blackswan Pvt. Ltd. Himayatnagar, Hyderabad, 500 029 Telangana.

Web-based:
1. https://ncert.nic.in/textbook/pdf/fess301.pdf
2. https://www.greaterpacificcapital.com/thought-leadership/indias-diversity-is-a-strategic-asset
3. https://egyankosh.ac.in/bitstream/123456789/18835/1/Module-1.pdf
4. https://k12database.unc.edu/wp-content/uploads/sites/31/2017/11/IndiasCultureDiversity.pdf
5. https://legalstudymaterial.com/Moduley-in-diversity-in-india/
6. https://blog.ipleaders.in/overview-Moduley-diversity-india/
7. https://www.bhattadevuniversity.ac.in/docs/studyMaterial/Dr.BharatiGogoi_Geography/PG_2ndSem_India_as_Moduley_in_diversity_by_Dr._Bharati_Gogoi.pdf
8. https://dsel.education.gov.in/sites/default/files/book_Moduley_in_diversity.pdf
9. https://elearning.raghunathpurcollege.ac.in/files/C596639B15858837070.pdf
10. https://ims-cal.org/wp-content/uploads/2021/10/VOICES-OCT-2021.pdf

Skill Enhancement Course (SEC)
Course Title: Participatory Rapid Appraisal Techniques for Social Science (Theory)
Course Code: UG-GEG-SEC-101
Marks: 75
Credits: 3
Duration: 30 lectures of 1 hour each

Prerequisite Courses: Nil

Course Objectives:
1. To introduce the basics of Participatory Rapid Appraisal techniques in geographical studies.
2. This will facilitate students in their field work and further research.

Course Outcomes: At the end of this course, students will be able to:
CLO1:   Be familiar with the basic concepts of PRA techniques
CLO2:   Develop the skill to prepare questionnaires and Schedules for different PRA techniques.
CLO3:   Understand the application of PRA techniques in geographical studies
CLO4:   Accurately analyze and interpret the data collected using PRA techniques

Module	Topic	
I	PRA :Meaning Nature and Scope, evolution	(15 hours)
	Principles of Participatory Rapid Appraisal -Offsetting biases, Reversal of Roles	
	Mapping Models:	
	Creating a CommModuley Inventory, Focus Group Discussions, Matrix Ranking and Scoring, Wealth Ranking, Trend Analysis, Timeline	
	Venn diagrams, Traditional management systems and local-resource collections, Folklore, Songs, Poetry, And Dance	
II	**PRA techniques:** Transect walks.	(15 hours)
	Daily-activity profiles**,** Semi structured interviewing**,** Field report writing: techniques and structure.	
III	**Projects containing the following exercises:**	(15 hours)
	Preparing a field Plan, Social mapping chart, Semi-structured interview, Timeline, Time chart, Wealth ranking., Venn diagram preparation., Daily activity profiling.	

References:
Mandatory:
1. Mukherjee A, Chambers R,(2004), Participatory Rural Appraisal: Methods and Applications in Rural Planning, Concept Publishing Company, New Delhi
2. Narayanaswamy, N., (2008), Participatory Rural Appraisal: Principles, Methods and Application, SAGE publications, New Delhi
3. Bartle Phil, (2003), Methods of Participatory Appraisal, CSMED
4. Mikkelsen Britha, (2005), Methods for Development Work and Research: A New Guide for Practitioners, SAGE publications, New Delhi

5. Pokharel Ridish, Balla Mohan, (2003), A Process for Participatory Rural Appraisal, Institute of Forestry, Pokhar

Supplementary Readings

Neela Mukherjee · (1993) Participatory Rural Appraisal Methodology and Applications. Concept Publishing company

Web-based:

1. http://www.fao.org/3/i2495e/i2495e06.pdf
2. https://www.participatorymethods.org/resource/participatory-rapid-appraisal-commModuley-development-training-manual-based-experiences
3. https://www.nccmt.ca/knowledge-repositories/search/289
4. https://www.crs.org/sites/default/files/tools-research/rapid-rural-appraisal-and-participatory-rural-appraisal.pdf
5. https://getd.libs.uga.edu/pdfs/wolfgang_stephanie_l_201205_mla.pdf

SEMESTER II

DISCIPLINE SPECIFIC CORE COURSE (DSC)

Course Title: Basics of Human Geography (Theory)
Course Code:UG-GEG-DSC-102
Marks: 75
Credits: 03
Duration: 45 hours

Prerequisite Courses: Nil

Course Objectives:
1. To focus on cultivating basic knowledge through understanding and analysis of the fundamental concepts in Human geography.

Courses Learning Outcomes: At the end of this course, students will be able to:
CLO1: Understand the fundamental concepts of Human Geography
CLO2: Analyze human related issues in societies
CLO3: Evaluate level of development using social, economic and demographic
CLO4: Calculate demographic variables and visually illustrate

Module	Topic	Sub-Topic	
I	**Concept and Nature**	Meaning, Scope and Development of Human Geography, schools of thoughts. Basic principles-Principle of Activity or Change, Principle of Terrestrial Moduley or whole. Approaches in human geography (scientific and welfare approach)	(15 hours)
II	**Society and Culture**	Evolution of man (Australopithecus, Homo Erectus, Homo sapiens, humanization of the earth. Culture- meaning and components. Cultural realms of the world, Language and religion. (Classification, distribution, issues and challenges.) Ethnicity and the related issues.	(15 hours)
III	**Indicators of Development**	Less Developed Countries and More Developed Countries- social, economic and demographic indicators. Globalization and cultural challenges.	(15 hours)

References:
Mandatory:
1. Hussain, M.(2004)*Human Geography*. Rawat Publication. New Delhi.
2. H.J De Blij,AlexanderB.Murphy,Erin H. Fouberg(2007) *Human Geography: People, Place and Culture*.John Wiley and sons. USA.
3. De Blij, H.J., Human Geography, Culture, Society and Space, John Wiley, New York, 2006

4. Fellman, J.L. Human Geography-Landscapes of Human Activities, Brown and Bench man, Pub. U.S.A. 2007.
5. PanigrahiP.K. (2011)*Human Geography-Landscape of Human Activities*. Murari Lala and sons. New Delhi.

Supplementary:
1. Sharma Y.K. (2007) *Human Geography*.LakshmiNarainAgrawal, Agra.
2. Rubenstein J M (2010) *Contemporary Human Geography*. PHI learning Pvt., New Delhi.
3. Chandna, R.C. (2006)*Geography of Population*.Kalyani Publishers. New Delhi
4. Hagget, P.(2002)*Geography: A Modern Synthesis*. Harper & Row, New York
5. Arun Kumar Sharma, 2012: Principles of Human Geography, Rastogi Publications, Meerut

Web-based:
1. https://researchguides.dartmouth.edu/human_geography
2. https://freegeobook.files.wordpress.com/2009/01/0761942637.pdf
3. https://www.britannica.com/science/human-evolution
4. https://ourworldindata.org/economic-inequality-by-gender
5. https://pages.uwc.edu/keith.montgomery/Demotrans/demtran.htm

DISCIPLINE SPECIFIC CORE COURSE (DSC)

Course Title: Basics of Human Geography (Practical)
Course Code: UG-GEG-DSC-102
Marks: 25
Credits: 1
Duration: 30 hours
Module.   Title

| I | I) | Types of Scale | (30 hours) |

II)   Elements of Maps
III)   Techniques of demographic data representation
1. Fertility measures: Crude Birth Rate, General Fertility Rate
2. Mortality measures: Crude Death Rate, Infant Mortality Rate.
3. Age data Analysis: Age and gender composition
4. Construction of Population Pyramid
5. Literacy measures: Crude Literacy Rate.
   Gross Enrolment Ratio.
6. Work Participation Ratio.
7. Per capita income
8. Gross Domestic Product

References:
Mandatory:
1. Bose, Ashishet. al., (2004): Population in India's Development, Vikas Publishing House, New Delhi
2. Chandna, R.C. Geography of Population: Concept, Determinants and Patterns, Kalyani Publishers, New York 2000.
3. Bogue, D. J., 2001: Principles in Demography, John Wiley, New York
4. Sawant&Athavale, 2005: Population Geography, Mehta Publishing House, Pune.
5. Srinivsan, K. and M. Vlassoff, 2001. Population Development Nexus in India: Challenges for the New Millennium. Tata McGraw Hill, New Delhi.

Supplementary:
6. Census of India, 2001, India: A State Profilehttps://censusindia.gov.in/
7. Census of India, 2011https://censusindia.gov.in/
8. Crook, Nigel, (2007), Principles of Population and Development. Pergmon Press, New York.
9. Daugherty, Helen Gin, Kenneth C.W. Kammeryir (2008) An Introduction to Population (Second Edition). The Guilford Press, New York, London
10. Mitra, Asok, 2008, India's Population. Aspects of quality and Control Vol. I & II. Abhinar Publication. New Delhi.
11. Srinivasan, K. (2008).Basic Demographic Techniques and Applications Sage Publications, New Delhi
12. UNDP, (2000): Human Development Report Oxford University Press, Oxford.
13. Moduleed Nations,(2004), Methods for Projections of Urban and Rural Populations. No. VIII, New York.
14. Woods, R., (2009): Population Analysis in Geography, Longman, London.

Web-based:

1. https://ourworldindata.org/fertility-rate
2. https://www.who.int/data/gho/indicator-metadata-registry/imr-details/3130
3. https://censusindia.gov.in/census_and_you/gender_composition.aspx
4. https://www.britannica.com/topic/population-pyramid
5. https://censusindia.gov.in/Census_Data_2001/India_at_glance/workpart.aspx

Multidisciplinary Course (MDC)

Course Title: Geography of Sustainable Development

Course code: UG-GEG-MDC-102

Marks: 75

Credits: 3

Duration: 45 hours

Course Learning Objectives: The basic objective of this course is to introduce the concept of sustainable development this course focuses on

CLO1:   Understand the concept development and Key concepts in sustainable development

CLO2:   Analyze the sustainable model by adopted by Norway.

CLO3:   Apply Development Models by taking case studies of the world.

Module	Title	
I	**Development to Sustainable Development:**	(15 hours)

- What is development?
- Concept of sustainable development
- Distinction between development and sustainable development
- Key concepts in sustainable development

II	**The Norwegian Model of Sustainable Development**	(15 hours)

- The post-war development model and its limits
- Norwegian Model of Sustainable Development
- Issues and Challenges in adaptation of the Norway Model

III	**Environment and sustainable development (Any three)**	(15 hours)

- Tourism and Sustainability Model
- Demographics and Sustainability Model
- Marine resources
- Urban cities and sustainable model
- Local Issues and Challenges in attaining Sustainable Development

References:
1. Ahlawat A (2019)Sustainable Development Goals: Directive Principles For Sustainable India By 2030 , Notion Press, New Delhi
2. Chakraborty T , , Mukherjee D & Saha S (2021) Contemporary Issues in Sustainable Development The Case of India, Routeldge , New Delhi India
3. Ossewaarde Martin J.(2018) Introduction to Sustainable Development ,SAGE Publications Pvt. Ltd; New Delhi
4. Rogers Peter . Jala, Kazi F. l, Boyd J A. (2007) An Introduction to Sustainable Development , Routledge; Taylor & Francis Books India Pvt. Ltd., , The National Council of YMCAs of India, Delhi 110001, India,
5. Zimi Gutu Kia (2014) Conscious Development: Another Approach to Sustainable Development Author Houswe , New Delhi

Weblink
1. (https://www.researchgate.net/publication/329520475_The_Norwegian_Model_in_NorwayPDF) The Norwegian Model in Norway (researchgate.net)

Value Added Course (VAC)

Course Title: Environmental Studies (Theory)
Course Code: UG-GEG-VAC-102
Marks: 50
Credits: 2
Duration: hours
Prerequisite Courses: Nil

Course Objectives:
1. To provide students with basic knowledge of environment and its aspects.
2. To sensitize students about environmental issues.

Course Learning Outcomes: At the end of this course, students will be able to:
CLO1: Understand the complex linkages of environment with different disciplines.
CLO2: Apply the knowledge acquired for environmental management.

Module	Topic	
I	**Environment and Natural Resources**	(15 hours)
	Environment: Current environmental issues: Global, national, local Sustainable development: meaning and significance; Swachh Bharat Abhiyaan.	
	Ecosystem: Structure, Functions, Energy flow. Ecological succession; Ecological niche Biodiversity: Biogeographical classification of India Conservation; Ecosystems and bio diversity services.	
	Bio safety protocol-2000, Biodiversity rule 2004, Genetically modified foods.	
II	**Environment and Economic development**	(15 hours)
	Calculation of Ecological and carbon footprints, Environmental Kuznet's Curve; environmental accounting.	
	Climate protection protocol (Kyoto and Doha) Human and climate change.	
	Environmental pollution: Ambient, damage, problem of residuals. Abatement and enforcement cost. Environmental resources, externality and market failure.	
	Environmental management: concept and significance.	

References:
Mandatory:
1. Asthana, D. K., Asthana M. (2009): A Text book of Environmental Studies. S Chand and Company Limited, New Delhi.
2. Bharucha E. (2013): Text Book of Environmental Studies. University Press(India)Private Limited, Hyderabad(A.P.) India.
3. Field, Berry and Field, Martha(2001), Environmental Economics. MacGraw Hill/ Irwin
4. Mishra,D.D.(2009): Fundamental Concepts in Environmental Studies. S.Chand and Company Limited,New Delhi.

5. Titenberg Tom and Lynne, Lewis(2012), Environmental and Natural resources economics, 9th edition, Pearson Publishing House.

Supplementary:

1. Rana, S.V.S. (2003): Essentials of Ecology and Environmental Science, Prentice Hall of India Private Limited New Delhi.
2. Sharma, P.D. (2011): Environmental Biology and Toxicology, Rastogi Publications, Meerut, India.
3. Shinde,P.G. , Pendse S., Dongre P. (2007): Environmental Education. Sheth Publishers Pvt. Ltd, Mumbai, India.

Web-based:

1. https://swachhbharatmission.gov.in/sbmcms/index.htm
2. https://swachhbharat.mygov.in
3. https://croplife.org/wp-content/uploads/pdf_files/Biosafety-Protocol-A-summary-of-the-plant-science-industrys-key-positions.pdf
4. http://nbaindia.org/uploaded/Biodiversityindia/Legal/33.%20Biological%20Diversity%20Rules,%202004.pdf
5. https://www.who.int/news-room/questions-and-answers/item/food-genetically-modified
6. https://www.nature.org/en-us/get-involved/how-to-help/carbon-footprint-calculator/#:~:text=A%20carbon%20footprint%20is%20the,is%20closer%20to%204%20tons.
7. https://www.epa.gov/ems#:~:text=An%20Environmental%20Management%20System%20(EMS,and%20increase%20its%20operating%20efficiency.

Skill Enhancement Course (SEC)

Course Title: Introduction to Digital Mapping
Course Code: UG-GEG-SEC-102
Marks: 75
Credits: 3
Duration: 45 hours

Course Objectives:
1. To course aims to introduce basic tools used in digital mapping.
2. The course focuses on introducing basic data structure, sources and processing digital data.
3. To acquaint the students with the use of basic analysis of vector and raster data.

Course Learning Outcomes: At the end of this course, students will be able to:
CLO1: Understand the basic tools and functions of digital mapping open source software.
CLO2: Collect free vector and raster data from various sources.
CLO3: Process raster and vector data independently.
CLO4: Prepare map layout and get the print of the map.

Module	TOPIC	

I	**Introduction to digital mapping:** concepts, techniques, Sources of Data, the concept of Longitude and Latitude
	Introducing Workspace: Adding Vector and Raster Data, Layer Properties, Project Properties.
	Data visualization: working with the Attribute Table, Statistical Summary, Queries Preview, Plugins, Quick Map Services Plugin.
	Hands on:
	  1) Map projection: Assign projection-change projection, Coordinate Reference Systems (CRS).
	  2) Working with Features, Identify & Measurement, attribute table.
	  3) Symbology: Raster and Vector symbology
		(15 hours)

II	**Creating data:** Shapefile, Attribute Fields, Editing Mode, Geo-packages, and Intro to Advanced Digitizing and error.
	Getting online data: XYZ Tile Base maps, Natural Earth Data, DIVA GIS, TIGER Data, OSM Data, Data Extracts.
	Basic vector analysis; Vector basics, Buffers, Clips, Intersect, Dissolve, Unions, Calculating Lengths or Areas.
	Hands on:
	  1) Creating shape files, digitization and editing.
	  2) Use of online data: raster, vector data & extract.
	  3) Vector analysis.
		(15 hours)

III	**Basic raster analysis**: Raster Basics, Getting multispectral and Elevation Data, Raster Symbology. Hill shades, Creating Basic Contour Lines, Sun Aspect Calculations, calculating Slope from DEM **Raster processing:** Raster Calculator	(15 hours)

Map layouts: Creating Print Layout, Grids and Guides, adding Maps Elements, Adding Images to Your Layout, Exporting and Printing.

Hands on:
1) Raster analysis: Multispectral & DEM
2) Use of raster calculator
3) Map layout

References:
Mandatory:
1. Anita Graser (2016) Learning QGIS - Third Edition: Create great maps and perform geoprocessing tasks with ease. Packet Publishing Limited, India.
2. Anita Graser, Gretchen N Peterson and Gary Sherman (2018) QGIS MAP DESIGN 2/E, Locate Press. Moduleed Kingdom
3. Gretchen N. Peterson, (2020): GIS Cartography: A Guide to Effective Map Design, Third Edition, CRC Press; London.
4. Kurt Menke and Gary Sherman,(2022): Discover QGIS 3.x – (2nd ed): A Workbook for Classroom or Independent Study. Locate Press; 2nd ed. Edition. Moduleed Kingdom
5. Scott Madry, (2021): Introduction to QGIS Open-Source Geographic Information System. Locate Press, Moduleed Kingdom

Supplementary
1. C. Dana Tomlin, (2012): GIS and Cartographic Modeling. Esri Press; California.
2. Cynthia A. Brewer, (2015): Designing Better Maps: A Guide for GIS Users. Esri Press. California
3. Jon Kimerling, Aileen R. Buckley, Phillip C. Muehrcke and Juliana O. Muehrcke, (2016): Map Use: Reading, Analysis, ESRI press. California
4. Kenneth Field (2019) Cartography. The Definitive Guide to Making Maps. ESRI Press, USA

Web Base
1. https://developers.google.com/maps
2. https://www.arcgis.com/index.html
3. https://www.mapbox.com/
4. https://www.qgis.org/en/site/
5. https://www.qgistutorials.com/

Annexure C
SYLLABUS FOR TWO YEAR POSTGRADUATE DEGREE
PROGRAMME IN M.A. GEOGRAPHY
(Implemented from the Academic Year 2023-2024 onwards)

Sem/Level	Core	Course 1	Course 2	Course 3	Course 4	Course 5
I/400	**Core** **4 Credits**	Advanced Geomorphology	Advanced Climatology	Introduction to Remote Sensing	Advanced Cartographic Skills in Geography	
I/400	**Elective** **2 Credits**	Advanced Regional Planning and Development	Techniques of Regional Analysis	Environment Impact Assessment	Natural Resources Management in India	Climate Change and Adaptations
II/400	**Core** **4 Credits**	Advanced Population Studies in Geography	Advanced Economic Geography	Introduction toGeographic Information System	Field Techniques and Village Survey	
II/400	**Elective** **2 Credits**	Techniques of Disaster Management, Mitigation and Resilience	Geographical Thought	Advanced Urban Geography	Soil and Water Resource Management	Geography of India
III/500	**Generic Elective 4 Credits**	Regional Perspectives ofGeopolitics	Urbanisation and Society in 21st Century	Agro Meteorology		
III/500	**Research Specific Elective 4 Credits**	Advanced Research Design	Advanced Quantitative Techniques in Geography	Research Applications in Physical Geography	Research Applications in Human Geography	
IV/500	**Dissertation/Internship 16 Credits**	Dissertation/Internship				

Annexure C
Course Structure
Level 400 Courses

- Any two electives to be chosen in Semester I/II
- Bridge Course for level 400 Courses
- Generic Elective can be opted across the departments
- Electives 401 and 402 should be taken together

Semester	Course Code	Course Title (T/P)	Credits (T+P)
Semester I Level 400 Discipline Specific Core			
I	PGMP –GEG-DSC-401	Advanced Geomorphology (T/P)	3+1
I	PGMP –GEG- DSC-402	Advanced Climatology (T/P)	3+1
I	PGMP –GEG- DSC-403	Introduction to Remote Sensing	2+2
I	PGMP –GEG- DSC-404	Advanced Cartographic Skills in Geography	2+2
Semester I Level 400 Discipline Specific Elective			
I	PGMP –GEG-DSE-401	Advanced Regional Planning and Development	2
I	PGMP –GEG-DSE-402	Techniques of Regional Analysis	2
I	PGMP –GEG-DSE-403	Environment Impact Assessment	2
I	PGMP –GEG-DSE-404	Natural Resources Management in India	2
I	PGMP –GEG-DSE-405	Climate Change and Adaptations	2
Semester II Level 400 Discipline Specific Core			
II	PGMP –GEG-DSC-405	Advanced Population Studies in Geography	3+1
II	PGMP –GEG- DSC-406	Advanced Economic Geography	3+1
II	PGMP –GEG- DSC-407	Introduction toGeographic Information System	2+2
II	PGMP –GEG- DSC-408	Field Techniques and Village Survey	2+2
Semester II Level 400 Discipline Specific Elective			
II	PGMP –GEG-DSE-406	Techniques of Disaster Management, Mitigation and Resilience	2
II	PGMP –GEG-DSE-407	Geographical Thought	2
II	PGMP –GEG-DSE-	Advanced Urban Geography	2

	408		
II	PGMP –GEG-DSE-409	Soil and Water Resource Management	2
II	PGMP –GEG-DSE-410	Geography of India	2
Semester III Level 500 Generic Elective			
III	PGMP –GEG-GE-501	Regional Perspectives ofGeopolitics	4
III	PGMP-GEG-GE-502	Urbanisation and Society in 21st Century	4
III	PGMP-GEG-GE-502	Agro Meteorology	4
Semester III Level 500 Discipline specific research Elective			
III	PGMP –GEG-DSRE-401	Advanced Research Design	4
III	PGMP-GEG-DSRE-402	Advanced Quantitative Techniques in Geography	4
III	PGMP-GEG-DSRE-403	Research Applications in Physical Geography	4
III	PGMP-GEG-DSRE-404	Research Applications in Human Geography	4
Semester IV Level 500 Discipline Specific Research or Internship			
IV	PGMP –GEG-DSR-401	Dissertation/Internship	16

Guidelines for Internship and Dissertation

Annexure C

MA GEOGRAPHY

SEMESTER I

Level 400 <u>Discipline Specific Core</u>

Course Title: Advanced Geomorphology
Course Code: PGMP –GEG-DSC- 401
Credits: 03
Marks: 75
Duration: 45Hours of 1 hour each

Pre-requisite Courses:
- Basic knowledge about geomorphic concepts

Course Objectives:
1. To understanding the natural processes which act on the earth's surface, shaping landforms.
2. To perform absolute dating techniques to find the ages of geological formation.
3. Assess the roles of structure, stage and time in shaping the landforms, interpret geomorphological maps and apply the knowledge in geographical research.
4. To develop skills in landform recognition and interpretation of geological features and maps

Course Learning Outcomes:
After successful completion of the course the students will be able to:
CLO1: Understand the dynamics of the physical geography including the origin of the Earth and its evolution through geologic time scale.
CLO2: Differentiate various process in landform formations which shapes the earth.
CLO3: Analyse the relationship between folding, faulting, volcanic activity, and plate tectonics.
CLO4: Applying geomorphology skills in Disaster management and planning.

Course Content

Module	Topic	Subtopic	Hours
I	Concept of geomorphology and Geo tectonic	Fundamental Concepts in Geomorphology, Theories of Landform Development, (L.C King, Wood, John Hack and Frank Ahnert)	15
		Geomorphic Dating Methods: Radiocarbon dating, tree-ring dating (Dendrochronology), and Lichenometry.)	
		Recent advancement in Geo-tectonics- Plate tectonics, Geosynclines and Geo-magnetism	
II	Tropical Geomorphology	Polycyclic reliefs.	15
		Weathering in Tropical areas	
		Denudation processes	
		Landforms in humid tropics	
III	Applied Geomorphology	Role of Geomorphology in Hazard management and mitigation	15
		Application of geomorphology in planning and development	
		TOTAL	**45**

References:

Mandatory:
1. Thornbury, W. D. (2013) Principles of Geomorphology. New Delhi: New Age International Limited Publishers.
2. Gupta A. (2011) Tropical Geomorphology, Cambridge University Press.
3. Christopherson, Robert W., (2011) Geosystems: An Introduction to Physical Geography, 8 Ed., Macmillan Publishing Company.
4. Singh, S. (2006) Physical Geography. Allahabad: Prayag Pustak Bhavan.
5. Allision, R. (2002) Applied Geomorphology: Theory and Practices, Wiley Europe.
6. Bloom A. L. (2003) Geomorphology: A Systematic Analysis of Late Cenozoic Landforms, Prentice-Hall of India, New Delhi.
7. Kale, V. and Gupta, A. (2001) Introduction to Geomorphology, Orient Longman, Kolkata.

Supplementary:
1. Siddhartha, K. (2013). The Earth's Dynamic Surface. New Delhi: Kisalaya Publications Pvt. Limited.
2. Goudie Andrew (2014), Encyclopedia of Geomorphology, Volume I, Routledge Publication.
3. Goudie Andrew (2014), Encyclopedia of Geomorphology, Volume II, Routledge Publication.
4. Selby, M.J. (2005) Earth's Changing Surface, Indian Edition, OUP.

Web References:
1. http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000017GE/P001786/M025400/ET/1512631234UGCModuleofAppliedGeomorphologyfinal.pdf
2. https://www.nationalgeographic.org/encyclopedia/uniformitarianism/
3. http://studymaterial.unipune.ac.in:8080/jspui/bitstream/123456789/4495/1/Gg.111%20davis%20theory.pdf
4. https://study.com/academy/lesson/isostasy-definition-equation-examples.html
5. https://www.geographynotes.com/geomorphology/7-major-geomorphic-theories-of-landform-development/686
6. https://www.bbc.co.uk/bitesize/guides/z83nj6f/revision/2
7. https://lotusarise.com/applied-geomorphology-upsc/
8. https://onlinelibrary.wiley.com/doi/abs/10.1002/9781118786352.wbieg0144#:~:text=Applied%20geomorphology%20is%20a%20field,to%20problems%20of%20geomorphic%20context.

Course Title: Advanced Geomorphology (Practical)
Course Code: PGMP –GEG-DSC- 401
Credits: 01
Marks: 25
Duration: 15 Practical of 2hrs each

Course Content

Module	Topic	Subtopic	Hours
I	Geomorphic Mapping	Morphometric Analysis (Drainage Basin) Geomorphic mapping Sediment size Analysis	20
II	Field work	Observation of faults lineament and rocks.Measurement of channel cross-sections in the field, Study of erosional and depositional features in the field (river and coast).	10
		TOTAL	**30**

References:
Mandatory:
1. Khullar D. R. (2007) Essentials of Practical Geography, New Academic Publishing Co. Jalandhar.
2. Strahler A. (2016) Introducing Physical Geography, 6th ed., Wiley.
3. SinghR. L. and Singh P. B. R. (2014) Elements of Practical Geography, Kalyani Publishers, New Delhi.
4. Singh, R. B. (ed.), (2006). Natural Hazards and Disaster Management: Vulnerability and Mitigation, Rawat Publications Delhi, India.
5. Kale, V. and Gupta, A. (2001) Introduction to Geomorphology, Orient Longman, Kolkata.

Supplementary:
1. Khullar D. R. (2007) Essentials of Practical Geography, New Academic Publishing Co. Jalandhar.
2. Sarkar, A. (2015) Practical Geography: A systematic approach, Orient Black Swan Private Ltd., New Delhi.
3. Siddhartha, K. (2013). The Earth's Dynamic Surface. New Delhi: Kisalaya Publications Pvt. Limited.

Web References:
1. https://www.geog.ucl.ac.uk/resources/laboratory/laboratory-methods/particle-size-analysis/particle-size-analysis-for-soils-sediments
2. https://www.fsl.orst.edu/geowater/FX3/help/3_Running_FishXing/Crossing_Input_Window/Tailwater_Methods/Channel_Cross_Section_Method.htm
3. https://irangeomorphology.ir/files/site1/ybakhshi_67841/files/Geomorphological_Mapping.pdf
4. https://www.hindawi.com/journals/geography/2014/927176/

5. https://www.geomorphology.org.uk/sites/default/files/geom_tech_chapters/2.6_GeomMapping.pdf
6. https://www.youtube.com/watch?v=BJR8drMF7yI
7. https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1029/2008JF001092#:~:text=The%20hypsometric%20curve%20represents%20the,Keller%20and%20Pinter%2C%202002%5D.
8. https://www.youtube.com/watch?v=u6q7u2lIW_M

Course Title: Advanced Climatology
Course Code: PGMP –GEG-DSC- 402
Credits: 03
Marks: 75
Duration: 45Hours of 1 hour each

Pre-requisite Courses: NIL
Course Objectives:
1. To develop knowledge of the structure of the atmosphere and atmospheric phenomena and
2. To understand the nature and scope of modern study of climate by imparting latest knowledge about the basic thermal and dynamical atmospheric processes operating at different spatial and temporal scales
3. To understand climatic variability and change to the issue of current and future global environmental change.
4. To explain weather generation systems of the atmosphere and how they influence Climate of the world and regions in the long term

Course Learning Outcomes:
After successful completion of the course the students will be able to:
CLO1: Develop in depth basic knowledge of atmospheric weather and climate and the structure of the atmosphere.
CLO2: Understand and explain how temperature, pressure, humidity and wind motion vary in time and space and their effect on weather.
CLO3: Understanding the characteristics of climatic regions.
CLO4: Apply knowledge on upper atmospheric conditions and cyclonic features.

Course Content

Module	Topic	Subtopic	Hours
I	Atmospheric Motions	Atmospheric humidity and Condensation, Fog Clouds and Precipitation, Airmasses, Fronts and Glacial Lake Outburst (GLO) Precipitation Theories: Ice-crystal theory, Collision-Coalescence Theory	15
II	Monsoon Dynamics	Theories of Monsoonal Circulation. Indian Ocean Dipole, Madden-Julian Oscillation index. Atmospheric stability and instability Jet streams, ENSO Events. Western Disturbances and Easterly waves.	15
III	Climatic Classification and	Climatic Classification – Kopppen and Thornwite classification, Genesis and impacts of Atmospheric disturbances: Cyclones	15

Disturbances   and anti-cyclones, Thunderstorms, Tornadoes, Hailstorms, Heat and Cold waves,

TOTAL   **45**

References:
Mandatory:
1. Lal, D. S. (2003). Climatology. Allahabad: Sharda Pustak Bhawan.
2. Oliver, J. E. (2002). Climatology: An Atmospheric Science. Noida: Pearson Education India.
3. Rohli, R. V., & Vega, A. J. (2017). Climatology. Burlington: Jones & Bartlett Learning.
4. Strahler, A. (2013). Introducing Physical Geography (6 ed.). New York: Wiley.
5. Thompson, R., & Perry, A. (1997). Applied Climatology. New York: Routledge.
6. Trewartha, G. T. (1980). An Introduction to Climate (5 ed.). New York: McGraw Hill.

Supplementary:
1. Singh, S.(2020). Climatology. Pravalika Publications. Allahabad.
2. IPCC, 2013. Climate Change 2013: The Physical Science Basis, the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, Moduleed Kingdom and New York, NY, USA,
3. Chawan S.V. (ed) (2015): Physical Geography, Paper I, Published by Director (I/C), Institute of Distance and Open Learning, University of Mumbai.

Web References:
1. https://www.imdpune.gov.in/training/training%20notes/Climatology-IMTC.pdf
2. https://samples.jbpub.com/9781284032307/9781284028775_CH01_Rohli3e_SECURE.pdf
3. https://en.wikibooks.org/wiki/Climatology/Introduction
4. https://assamhistory.com/climatology/
5. https://www.pmfias.com/climatology/

Course Title: Advanced Climatology (Practical)
Course Code: PGMP –GEG-DSC- 402
Credits: 01
Marks: 25
Duration: 15 Practical of 2hrs each

Course Content

Module	Topic	Subtopic	Hours
I	Temperature and Rainfall Analysis	Collection and Processing of atmospheric data. Analysis of atmospheric data – Tephigram (Temperature-Height diagram). Classification of climate based on Koppen and Thornthwaite's Climatic classification. Discomfort index by Thom's (1959) method. Identification and categorization of heat and cold waves. Calculation of decadal rainfall deviation.	18
II	Water Budget	Computation of water budget and water deficit amounts during crop growing season. Computation of Water Requirement Satisfaction index. Construction of crop-coefficient curve for any one crop.	12
		TOTAL	**30**

References:
Mandatory:
1. Lal, D. S. (2003). Climatology. Allahabad: Sharda Pustak Bhawan.
2. Oliver, J. E. (2002). Climatology: An Atmospheric Science. Noida: Pearson Education India.
3. Rohli, R. V., & Vega, A. J. (2017). Climatology. Burlington: Jones & Bartlett Learning.
4. Strahler, A. (2013). Introducing Physical Geography (6 ed.). New York: Wiley.
5. Thompson, R., & Perry, A. (1997). Applied Climatology. New York: Routledge.
6. Trewartha, G. T. (1980). An Introduction to Climate (5 ed.). New York: McGraw Hill.

Supplementary:
1. Aguado, E. Burt, J.E. (2001): Understanding Weather and Climate, Prentice Hall of India Pvt. Ltd, New Delhi.
2. Critchfield, H.J. (1983): General Climatology, Prentice Hall of India, New Delhi.
3. Oliver John, E. and Hidore John, J. (2003): Climatology, Pearson Education.
4. Oliver, J. E., and Hidore J. J., (2002): Climatology: An Atmospheric Science, Pearson Education, New Delhi.
5. Trewartha, G. T., and Horne L. H., (1980): An Introduction to Climate, McGraw-Hill

Course Title: Introduction to Remote Sensing
Course Code: PGMP –GEG-DSC- 403
Credits:02
Marks: 50
Duration: 30 hrs

Prerequisite Courses: Nil

Course Objectives:
1. To introduce basics of remote sensing and its importance.
2. Attain a foundational knowledge and comprehension of the physical computational and perceptional bias of remote sensing.
3. To attain the data collection processes in remote sensing.
4. Aware and use of modern techniques in geography through remote sensing.

Course Outcomes:
At the end of this course, students will be able to:
CO1: Understand basic principles of remote sensing.
CO2: Compare traditional vs. modern techniques of remote sensing.
CO3: Explain basic computational properties of remote sensing.
CO4: Classify the different datasets and products of remote sensing applications.

Course Content

Module	Topic	Subtopic	Hours
I	Introduction to Remote Sensing system, Satellites and Aerial Photographs	Remote Sensing: principles, historical development, satellite and sensors, concept of resolution, photography vs. image. Aerial photography: stereoscopy, principles of aerial photo interpretation	15
II	Electro-magnetic Radiation, and Spectral Signatures	Electromagnetic radiation principles; interaction mechanism with atmosphere and earth surfaces; spectral responses of earth surface features, visual interpretation of satellite images	15
		TOTAL	**30**

Reference Books:
Mandatory:
1. Bossler J.D (2002), Manual of Geospatial Science and Technology, Taylor and Francis, London.
2. Girard M.C and Girard C.M (2003), Processing of Remote Sensing Data, Oxford & IBH, New Delhi.

3. John R. Jensen (2000), Remote Sensing of the environment: An earth resource perspective, Pearson publication.
4. John.Wiley and Sons. Pradip Kumar Guha (2013), Remote Sensing for the beginner, Third Edition, East-West Press, New Delhi.
5. Suresh S and Mani K., (2017), Application of Remote Sensing in understanding the relationship Between NDVI and LST, IJRET, Vol. 6, Issue: 02.

Supplementary:

1. Campbell, J.B.2002: Introduction to Remote Sensing. Taylor Publications
2. Jensen, J.R. 2000: Remote Sensing of the Environment: An Earth Resource Perspective. Prentice Hall.
3. Joseph George, 2003: Fundamentals of Remote Sensing. Universities Press

Web references:

1. https://www.usgs.gov/faqs/what-remote-sensing-and-what-it-used#:~:text=Remote%20sensing%20is%20the%20process,sense%22%20things%20about%20the%20Earth.
2. https://oceanservice.noaa.gov/facts/remotesensing.html
3. https://gisgeography.com/remote-sensing-earth-observation-guide/

Course Title: Introduction to Remote Sensing (Practical)
Course Code: PGMP –GEG-DSC- 403
Credits: 02
Marks: 50
Duration: 60 hours

Prerequisite Courses:
1. Basic knowledge of Remote Sensing
2. Bridge course is compulsory who have not completed Remote Sensing at under graduate level

Course Objective:
1. To introduce basics of remote sensing and its importance.
2. Attain a foundational knowledge and comprehension of the physical computational and perception bases of remote sensing.
3. To attain the data collection processes in remote sensing.
4. Aware and use of modern techniques in geography through remote sensing.

Course Outcomes:
At the end of this course, students will be able to:
CO1: Understand traditional v/s modern techniques of remote sensing.
CO2: understand and recognize and explain basic computational properties and remote sensing.
CO3: Classify the different datasets and products of remote sensing applications.

Course Content

Module	Topic	Subtopic	Hours
I	Data Representation& Accessing Web Resources	Downloading free satellite data: Multispectral Data and Digital Elevation Data Introduction to Remote Sensing Software, Image visualization. Comparison of images with various resolution concepts Basic calculations (scale, height of objects) on aerial photographs Visual Interpretation of Aerial Photographs Colour composite in remote sensing software Visual interpretation of satellite images.	15
II	Image Interpretation, Image Classification & Change Detection	Image Correction, PCA and indices, Image classification techniques, Accuracy Assessment, Area calculations, Change Detection in land use pattern	15
		TOTAL	**60**

Reference Books:
Mandatory:
1. Bossler J.D (2002), Manual of Geospatial Science and Technology, Taylor and Francis, London.
2. Girard M.C and Girard C.M (2003), Processing of Remote Sensing Data, Oxford & IBH, New Delhi.
3. John R. Jensen (2000), Remote Sensing of the environment: An earth resource perspective, Pearson publication.
4. John.Wiley and Sons. Pradip Kumar Guha (2013), Remote Sensing for the beginner, Third Edition, East-West Press, New Delhi.
5. Suresh S and Mani K., (2017), Application of Remote Sensing in understanding the relationship Between NDVI and LST, IJRET, Vol. 6, Issue: 02.

Supplementary:
1. Campbell, J.B.2002: Introduction to Remote Sensing. Taylor Publications
2. Jensen, J.R. 2000: Remote Sensing of the Environment: An Earth Resource Perspective. Prentice Hall.
3. Joseph George, 2003: Fundamentals of Remote Sensing. Universities Press

Web references:
1. https://www.usgs.gov/faqs/what-remote-sensing-and-what-it-used#:~:text=Remote%20sensing%20is%20the%20process,sense%22%20things%20about%20the%20Earth.
2. https://oceanservice.noaa.gov/facts/remotesensing.html
3. https://gisgeography.com/remote-sensing-earth-observation-guide/
4. http://www.ai.soc.i.kyoto-u.ac.jp/field_en/english_textbook/RemoteSensing_1.
5. https://www.iwmi.cgiar.org/assessment/files/word/Workshops/ILRI-March/Presentations/Atsmachew.pdf

Course Title: Advanced Cartographic Skills in Geography
Course Code: PGMP –GEG-DSC- 404
Credits: 02
Marks: 50
Duration: 30 Practical of 2 hrs each

Pre-requisite Courses: Students must have knowledge of cartography skills such as scales and map types.

Course Objectives:
1. Understand what a survey, pre-requisites and post field work practices.
2. Apply various field based methods for data collection.
3. Design and formulate survey plans and questionnaires.

Course Learning Outcomes: After successful completion of the course the students will be able to:
CO1: Will be able to perform survey techniques in different terrain and conditions.
CO2: Will be able to prepare and test questionnaire.
CO3: Enhancement of skills in using of various field instruments like GPS & DGPS in survey.
CO4: Able to create plans and map layouts using cartography skills.

Course Content

Module	Topic	Subtopic	Hours
I	Map Scales and Projections	Elements of Maps Types and classification of Maps Indexing of Maps - SOI Toposheet, USGS Maps Map Projections and datum-Concept and Types	30
II	Computer Aided Cartography	Data Entry, Editing, Sorting and Retrieval DBMS (Data Base Management System) Interpolation and Extrapolation	30
		Total	**60**

References:
Mandatory:
1. Kraak M.-J. and Ormeling F., 2003: Cartography: Visualization of Geo-Spatial Data, Prentice-Hall
2. Mishra R.P. Ramesh. A 2000, Fundamentals of Cartography. Concept Publishing Company, New Delhi.
3. Robinson A. H., 2009: Elements of Cartography, John Wiley and Sons, New York.
4. Sarkar, A. (2015) Practical geography: A systematic approach. Orient Black Swan Private Ltd., New Delhi
5. Peterson, G.N. 2009. GIS Cartography, A Guide to effective map designing, CRC Press.
Supplementary:

1. Singh &Karanjta., 1972. Map work and Practical Geography Central Book Dept Allahabad 1972.
2. Singh, R.L.andDutt, P.K., 1968. Elements of Practical Geography, Students Friends, Allahabad.1968.

Web references:
1. http://uregina.ca/~sauchyn/geog411/
2. https://www.arcgis.com/home/item.html?id=12bde0260dd84c148446072c52c7c9d2
3. https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1015&context=geographyfacpub
4. https://www.sciencedirect.com/topics/earth-and-planetary-sciences/field-survey
5. https://methods.sagepub.com/reference/encyclopedia-of-survey-research-methods/n187.xml

Course Title: Advanced Cartographic Skills in Geography (Practical)
Course Code: PGMP –GEG-DSC- 404
Credits: 02
Marks: 50
Duration :60 hours

Course Content

Mod ule	Topic	Subtopic	Hours
I	Map Scales and Projections	Map Projections – Conical, Cylindrical, Zenithal (3 each) Types and classification of Maps Classification of Colour Schemes, for various data representation. Lettering of map	30
II	Data Representation	Data Analysis: Processing of Data; tabulation, graphic presentation and analysis of Data (using Excel)	30
		Total	**60**

References:
Mandatory:
1. Kraak M.-J. and Ormeling F., 2003: Cartography: Visualization of Geo-Spatial Data, Prentice-Hall
2. Mishra R.P. Ramesh. A 2000, Fundamentals of Cartography. Concept Publishing Company, New Delhi.
3. Robinson A. H., 2009: Elements of Cartography, John Wiley and Sons, New York.
4. Sarkar, A. (2015) Practical geography: A systematic approach. Orient Black Swan Private Ltd., New Delhi
5. Peterson, G.N. 2009. GIS Cartography, A Guide to effective map designing, CRC Press.

Supplementary:
1. Singh &Karanjta., 1972. Map work and Practical Geography Central Book Dept Allahabad 1972.
2. Singh, R.L.andDutt, P.K., 1968. Elements of Practical Geography, Students Friends, Allahabad.1968.

Web references:
1. http://uregina.ca/~sauchyn/geog411/
2. https://www.arcgis.com/home/item.html?id=12bde0260dd84c148446072c52c7c9d2
3. https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1015&context=geographyfac pub
4. https://www.sciencedirect.com/topics/earth-and-planetary-sciences/field-survey
5. https://methods.sagepub.com/reference/encyclopedia-of-survey-research-methods/n187.xml

Discipline Specific Electives

Course Title: Regional Planning and Development
Course Code: PGMP –GEG-DSE- 401
Credits: 02
Marks: 50

Prerequisite Courses: NIL

Course Objectives:
1. To equip the students with the knowledge of regions: in terms of typology, functions and to prepare planning for the regions through the understanding of land, infrastructure, climate, etc
2. To understand the structure and nature of development and planning process and different levels.

Course Learning Outcomes:
After successful completion of the course the students will be able to
CLO1:   Understand regional planning and its importance to regional development.
CLO2:   Differentiate types of regions in context of formal and functional regions for development purpose and sustainable practices in regional planning and development.
CLO3:   Support the concept of multi-level planning and decentralized planning and the participation of people in planning process.

Course Content

Module	Topic	Subtopic	Hours
I	Concept and Types of regions	concept of Region in geography, approaches and applications to regional planning concept of space, area and locational attributes. Types of regions, hierarchy; Delineation of different types of regions and their utility in planning.	15
II	Regional case studies and applications	Planning process – sectoral, temporal and spatial dimensions; short-term and long-term perspectives of planning Physical regions, resource regions, regional divisions according to variations in levels of socio-economic development; Special purpose regions: river valley regions, metropolitan regions, Problem regions-hilly regions, tribal regions, regions of drought and floods. Indicators of development and their data sources,	15

measuring levels of regional development and disparities –A case study from ~~of~~ India.

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TOTAL   **30**

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References:
Mandatory:
1. Glasson, J. (2017) Contemporary Issues in Regional Planning, Routledge.
2. Chandana, R.C. (2016) Regional Planning and Development, 6th ed, Kalyani Publishers.
3. Kumar, A., Meshram, D.S., Gowda, K. (Eds) (2016) Urban and Regional Planning Education: Learning for India, Springer.
4. Town and Country Planning Organisation, (2015) Ministry of Urban and Development Plan Formulation and Implementation (URDPFI) Guidelines, Government of India, Ministry of Urban Development, Vol. 1.
5. Bhargava, G. (2001) Development of India's Urban, Rural, and Regional Planning in 21st Century: Policy Perspective, Gyan Publishing House.
6. Chand, M., Puri, V.K. (2000) Regional Planning In India, Allied Publishers Ltd.

Supplementary:

1. Higgins, B., Savoie, D.J. (2017) Regional Development: Theories and Their Application, Routledge .
2. Gore, C. (2011) Regions in Question: Space, Development Theory, and Regional Policy, Routledge.
3. Ray, J. (2001) Introduction to Development & Regional Planning, Orient Blackswan.

Web references:
1. https://mohua.gov.in/upload/uploadfiles/files/URDPFI%20Guidelines%20Vol%20I(2).pdf
2. https://rdavisaphgfinal.weebly.com/nature-and-perspectives/types-of-regions
3. https://www.albert.io/blog/regions-ap-human-geography-crash-course/
4. http://www2.harpercollege.edu/mhealy/g101ilec/intro/int/g3intrfr.htm
5. https://www.brainkart.com/article/Approaches-to-the-Study-of-Geography_33741/
6. https://geographyandyou.com/regional-development-and-planning-in-india/
7. https://mitpress.mit.edu/books/regional-development-and-planning
8. https://journals.sagepub.com/doi/10.1177/016001760102400307

Course Title: Techniques of Regional Analysis
Course Code: PGMP –GEG-DSE- 402
Credits: 02
Marks: 50
Duration: 30hrs

Prerequisite Courses: Nil

Course Objectives:
1. To equip the students with the knowledge of regions: in terms of typology, functions and to prepare planning for the regions through the understanding of land, infrastructure, climate, etc
2. To understand the structure and nature of development and planning process and different levels.
3. To create an understanding of reserve utilization in terms of sustainable development.

Course Learning Outcomes:
After successful completion of the course the students will be able to
CLO1: Differentiate types of regions in context of formal and functional regions for development purpose.
CLO2: Determine the importance of sustainable practices in regional planning and development.
CLO3: Support the concept of multi-level planning and decentralized planning and the participation of people in planning process.

Module	Topic	Subtopic	Hours
I	Introduction	Introduction: origin, growth, scope and nature of regional science. Attributes of Regional Analysis- Physical and Cultural Case study of Physical and Cultural Attributes.	15
II	Regional Analysis	Regional Economic Analysis: regional income estimation and social accounting; interregional flow analysis and balance of payment statements; regional cycle and multiplier analysis; regional industrial location and complex analysis; interregional and regional input-output techniques. Decision Analysis: game theory and decision analysis	15

References:
Mandatory

1. Glasson, J. (2017) Contemporary Issues in Regional Planning, Routledge.
2. Chandana, R.C. (2016) Regional Planning and Development, 6th ed, Kalyani Publishers.

3. Kumar, A., Meshram, D.S., Gowda, K. (Eds) (2016) Urban and Regional Planning Education: Learning for India, Springer.
4. Bhargava, G. (2001) Development of India's Urban, Rural, and Regional Planning in 21st Century: Policy Perspective, Gyan Publishing House.
5. Chand, M., Puri, V.K. (2000) Regional Planning In India, Allied Publishers Ltd.

Supplementary:

1. Higgins, B., Savoie, D.J. (2017) Regional Development: Theories and Their Application, Routledge .
2. Gore, C. (2011) Regions in Question: Space, Development Theory, and Regional Policy, Routledge.
3. Ray, J. (2001) Introduction to Development & Regional Planning, Orient Blackswan.

Web References:

1. http://www.economia.unam.mx/cedrus/descargas/Methodsofregionalanalysis.pdf
2. https://library.fiveable.me/ap-hug/Module-1/regional-analysis/study-guide/KBREMrUx0XlbNmfha937
3. https://globalchange.mit.edu/research/focus-areas/regional-analysis
4. https://static1.squarespace.com/static/5887c80b86e6c0638ec11e45/t/5afc25c4562fa76042f3c270/1526474184866/CB714+-+Part+3.pdf
5. https://ideas.repec.org/a/bla/presci/v1y1955i1p227-247.html
6. http://www.usp.br/nereus/wp-content/uploads/Industrial-location.pdf
7. https://niu.edu.in/sla/online-classes/Location-of-Industries.pdf

Course Title: Environment Impact Assessment
Course Code: PGMP –GEG-DSE- 403
Credits: 02
Marks: 50
Duration: 30hrs

Prerequisite Courses: Nil

Course Objectives:
1. It lays the foundation of environmental issues and its impact on society.
2. To gain skills to mitigate the environmental problems.

Course outcome:
After successful completion of the course the students will be able to:

CLO1: The students will learn various issues related to environmental impact assessment and its importance.

CLO2: Will be able to understand the various policies related to environment and classify the environmental issues

CLO3: Will be able to create EIA report

Course Content

Module	Topic	Subtopic	Hours
I	Environmental Impact Assessment (EIA) Concepts	EIA: Principles, Concepts and approaches, Methods, procedure and current issues in EIA. Environmental Impact Assessment Regulations and Policies in India. Procedures of EIA: Less Developed and More Developed countries EIA Procedures, National Green Tribunal.	15
II	Evaluation and Policies	EIA: evaluation and mitigation, cost-benefit analysis of any two projects in India Case Studies of environmental impact assessment: Water Impact Assessment; Hydroelectric power Impact Assessment; Ecological Impact assessment; Social Impact Assessment; Mining Impact Assessment.	15
		TOTAL	**30**

References:
Mandatory
1. Richard, K. Morgan, 1999. Environmental Impact Assessment: A Methodological Perspective, Springer.
2. Sinclair, J., 2000. Canadian Environmental Assessment in Transition, University of Waterloo Press, Waterloo.
3. Smith, L.G., 1993. Impact Assessment and Sustainable Resource Management, Longman, Harlow.

4. Subramanian, V., 2001. Text Book on Environmental Sciences, Narosa Publishing House, N. Delhi.
5. Eccleston, C. H., 2017. Environmental Impact Assessment: A Guide to Best Professional Practices, CRC Press, New York.

Supplementary
1. Chandna R. C., 2002: Environmental Geography, Kalyani, Ludhiana
2. Cunninghum W. P. and Cunninghum M. A., 2004: Principals of EnvironmentalScience: Inquiry and Applications, Tata Macgraw Hill, New Delhi.
3. MoEF, 2006: National Environmental Policy-2006, Ministry of Environment andForests, Government of India.
4. Singh, R.B. (Eds.) (2009) Biogeography and Biodiversity. Rawat Publication, Jaipur

Course Title: Natural Resource Management
Course Code: PGMP –GEG-DSE- 404
Credits: 02
Marks: 50
Duration: 30hrs

Prerequisite Courses: Nil

Course Objectives:
1. Awareness about resource availability, accessibility, utilization, its use and misuse.
2. Spatial distribution of natural resources.

Course outcome:
After successful completion of the course the students will be able to:
   CLO1: Conservation methods and awareness about community participation in resource management and utilization.
   CLO2: Assessment of role of national and international efforts to mitigate resource problems.

Course Content

Module	Topic	Subtopic	Hours
I	Natural Resources	Introduction: Concept, approaches and appraisal to natural resource management, Natural Resources: Land, Water, Forest. Integrated Resource Management: Case Studies (any one) from Himalayan, coastal and desert regions, use of techniques of RS and GIS.	15
II	Resource Management	Problems in Resource Management: Issues and constraints in resource management, Environmental, Political and Socio-Economic challenges. Governance: Sustainable Development Goals, (SDG 12) National Policy, Planning and Institutional advancement in natural resource management.	15
		TOTAL	**30**

References:
Mandatory
1. Berkes, F. (ed.), 1989. Common Property Resources: Ecology and CommModuley Based Sustainable Development, Belhaven Press London.
2. Mather, A.S. and Chapman, K. 1995. Environmental Resources, Longman, Harlow, England.
3. McClay, K.R. 1995. Resource Management Information System: Process & Practice, Taylor Francis, London.
4. Mitchell B. 1988. Geography and Resources Analysis, 2nd edition, Longman, London.

5. Newson, M.D. 1991. Land, Water and Development: River Basin Systems and Management, Routledge,London.
6. Owen, S. and Owens, P.L. 1991. Environment, Resources and Conservation, Cambridge University Press, New York.

Supplementary
1. Mitchell, B. 1997. Resource and Environmental Management, Longman, Harlow, England.
2. Taylor, Russel D., and Torquebiau, Emmanuel (Eds.). 2011. Natural Resource Management and Local Development, Springer, Netherland.
3. Thakur, B. 2003-2018. Perspectives in Resource Management in Developing Countries, Vol.1-13, Concept Publishing Company, New Delhi.

Course Title: Climate Change and Adaptations
Course Code: PGMP –GEG-DSE- 405
Credits: 02
Marks: 50
Duration: 30hrs

Prerequisite Courses: Nil

Course Objectives:
1. Providing in depth knowledge of Climate Change.
2. Assessment of Climate Change impacts on fragile ecosystems.
3. Adaptation strategy and governance.

Course outcome:
After successful completion of the course the students will be able to

CLO1:	Understanding of various dimensions of Climate Change.
CLO2:	Significance of adaptation strategies.
CLO3:	Evaluate the role of Local and global organisations

Course Content

Module	Topic	Subtopic	Hours
I	Introduction to Climate Change	Science of Climate Change: Meaning, Concept and Approaches.	15
		Measuring Climate Change: Urban heat islands, Stress, exposure, risk and vulnerability related to climatic hazards and disasters.	
		Empirical Assessment of Climate Change Adaptation: Assessment in fragile ecosystems; Mountain, Desert and Coastal.	
II	Climate Change and Adaptation	Climate Change Adaptation: Role of Indigenous Traditional Knowledge (ITK) and Resilience for Future Sustainability	15
		Policy Framework for Climate Change Adaptation: SDGs Approach, International Climate Change Agreements and Local Governance.	

References:
Mandatory

1. Adger, W. N. 2006. Vulnerability, Global Environmental Change, 16 (3), 268-281
2. Agrawala, S. and Fankhauser, S. (Eds.), 2008. Economic Aspects of Adaptation to Climate Change: Costs, Benefits and Policy Instruments, OECD, Paris
3. Barros, Vicente R. (eds.), 2014. Climate Change 2014. Impacts, Adaptation and Vulnerability: Global and Sectoral Aspects. Fifth Assessment Report of the Intergovernmental Panel on Climate Change (Part B; Regional Aspect), Cambridge University Press, New York.

4. Bergkamp, G., Orlando, B. and Burton, I. 2003. Change: Adaptation of Water Resources Management to Climate Change, IUCN, Gland.
5. Brewster, E. N. 2010. Climate Change Adaptation: Steps for a Vulnerable Planet, New York, Nova Science.

Supplementary:-
1. Mukherji Shormila, 2004. Fragile Environment, Manak Publication Pvt. Ltd.
2. NDMA, 2009. National Disaster Management Guidelines-Management of Landslides and Snow Avalanches. Publication of National Disaster Management Authority, Government of India. New Delhi
3. Pandey, R, Jha, S. 2011. Climate vulnerability index –measure of climate change vulnerability to communities: a case of rural Lower Himalayas, India, Mitigation and Adaptation Strategies Global Change, Published online December 2011
4. Rai, S.C. 2009. Land Use and Climate Change, Nova Science Publishers, Inc., New York.

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1. http://www.yourarticlelibrary.com/watershed-management/watershed-management-meaning-types-steps-and-programmes/77309
2. http://agritech.tnau.ac.in/agriculture/agri_majorareas_watershed_watershedmgt.html
3. https://dep.wv.gov/WWE/watershed/Pages/watershed_management.aspx
4. https://www.rdrwa.ca/node/27
5. https://www.teriin.org/blog/watershed-management-and-development

MA GEOGRAPHY
SEMESTER II

SEMESTER II Level 400 Discipline Specific Core

Course Title: Advanced Population Studies in Geography
Course Code: PGMP –GEG-DSC- 405
Credits: 03
Marks: 75
Duration:45 hrs

Prerequisite Courses: NIL

Course Objectives:
1. To introduce basic and advance concept of population characteristics to understand the dynamics of population.
2. To enable students to develop an understanding and apply certain theories of population theoriesin the context of population growth, resources and migration.
3. To envisage contemporary population issues in the context of India .

Course Learning Outcomes: After successful completion of the course the students will be able to

CLO1: Identify, describe, and explain key terms, themes, and concepts in population geography/Demonstrate basic understanding of key population geography concepts, patterns, and processes

CLO2: Demonstrate competency with population geographic and demographic datasets and analysis methods.

CLO3: Identify and apply theoretical social science concepts explain past and current population trends national &global contexts.

CLO4: Synthesize various theoretical frameworks and construction order to interpret principal causes and impacts associated with population change.

CLO5: Analyze and interpret and represent geographic population data using case studies that signify important recent and ongoing population trends

Course Content

Module	Topic	Sub topic	Hours
I	Population Geography as a discipline	Introduction to Population Geography: Development of population geography, contents and approaches in ~~of~~ population geography and sources of population data. Components of population physiological, social and economic.	15
	Spatio – temporal dynamics of population m	Fertility and mortality: Determinants of Fertility and Mortality, Demographic Transition theory, its relevance and impacts.	
		Global Population growth and distribution – Global perspective and dynamics of population growth	

II	Human Population over Time and Space, Determinants of population growth	Theories of Population growth: Malthus and Saddler. Importance of Migration, types of migration, cause – effect of migration, Indian migration abroad, recent trends and consequences. Migration theories – Lee, Ravenstein, Zelinsky and Sjaard.	15
III	Population Issues - Global and India	Pro – natal and Anti–natal population policies, two case studies, Population ageing, issues and challenges, climate change and displacement, India's Population Policy and consequences, Demographic dividend, Demographic Challenges in India Human development Index	15
		TOTAL	**45**

References:
Mandatory:

1. Newbold K.B. (2017) Population Geography: Tools & Issues, 3rd ed, Rowman & Littlefield Publishers.
2. Majumdar P.K. (2013) India's Demography: Changing Demographic Scenario in India, Rawat Publications.
3. Mukherji S. (2013) Migration in India: Links to Urbanization, Regional Disparities and Development Policies, Rawat Publications.
4. Pacione M. (2012) Population Geography: Progress and Prospect, Routledge.
5. Khullar D.R. (2011) India: A Comprehensive Geography, Kalyani Publishers.
6. Chandna R.C. (2002) Geography of Population: Concept, Determinants and Patterns, Kalyani Publishers, New Delhi.

Supplementary:
1. Fouberg, E.H., Murphy, A.B., de Blij H.J. (2015) Human Geography: People, Place, and Culture, 11thed, Wiley.
2. Dyson T. (2011) Population and Development: The Demographic Transition, Rawat Publications.
3. Hassan M. (2007) Population Geography, Rawat Publication, Jaipur.
4. Kayastha S. L. (2006) Geography of Population, Rawat Publication, Jaipur.

Web References:
1. https://www.studysmarter.co.uk/explanations/human-geography/population-geography/
2. http://www.eolss.net/sample-chapters/c01/e6-14-03-01.pdf
3. https://ofm.wa.gov/washington-data-research/population-demographics/population-estimates/components-population-change#:~:text=The%20main%20components%20of%20population,between%20live%20births%20and%20deaths.

4. https://www.nature.com/scitable/knowledge/library/introduction-to-population-demographics-83032908/
5. https://www.census.gov/newsroom/blogs/random-samplings/2016/03/growth-or-decline-understanding-how-populations-change.html
6. https://egyankosh.ac.in/bitstream/123456789/43759/1/Unit-3.pdf
7. https://hdr.undp.org/data-center/human-development-index#/indicies/HDI
8. https://www.geogalot.com/myp-humanities/year-10/population-patterns-and-trends/006-population-policies
9. https://ourworldindata.org/world-population-growth
10. https://www.jstor.org/stable/213996
11. http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000453PO/P001844/M029737/ET/1525155291PS_MU_15Lee_Migration_Theory__Push_and_pullModule15Paper10Ed.pdf

Course Title: Advanced Population Studies in Geography(Practical)
Course Code: PGMP –GEG-DSC- 405
Credits: 01
Marks: 25
Duration: 30 Hours

Course Content

Module	Topic	Sub Topic	Hours
I	Population growth and Distribution	Fertility and Mortality measures, Population growth and projections (semi average method, least square method, Exponential population growth), Population density- Arithmetic, Agricultural, Nutritional and Economic. Gender Ratio, Work Participation Rate, Literacy rate, Migration rate, Dependency ratio. Calories per head	16
II	Models	Gini's concentration Index Demographic Transition model Human Development Index Gender Index Poverty index Social development index	14
		TOTAL	**30**

References:

Mandatory:
1. Newbold K.B. (2017) Population Geography: Tools & Issues, 3rd ed, Rowman & Littlefield Publishers.
2. Majumdar P.K. (2013) India's Demography: Changing Demographic Scenario in India, Rawat Publications.
3. Mukherji S. (2013) Migration in India: Links to Urbanization, Regional Disparities and Development Policies, Rawat Publications.
4. Pacione M. (2012) Population Geography: Progress and Prospect, Routledge.
5. Khullar D.R. (2011) India: A Comprehensive Geography, Kalyani Publishers.
6. Chandna R.C. (2002) Geography of Population: Concept, Determinants and Patterns, Kalyani Publishers, New Delhi.

Supplementary:
1. Fouberg, E.H., Murphy, A.B., de Blij H.J. (2015) Human Geography: People, Place, and Culture, 11thed, Wiley.
2. Dyson T. (2011) Population and Development: The Demographic Transition, Rawat Publications.
3. Hassan M. (2007) Population Geography, Rawat Publication, Jaipur.
4. Kayastha S. L. (2006) Geography of Population, Rawat Publication, Jaipur.

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1. https://www.studysmarter.co.uk/explanations/human-geography/population-geography/
2. http://www.eolss.net/sample-chapters/c01/e6-14-03-01.pdf
3. https://ofm.wa.gov/washington-data-research/population-demographics/population-estimates/components-population-change#:~:text=The%20main%20components%20of%20population,between%20live%20births%20and%20deaths.
4. https://www.nature.com/scitable/knowledge/library/introduction-to-population-demographics-83032908/
5. https://www.census.gov/newsroom/blogs/random-samplings/2016/03/growth-or-decline-understanding-how-populations-change.html
6. https://egyankosh.ac.in/bitstream/123456789/43759/1/Unit-3.pdf
7. https://hdr.undp.org/data-center/human-development-index#/indicies/HDI
8. https://www.geogalot.com/myp-humanities/year-10/population-patterns-and-trends/006-population-policies
9. https://ourworldindata.org/world-population-growth
10. https://www.jstor.org/stable/213996
11. http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000453PO/P001844/M029737/ET/1525155291PS_MU_15Lee_Migration_Theory__Push_and_pullModule15Paper10Ed.pdf

Course Title:Advanced Economic Geography
Course Code: PGMP –GEG-DSC- 406

Marks: 100

Credits: 3

Duration: 45 Hours

Prerequisite Courses: Nil

Course Objectives:
1. To understand the ways in which economic activities are organized
2. To analyse the rapidly increasing integration of economies processes such as globalization, trade and transportation and their impacts on economic, cultural and social activities
3. To evaluate economic processes operating at different geographical scales are depending on the complex economic-political-social interactions that are framed at the global level.
4. Apply various statistical techniques, relevant to research in economic geography

Course Learning Outcomes:
At the end of this course, students will be able:
CO1: Understand and contrast on the theories related to economic geography with an emphasis on alternative viewpoints.
CO2: Recognize the significance of geographic concepts for understanding socio-economic processes and outcomes.
CO3: Apply and compare the global economic patterns with local economic scenarios
CO4: Apply, analysing and interpreting statistical data.

Module	Topic	Sub Topic	Hours
I	Introduction to Economic Activities	Trends in economic geography, Approaches in Economic Geography, Factors of location of economic activities (Physical, social, economic and cultural))	15
II	Models in economic geography	Von Thunen's model and its modifications. Potential Population Surfaces Labor Theory of Value- Karl Marx Behavioral Location Theory – Cyert and March \Economic development Models-Rostow Model, Friedmans Model	20
III	Trade and Transport	Modes of transportation and transport cost; accessibility and connectivity: international, inter and intraregional; comparative cost advantages. Typology of markets and market system. Globalisation and Markets (labour, resource, capital)	10
		TOTAL	**45**

References:

Mandatory:

1. Saxena, H. (2016): "Economic Geography", Rawat Publishers, Jaipur
2. Datt, G. And Mahajan, A. (2016): "Datt and Sundaram's Indian Economy", S. Chand Publishing, New Delhi
3. Singh K. & Siddiqui A. R. Economic Geography, Pravalika Publisher, Allahabad. 2016.
4. Roy, P. K. Economic geography: A Study of Resources, New Central Book Agency Ltd. Kolkata, 2014.
5. Saxena, H. M. Economic geography. Rawat Publication. New Delhi. 2013.
6. Sharm, T.C. Economic geography of India, Rawat Publication. New Delhi. 2013.
7. Gautam, A. (2010): "Advanced Economic Geography", ShardaPustakBhawan, Allahabad
8. Berry, Conkling & Ray (1988): Economic Geography Prentice Hall of India, New Jersey.

Supplementary:

1. Haninkdean M. (2012) Principles and Applications of Economic Geography: Economy, Policy, Environment, John Wiley& Sons
2. Miroslav N. Jovanovic(2009)Evolutionary Economic Geography, Location OfProduction And The European union Routledge, London And New York
3. M. Sokol (2011) Economic Geography. Undergraduate Study In Economics, Management, Finance And The Social Sciences, University Of London.
4. Pachurapiotr (2011) The Economic Geography Of Globalization,(Ed) Intech Pub.
5. Sharmistha Bagchi-Sen AndHelenlawton Smith (2006) Economic Geography Past, Present And Future (Edited). Routledge, USA.
6. Hegget Peter, Cliff A.D. et. al. (2001) Locational Methods, Locational Analysis in Human Geography, Vol. II Arnold – Heinemann Pub. (India)

Web Based:

1. http://dl.booktolearn.com/ebooks2/science/economy/9781138924512_An_Introduction_to_Economic_Geography_0868.pdf
2. https://london.ac.uk/sites/default/files/uploads/gy2164-economic-geography-study-guide.pdf
3. https://transportgeography.org/?page_id=5260
4. https://web.ccsu.edu/faculty/kyem/GEOG110/Economic_Geography/Economic%20Geography.htm
5. https://www.networkideas.org/wp-content/uploads/2020/11/STEP_Report.pdf
6. https://www.thoughtco.com/reillys-law-of-retail-gravitation-1433438
7. https://www.geographyforyou.com/2019/09/maximum-positive-deviation-crop.html
8. http://sajms.com/wp-content/uploads/2017/10/paper_2-1.pdf
9. http://gswb.in/wp-content/uploads/2012/08/v2n1jully2012_18.pdf

Course Title: Advanced Economic Geography (Practical)
Course Code: PGMP –GEG-DSC- 406
Credits: 01
Marks: 25
Duration: 30 Hours

Course Content

Module	Topic	Sub topic	Hours
1	Agricultural Regions	Jasbir Singh's modified method Gibbs Martins Index Maximum Positive Deviation method of Raffiullah(1956) Athawale's method of crop combination (1966) Sapre and Deshpande	**15**
2	Transport Network	I) Graph Theoretical measures of whole transport network, a)Non-ratio measures cyclomatic number diameter b) Ratio measures: Eta, Theta, Iota, Pi c) Measurement of route II) Measures of Individual elements of transport a) Associated number b) Degree of connectivity network c) Dispersion d) Accessibility Index	**15**
		TOTAL	**30**

References:

Mandatory:

1. Saxena, H. (2016): "Economic Geography", Rawat Publishers, Jaipur
2. Datt, G. And Mahajan, A. (2016): "Datt and Sundaram's Indian Economy", S. Chand Publishing, New Delhi
3. Singh K. & Siddiqui A. R. Economic Geography, Pravalika Publisher, Allahabad. 2016.
4. Roy, P. K. Economic geography: A Study of Resources, New Central Book Agency Ltd. Kolkata, 2014.
5. Saxena, H. M. Economic geography. Rawat Publication. New Delhi. 2013.
6. Sharm, T.C. Economic geography of India, Rawat Publication. New Delhi. 2013.
7. Gautam, A. (2010): "Advanced Economic Geography", ShardaPustakBhawan, Allahabad
8. Berry, Conkling & Ray (1988): Economic Geography Prentice Hall of India, New Jersey.

Supplementary:

1. Haninkdean M. (2012) Principles and Applications of Economic Geography: Economy, Policy, Environment, John Wiley& Sons

2. Miroslav N. Jovanovic(2009)Evolutionary Economic Geography, Location OfProduction And The European union Routledge, London And New York
3. M. Sokol (2011) Economic Geography. Undergraduate Study In Economics, Management, Finance And The Social Sciences, University Of London.
4. Pachurapiotr (2011) The Economic Geography Of Globalization,(Ed) Intech Pub.
5. Sharmistha Bagchi-Sen AndHelenlawton Smith (2006) Economic Geography Past, Present And Future (Edited). Routledge, USA.
6. Hegget Peter, Cliff A.D. et. al. (2001) Locational Methods, Locational Analysis in Human Geography, Vol. II Arnold – Heinemann Pub. (India)

Course Title: Introduction to Geographic Information System
Course code PGMP –GEG-DSC- 407
Credits: 2
Marks: 50
Duration: 30hrs

Prerequisite courses:NIL
Course objective -
1. The course focuses on the fundamentals concept Geographical Information System, and Global Positioning System
2. Introducing the spatial data, non- spatial data, hardware and software used in collection, processing and analysis of geospatial data.

Course outcome:
After successful completion of the course the students will be able to

CO1: Students will demonstrate proficiency and conceptual understanding in using software and automated techniques to carry out thematic maps and analysis through a series of laboratory exercises and creation of reports.

CO2: Personal effectiveness and workplace competencies are practiced through engagement in discussion boards, following course guidelines, and interactions with the instructor and other students in the class.

CO3: To be able use these skills to identify and analysed real world problem and preparing them for a successful career in geospatial industry and research institute.

Course Content

Module	Topic	Sub Topic	Hours
I	Introduction to GIS	Definition, Development and Applications: elements of GIS; geographic objects: point, line and area; coordinate systems and map projections Geographic Data, Input, Storage and Editing: spatial and attribute data, vector and raster-based models, digitization; storage and manipulation of GIS data bases, presentation of GIS output	**15**
II	Introduction to GPS	History of Positioning System GPS System Description, Error Sources & Receiver Introduction to DGPS and TOTAL Station, GPS Performance and Policy Applications Introduction to open-source GIS	15
		TOTAL	**30**

Reference book
Mandatory
1. Bhatta, B. (2008) Remote Sensing and GIS, Oxford University Press, New Delhi
2. Burrough, P.A. and McDonnell, R.A. (1998) Principles of geographical information systems. OxfordUniversity Press, Oxford, 327 pp.
3. Campbell, J.B. (2002). Introduction to remote sensing, 3rd ed., The Guilford Press. ISBN 1-57230-640-8.

4. Chang, K., 2009.Introduction to Geographic Information System, 4th Edition. McGraw Hill.
5. Jensen J. R., 2004: Introductory Digital Image Processing: A Remote Sensing Perspective, Prentice Hall.
6. Wolf P. R. and Dewitt B. A., 2000: Elements of Photogrammetry: With Applications in GIS, McGrawHill

Supplementary
1. Elangovan,K (2006) GIS: Fundamentals, Applications and Implementations. New India Publishing Agency, New Delhi.
2. Heywood, I., Cornelius, S., and Carver, S. (2006) An Introduction to Geographical Information Systems. Prentice Hall. 3rd edition.
3. *Jensen, J.R. (2000). Remote sensing of the environment: an Earth resource perspective. Prentice Hall. ISBN 0-13-489733-1.*
4. Thurston, J., Poiker, T.K. and J. Patrick Moore. (2003) Integrated Geospatial Technologies: A Guide to GPS, GIS, and Data Logging. Hoboken, New Jersey: Wiley.
5. Wise, S. (2002) GIS Basics. London: Taylor & Francis.

Web references
1) https://www.nrsc.gov.in/
2) https://www.iirs.gov.in/
3) http://www.undp.org/popin/wdtrends/wdtrends.htm
4) https://www.isprs.org/proceedings/xxxiii/congress/part7/1609_XXXIII-part7.pdf
5) http://www.tric.u-tokai.ac.jp/ISPRScom8/TC8/TC8_CD/headline/JAXA_Special_Session%20-%206/JTS64_20100608144600.pdf
6) https://www.semanticscholar.org/paper/Role-of-Remote-Sensing-in-Disaster-Management-Nirupama-Simonovic/da84562b2057ca5866d933d47ee8815a06f0229c

Course Title: Introduction toGeographic Information System(Practical)
Course code PGM-GEG.C10
Credits: 02
Marks: 50
Duration: 60 hours

Course Content

Module	Topic	Sub Topic	Hours
I	Introduction	Introduction to GIS Software	30
		Geo-referencing, Digitization and data joining, Vector & raster conversion, Geoprocessing tools, Query and Proximity Analysis, Overlay Analysis & Layout Preparation	
II	Data Analysis	Data joining, query analysis, Geo-database creation: point, line, area, Geoprocessing tools, Spatial analysis tools, Network analysis, shortest path, location-allocation	30
		Environmental modelling with GIS & Case study with sample GIS database	
		TOTAL	**60**

Reference book
Mandatory
1. Burrough, P.A. and McDonnell, R.A. (1998) Principles of geographical information systems. OxfordUniversity Press, Oxford, 327 pp.
2. Campbell, J.B. (2002). Introduction to remote sensing, 3rd ed., The Guilford Press. ISBN 1-57230-640-8
3. Chang, K. (2007) Introduction to Geographic Information System, 4th Edition. McGraw Hill.
4. Jensen J. R., 2004: Introductory Digital Image Processing: A Remote Sensing Perspective, Prentice Hall.
5. Wolf P. R. and Dewitt B. A., 2000: Elements of Photogrammetry: With Applications in GIS, McGrawHill

Supplementary
1. Elangovan,K (2006) GIS: Fundamentals, Applications and Implementations. New India Publishing Agency, New Delhi.
2. Heywood, I., Cornelius, S., and Carver, S. (2006) An Introduction to Geographical Information Systems. Prentice Hall. 3rd edition.
3. *Jensen, J.R. (2000). Remote sensing of the environment: an Earth resource perspective. Prentice Hall. ISBN 0-13-489733-1.*
4. Thurston, J., Poiker, T.K. and J. Patrick Moore. (2003) Integrated Geospatial Technologies: A Guide to GPS, GIS, and Data Logging. Hoboken, New Jersey: Wiley.
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2) https://www.iirs.gov.in/
3) http://www.undp.org/popin/wdtrends/wdtrends.htm

4) https://www.isprs.org/proceedings/xxxiii/congress/part7/1609_XXXIII-part7.pdf
5) http://www.tric.u-tokai.ac.jp/ISPRScom8/TC8/TC8_CD/headline/JAXA_Special_Session%20-%206/JTS64_20100608144600.pdf
6) https://www.semanticscholar.org/paper/Role-of-Remote-Sensing-in-Disaster-Management-Nirupama-Simonovic/da84562b2057ca5866d933d47ee8815a06f0229c

Course Title: Field Techniques and Village Survey
Course Code: PGMP –GEG-DSC- 408
Credits: 02
Marks: 50
Duration:30 hours

Pre-requisite Courses: Students must have knowledge of cartography skills such as scales and map types.

Course Objectives:
1. Understand what a survey, pre-requisites and post field work practices.
2. Apply various field-based methods for data collection.
3. Design and formulate survey plans and questionnaires.

Course Learning Outcomes: After successful completion of the course the students will be able to:
CO1: Will be able to perform survey techniques in different terrain and conditions.
CO2: Will be able to prepare and test questionnaire.
CO3: Enhancement of skills in using of various field instruments like GPS & DGPS in survey.
CO4: Able to create plans and map layouts using cartography skills.

Course Content

Module	Topic	Subtopic	Hours
I	Introduction to Field Survey and Village Survey.	Methods of data Collection preparation of questionnaires and schedule. Types of Survey Sampling Techniques Introduction to village survey. Importance of survey - scope and purpose, principles and application of selected survey instruments.	15
II	Sampling Techniques Questionnaire Formulation	Pre- field work, survey Strategies, Pilot Survey, Data Collection Report Writing	15
		TOTAL	**30**

References:
Mandatory:
1. Clendinning , J., 1958, Principles and use of Surveying Instruments. 2nd edition,Blockie.
2. Stoddard, Robert H. 1982. Field Techniques and Research Methods in Geography, Kendall/Hunt for National Council for Geographic Education
3. Lunsbury J.F. and Aldrich, F.T. 1979. Introduction to Geographic Field Methods and Techniques, Charles E. Mercill Publishing Company, Columbus.

4. Hay. I. 2010. Qualitative Research Methods in Human Geography, 3rd ed. Oxford University Press, South Melbourne, Australia,

Supplementary
1. Singh &Karanjta.,1972. Map work and Practical Geography Central Book Dept Allahabad 1972.
2. Singh, R.L.andDutt, P.K., 1968. Elements of Practical Geography, Students Friends, Allahabad.

Web references:
6. http://uregina.ca/~sauchyn/geog411/
7. https://www.arcgis.com/home/item.html?id=12bde0260dd84c148446072c52c7c9d2
8. https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1015&context=geographyfac pub
9. https://www.sciencedirect.com/topics/earth-and-planetary-sciences/field-survey
10. https://methods.sagepub.com/reference/encyclopedia-of-survey-research-methods/n187.xml

Course Title: Field Techniques and Village Survey (Practical)
Course Code: PGMP –GEG-DSC- 408
Credits: 02
Marks: 50
Duration:60 hours

Course Content

Module	Topic	Subtopic	Hours
I	Introduction to Field Survey and Survey instruments	Chain Survey Plane Table Survey (Radiation Method) Plane Table Survey (Intersection Method) Prismatic Compass Dumpy level: traverse survey, contour plan preparation	30
II	Types of Socio Economic survey and Web based Applications in data collection.	Interview, Questionnaire, Telephonic survey. Geographic data collection through web-based app's and processing and mapping of the data through computer techniques.	30
		TOTAL	**60**

References:
Mandatory:
1. Clendinning , J., 1958, Principles and use of Surveying Instruments. 2nd edition, Blockie.
2. Stoddard, Robert H. 1982. Field Techniques and Research Methods in Geography, Kendall/Hunt for National Council for Geographic Education
3. Lunsbury J.F. and Aldrich, F.T. 1979. Introduction to Geographic Field Methods and Techniques, Charles E. Mercill Publishing Company, Columbus.
4. Hay. I. 2010. Qualitative Research Methods in Human Geography, 3rd ed. Oxford University Press, South Melbourne, Australia,

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1. http://uregina.ca/~sauchyn/geog411/
2. https://www.arcgis.com/home/item.html?id=12bde0260dd84c148446072c52c7c9d2

3. https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1015&context=geographyfacpub
4. https://www.sciencedirect.com/topics/earth-and-planetary-sciences/field-survey
5. https://methods.sagepub.com/reference/encyclopedia-of-survey-research-methods/n187.xml

<u>Discipline Specific Electives</u>

Course Title: Techniques of Disaster Management, Mitigation and Resilience
Course Code: PGMP –GEG-DSE- 406
Credits: 02
Marks: 50
Duration: 30hrs

Prerequisite Courses: Nil
Course Objectives
1. To provide basic conceptual understanding of disasters.
2. To understand approaches of Disaster Management
3. To build skills to respond to disaster

Course Outcomes
After successful completion of the course the students will be able to
CLO1: Gain a perspective of disasters different than the Nature and Causes of Disaster.
CLO2: Pursue a profession in Disasters can do so by addressing real life issues of vulnerability of people.

Module	Topic	Subtopic	Hours
I	Definition and types of disaster	Meaning and concept of disaster, Types of Disaster a) Natural Disasters: Earthquakes, floods, drought, landside, land subsidence, cyclones, volcanoes, tsunami, avalanches, global climate extremes. b) Man-made disasters: Terrorism, gas and radiations leaks, toxic waste disposal, oil spills, forest fires. c)Social Economics and Environmental impact of disasters	15
II	Mitigation and Resilience techniques of Disaster	Concept of disaster management Disaster Management cycle, Disaster management policy, National and State Bodies for Disaster Management: (NDRF), Early Warming Systems, building design and construction in highly seismic zones, retrofitting of buildings.	15
		TOTAL	**30**

References

Mandatory
1. Kapur, A. (2010) Vulnerable India: A Geographical Study of Disasters, Sage Publication, New Delhi.

2. Modh, S. (2010) Managing Natural Disaster: Hydrological, Marine and Geological Disasters, Macmillan, Delhi.
3. Singh, R.B. (2005) Risk Assessment and Vulnerability Analysis, IGNOU, New Delhi. Chapter 1, 2 and 3
4. Singh, R. B. (ed.), (2006) Natural Hazards and Disaster Management: Vulnerability and Mitigation, Rawat Publications, New Delhi.
5. Sinha, A. (2001). Disaster Management: Lessons Drawn and Strategies for Future, New Moduleed Press, New Delhi.

Supplementary
1. Damon, P. Copola, (2006) Introduction to International Disaster Management, Butterworth Heineman.
2. Gupta A.K., Niar S.S and Chatterjee S. (2013) Disaster management and Risk Reduction, Role of Environmental Knowledge, Narosa Publishing House, Delhi.
3. Murthy D.B.N. (2012) Disaster Management, Deep and Deep Publication PVT. Ltd. New Delhi.

Course Title: Geographical Thought
Course Code: PGMP –GEG-DSE- 407
Credits: 02
Marks: 50
Duration: 30hrs

Prerequisite Courses: Nil

Course Objectives:
1. The course aims to develop a basic understanding and critical thinking of the variouscontributions from numerous scholars.
2. To gain grounding knowledge in the history, philosophy and scope in the discipline ofgeography

Course outcome:
After successful completion of the course the students will be able to
CO1: At the end of this course, student will gain sense of chronological organization and areal variation in human activities.
CO2: The students will be able to evaluate theoretical concepts from geography and elsewhere and demonstrate an understanding of the dynamic and contested nature of the discipline and its contemporary issues.

Module	Topic	Subtopic	Hours
I	Development of Geography	Geographical knowledge of the Ancient, Medieval & Modern period. Period. Contributions of explorers. Indian Schools of Thought, Contribution of Herodotus, Eratosthenes, Strabo, Ptolemy etc. Scientific explanations: Routes to scientific explanations Arab School of thought, Dark age, Age of Discovery, Contribution of Marco Polo, Columbus, Vaso-De-Gama and Captain Cook etc. Foundations of modern geography, German, French, British and American schools of thought, Contributions of Kant, Humboldt, Ritter, W. M. Davis, Charles Darwin etc.	15
II	Dualism in Geography & Geography in 21st Century	Systematic & regional geography; physical & human geography, the myth and reality about dualisms, Determinism and possibilism, Neo-determinism, Positivism, behaviorism, postmodernism. Conceptual and methodological developments and changing paradigms, Scientific methods, Quantitative revolution, Quantification and application of statistical techniques in Geography, Computer applications in geography.	15

TOTAL   **30**

References:
Mandatory
1. Arentsen M., Stam R. and Thuijis R., 2000: Post-modern Approaches to Space, eBook.
2. Martin Geoffrey J., 2005: All Possible Worlds: A History of Geographical Ideas, Oxford.
3. Holt-Jensen A., 2011: Geography: History and Its Concepts: A Students Guide, SAGE
4. Hubbard, Phil., Kitchin, Rob., Bartley Brendan and Duncan Fuller, (eds) 2002.Thinking Geographically: Space, Theory and Contemporary Human Geography, Continuum

Supplementary

1. Cresswell, Tim, 2013. Geographic Thought: A Critical Introduction, Wiley Blackwell.
2. Nayak, Anoop & Jeffrey Alex, 2011. Geographical Thought: An Introduction to Ideas in Human Geography, Harlow: Prentice Hall.
3. Gregory, Derek; Johnston, Ron; Pratt, Geraldine; Watts, Michael; Whatmore, Sarah, 2009. The Dictionary of Human Geography, Wiley-Blackwell.
4. Bonnett, Alastair, 2008. What is geography? Sage Publications.

Course Title: Advanced Urban Geography
Course Code: PGMP –GEG-DSE- 408
Credits: 02
Marks: 50
Duration: 30 Hours of 1 hour each

Pre-requisite Courses:
· **Basic knowledge about geomorphic concepts**

Course Objectives:
1. To critically understand the complexities of urban cities and the experience of living in these cities.
2. To critically understand a broad range of issues that cities face today.
3. To provide a basic social, cultural, political and economic understanding of cities.

Course Learning Outcomes:
CO1: To understand the linkages between urban cities and the societal forces that shapes it.
CO2: Critically analyse contemporary urban issues from a geographical perspective.
CO3: Understand urban issues in order to engage with possible and effective planning and policy interventions.

Course Content

Module	Topic	Subtopic	Hours
I	Introduction to Urban Geography	Meaning, Scope and Development of Urban Geography; Factors of Urban Growth –City as Centre of Change; Models of Urban Growth – Concentric Zone, Sectoral and Multinuclei; Conurbations and Megalopolis; Urban Umland Periurban and Urban Fringe; Functional Classification of Urban Settlements ~~Centres~~; Nelsons Classification, Urban Hierarchy and Rank Size Relationship, Metropolis and Megacities; Morphology of Urban Settlement; Indian Urban Scenario	15
II	Urban Structure, Problems and Perspectives	Demographic Structure and Characteristics of Urban Population, Trend of Urbanization, Occupational Pattern, Urban Amenities, Urban Land Use Problems, City Problems and Urban Planning; the Role of Geographer in Town Planning; Special Study Smart City, AMRUT scheme– Residential Problems, Morphological Characteristics and Functional Characteristics. Urban Mitigation and Resilience	15
		TOTAL	**30**

References

1. Ramachandran, R., 1992: The Study of Urbanisation, Oxford University Press, Delhi
2. Michael, P. 2009. Urban Geography: A Global Perspective, Taylor & Francis, Great Britain.
3. Carter, H. (2010) The Study of Urban Geography, Arnold Publishers, London
4. Misra , R.P. (2013) Urbanisation in South Asia, Cambridge University Press, New Delhi
5. Singh, R. B. (ed.) 2015. Urban Development Challenges, Risks and Resilience in Asian Mega Cities, Springer, Japan.
6. Singh, Savindra 2015. ParyavaranBhoogol, PrayagPustakBhavan, Allahabad
7. Sharma, P. and Rajput, S. (Eds.) (2017). Sustainable Smart Cities in India; Challenges and Future Perspectives, Springer Nature AG, Switzeland
8. Singh, S and Saroha, J. (2021) Urban Geography, Pearson Education.
9. Fyfe, N. R. and Kenny, J. T. (2020). The Urban Geography Reader. London, UK: Routledge.

Supplementary

1. Fyfe N. R. and Kenny J. T., 2005: The Urban Geography Reader, Routledge.
2. Graham S. and Marvin S., 2001: Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition, Routledge.
3. Hall T., 2006: Urban Geography, Taylor and Francis.
4. Kaplan D. H., Wheeler J. O. and Holloway S. R., 2008: Urban Geography, John Wiley.
5. Knox P. L. and McCarthy L., 2005: Urbanization: An Introduction to Urban Geography, Pearson Prentice Hall New York.
6. Knox P. L. and Pinch S., 2006: Urban Social Geography: An Introduction, PrenticeHall.
7. Pacione M., 2009: Urban Geography: A Global Perspective, Taylor and Francis.
8. Sassen S., 2001: The Global City: New York, London and Tokyo, Princeton University Press.
9. Ramachandran R (1989): Urbanisation and Urban Systems of India, Oxford University Press, New Delhi

Course Title: Soil and Water Resource Management
Course Code: PGMP –GEG-DSE- 409
Credits: 02
Marks: 50
Duration: 30hrs

Prerequisite Courses: Nil

Course Objectives:
1. To develop and understand the importance of water and watershed management.
2. To analyze different practices involved in watershed management.

Course Learning Outcomes: After successful completion of the course the students will be able to

CO1: Will be able to understand importance of water as a resource.
CO2: Will be able to classify different techniques and methods depend on the location and availability of resources.
CO3: Will be able to apply modern techniques in preparation of watershed management plans.

Course Content

Module	Topic	Subtopic	Hours
I	Introduction to Watershed Management and Management Practices	Concept of watershed Erosion control measures for non-agricultural lands, Contour and Staggered Trenching, Gully Control Structures, Sediment Retention Structures, Gully and Ravine Reclamation, Bunding, Check Dams, Loose boulder Dams	15
II	Groundwater and Issues related to Water conservation and harvesting	Movement of Groundwater, Factors affecting movement of groundwater, Soil Erosion, Soil Salinity, Siltation, Runoff, Deforestation, Water Scarcity, Groundwater depletion, Flooding etc. Methods, Potential, Assessment. Treatment of Catchments, Small Storage Structures, Planning Earth Dams, Agronomic measures in soil and water conservation problem and techniques of soil water conservation, Rainwater Harvesting, Rooftop Harvesting Role of Government and NGO's- Case Studies	15
		TOTAL	**30**

References:
1. Jain, S.K., Aggarwal, P.K. and Singh, V.P. 2007. Hydrology and Water Resources of India, Springer, The Netherlands.
2. Beach, Tim and Jonathan, M.F. 2017. Wetland Hydrology: The International Encyclopaedia of Geography, Wiley Online Library
3. Mutreja K.N. (1987) – Applied Hydrology, Tata Mckraw Hill.

4. Vir Singh, Raj ,(2000) Watershed Planning and Management, YashPublishing House, Bikaner, 2000.

Supplementary
1. Rai, S.C. 2017. Hydrology and Water Resources: A Geographical Perspective, Ane Book Pvt. Ltd., New Delhi.
2. Tideman E.M. (1996) – Watershed Management : Guidelines for Indian conditions, Omega, N. Delhi 1996.
3. Todd D.K.(1959)- Ground Water Hydrology, John wiley, New York.
4. Pereira H.C. (1973) – Land use and water Resources Cambridge University Press, Cambridge

Web references:
1. http://www.yourarticlelibrary.com/watershed-management/watershed-management-meaning-types-steps-and-programmes/77309
2. http://agritech.tnau.ac.in/agriculture/agri_majorareas_watershed_watershedmgt.html
3. https://dep.wv.gov/WWE/watershed/Pages/watershed_management.aspx
4. https://www.rdrwa.ca/node/27
5. https://www.teriin.org/blog/watershed-management-and-development

Course Title: Geography of India
Course Code: PGMP –GEG-DSE- 410
Credits: 02
Marks: 50
Duration: 30hrs

Course objective:
1. Todevelopanunderstandingofregionalgeographyof Indiain context of location, Physiography, drainage and climate.
2. Toappreciatethe unique regional diversity of India and the unification.
3. To enable to analyze and establish relationship between various factors in India's physical and cultural dimension.

Course Learning Outcomes:
1. **CO1**: Studentswillunderstandtheissuesrelatedofdisparities invariousregionsofIndia.
2. **CO2**: Students will able to differentiate various regions in India and its resource distributions, particularly from the perspective of physical, environmental and human perspective.
3. **CO3:** Students will apply their knowledge to identify different types of soils and vegetation found in India.

Course Content

Module	Topic	Subtopics	Hours
I	Location, Physiography, Drainage and Climate	Location importance, Extent and Geopolitical Significance Major Physiographic Regions and their Importance, Drainage System of India and their characteristics, Climate and Seasons	15
II	Resources in India and Contemporary Issues	Types of Soils, natural vegetation and Mineral resources distribution and degradation. Energy Resources: Conventional and Non-Conventional. Regional disparity, Poverty, Globalization, Demographic issues in India. India and Development- Global perspective	15
		TOTAL	**30**

References:

1. Pathak. C.R. 2002, Spatial Structure and Process of Development in India, Regional Science Association. Kolkata.
2. Sen. P.K. and Prasad, N. 2002, An Introduction to Geomorphology of India. Allied publishers. Delhi.
3. Johnson, B. L. C., ed. 2001. Geographical Dictionary of India. Vision Books, New Delhi.
4. Deshpande C. D., 1992: India: A Regional Interpretation, ICSSR, New Delhi.
5. Sharma, T. C. 2003: India - Economic and Commercial Geography. Vikas Publ., New Delhi.

Mandatory:
1. Govt.ofIndia:India-ReferenceAnnual,2001Pub.Div,NewDelhi,2001.
2. Govt.ofIndia:NationalAtlasofIndia,NATMOPublication,Calcutta..
3. Learmonth,A.T.A.et.al(ed.):ManandLandofSouthAsiaConcept,NewDelhi.
4. Shafi,M:GeographyofSouthAsia,McMillan&Co.,Calcutta,2000.
5. P.G.Saptarshi, J.C.More,V.R.Ugale&A.H.Musmade:AGeographicalRegionofIndia: Diamond Publication (2009)(Marathi)
6. Patil S. G., Suryawanshi R. S., Pacharne S., Choudhar A. H. : Economic Geography, AtharavPrakashan,Pune.(2014)(Marathi).
7. AherA.B.,ArekarR.:CommercialGeography, AtharavPrakashan,Pune.(2013)(Marathi).
8. Datt&Sundharam:IndianEconomy(2014),S.Chand&Co.,NewDelhi

Web references:
1. https://www.patnauniversity.ac.in/e-
2. https://www.toppr.com/guides/geography/drainage/drainage-system-of-india/
3. https://www.tutorialspoint.com/geography/geography_india_drainage_system.htm
4. https://www.researchgate.net/publication/227467090_India's_Water_Resources_Contemporary_Issues_on_Irrigation
5. https://econpapers.repec.org/bookchap/oxpobooks/9780195682168.htm

Annexure D
SYLLABUS FOR TWO YEAR POSTGRADUATE DEGREE
PROGRAMME IN M.Sc. GEOGRAPHY
(Implemented from the Academic Year 2023-2024 onwards)
COURSE STRUCTURE

SEMESTER	COURSE CODE	TITLE OF THE COURSE	NOMENCLATURE/TYPE OF COURSE	CREDITS
1	PGMP-GIS-DSC-401	Basics of GIS and GPS	DSC	4
	PGMP-GIS-DSC-402	Basics of Remote Sensing and Photogrammetry	DSC	4
	PGMP-GIS-DSC-403	Advanced of Geostatistics	DSC	4
	PGMP-GIS-DSC-404	Advanced Digital Cartography	DSC	4
	PGMP-GIS-DSE-401	Principles of Computer and Programming	DSE	4
	PGMP-GIS-DSE-402	Applications of GIS Techniques in Entrepreneurship	DSE	4
2	PGMP-GIS-DSC- 405	Spatial Analysis & Modeling	DSC	4
	PGMP-GIS-DSC-406	Advanced Remote Sensing and GIS	DSC	4
	PGMP-GIS-DSC-407	Digital Image Processing	DSC	4
	PGMP-GIS-DSC-408	Field techniques and Report writing	DSC	4
	PGMP-GIS-DSE- 403	Programming & Customization	DSE	4
	PGMP-GIS-DSE-404	GIS for Business and Service Planning	DSE	4
3	PGMP-GIS-DSE-501	Applications of GIS in Urban and Regional Planning	DSE	4
	PGMP-GIS-RSE- 501	Advanced Research Methodology	RSE	4
	PGMP-GIS-RSE-502	Research Applications in Resource Management	RSE	4
	PGMP-GIS-RSE-503	Research Applications in Agriculture and Soil	RSE	4
	PGMP-GIS-GE-501	WEB GIS and development of web Application	GE	4
4	PGMP-GIS-I-501	Project/ Internship	I	16
	PGMP-GIS-DSE-502	Applications of GIS in Disaster Management/Agriculture/Urban Planning/Tourism etc. (Online)	DSE	4

**SYLLABUS FOR TWO YEAR POSTGRADUATE DEGREE
PROGRAMME IN M.Sc. GEOGRAPHY
(Implemented from the Academic Year 2023-2024 onwards)**

Course Code	Course Title	Marks Theory and Practical 50+50	Credits (2+2=4)
SEMESTER I			
PGMP-GIS-DSC-401	Basics of GIS and GPS	**100**	**4**
PGMP-GIS-DSC-402	Basics of Remote Sensing and Photogrammetry	**100**	**4**
PGMP-GIS-DSC-403	Advanced of Geostatistics	**100**	**4**
PGMP-GIS-DSC-404	Advanced Digital Cartography	**100**	**4**
PGMP-GIS-DSE-401	Principles of Computer and Programming	**100**	**4**
PGMP-GIS-DSE-402	Applications of GIS Techniques in Entrepreneurship	**100**	**4**
SEMESTER II			
PGMP-GIS-DSC- 405	Spatial Analysis & Modeling	**100**	**4**
PGMP-GIS-DSC-406	Advanced Remote Sensing and GIS	**100**	**4**
PGMP-GIS-DSC-407	Digital Image Processing	**100**	**4**
PGMP-GIS-DSC-408	Field techniques and Report writing	**100**	**4**
PGMP-GIS-DSE- 403	Programming & Customization	**100**	**4**
PGMP-GIS-DSE-404	GIS for Business and Service Planning	**100**	**4**
SEMESTER III			
PGMP-GIS-DSE-501	Applications of GIS in Urban and Regional Planning	**100**	**4**
PGMP-GIS-RSE- 501	Advanced Research Methodology	**100**	**4**
PGMP-GIS-RSE-502	Research Applications in Resource Management	**100**	**4**
PGMP-GIS-RSE-503	Research Applications in Agriculture and Soil	**100**	**4**
PGMP-GIS-GE-501	WEB GIS and development of web Application	**100**	**4**
SEMESTER IV			
PGMP-GIS-I-501	Project/ Internship	**400**	**16**
Elective subject			
PGMP-GIS-DSE-502	Applications of GIS in Disaster Management/Agriculture/Urban Planning/Tourism etc. (Online)	**100**	**4**

Annexure D

M.Sc. GEOINFORMATICS
SEMESTER I

Course Title: BASICS OF GIS AND GPS
Course code: PGMP-GIS-DSC-401
Credits: 4
Marks: 100
Duration 90 Hours
Prerequisite courses: NIL
Course objective -
3. The course focuses on the fundamentals concept Geographical Information System, and Global Positioning System
4. Introducing the spatial data, non- spatial data, hardware and software used in collection, processing and analysis of geospatial data.

Course Learning Outcome:
   After completion of this course, students will be able to:
   CLO5:   Students will demonstrate proficiency and conceptual understanding in using software and automated techniques to carry out thematic maps and analysis through a series of laboratory exercises and creation of reports.
   CLO6:   Personal effectiveness and workplace competencies are practiced through engagement in discussion boards, following course guidelines, and interactions with the instructor and other students in the class
   CLO7:   To be able use these skills to identify and analyzed real world problem and preparing them for a successful career in geospatial industry and research institute
   CLO8:   Develop an tendency towards research through the compulsory internship in industry /research/ academic institutes which promote and inculcate professional ethics and code of practice among students, enabling them to work in a team with multidisciplinary approach

Course content

Module	Topics	Hours	
		L	P
		30	60
I	Introduction to GIS	10	20
	• **History and development.**		
	• **Components and Applications trends of GIS.**		
	• **Data models: vector and raster**		
	• **Data type, structure, Spatial and attribute, point, line, polygon-arc, nodes, vertices, and topology. Attribute data.**		
	• **Data processing systems, input and output devices, editing and attributing and linking**		
II	Spatial dada inputs	10	20
	• **Digitization**		
	• **Error identification**		
	• **Types and sources of error**		
	• **Correction editing and topology building**		

| III | Introduction to GPS | 10 | 20 |

- **History of Positioning System GPS System Description, Error Sources & Receiver**
- **Introduction to DGPS and Total Station, GPS Performance and Policy Applications**
- **Introduction to open source GIS**

Reference book
Mandatory Reading
7. Burrough, P.A. and McDonnell, R.A. (1998) Principles of geographical information systems. Oxford University Press, Oxford, 327 pp.
8. Campbell, J.B. (2002). Introduction to remote sensing, 3rd ed., The Guilford Press. ISBN 1-57230-640-8.
9. Chang, K. (2007) Introduction to Geographic Information System, 4th Edition. McGraw Hill.

Supplementary Reading
6. Curran Paul J Principles of Remote Sensing UK: ELBS,
7. Elangovan,K (2006) GIS: Fundamentals, Applications and Implementations. New India Publishing Agency, New Delhi"208 pp.
8. Heywood, I., Cornelius, S., and Carver, S. (2006) An Introduction to Geographical Information Systems. Prentice Hall. 3rd edition.
9. Jensen, J.R. (2000). *Remote sensing of the environment: an Earth resource perspective*. Prentice Hall. ISBN 0-13-609733-1.
10. Joseph, GeorgeFundamentals of Remote Sensing Universities Press India
11. Lillesand, T.M.; R.W. Kiefer, and J.W. Chipman (2003). Remote sensing and image interpretation, 5th ed., Wiley. ISBN 0-471-15227-7.
12. Thurston, J., Poiker, T.K. and J. Patrick Moore. (2003) Integrated Geospatial Technologies: A Guide to GPS, GIS, and Data Logging. Hoboken, New Jersey: Wiley.
13. Wise, S. (2002) GIS Basics. London: Taylor & Francis.

Online resources
7) https://www.nrsc.gov.in/
8) https://www.iirs.gov.in/
9) http://www.undp.org/popin/wdtrends/wdtrends.htm
10) https://www.isprs.org/proceedings/xxxiii/congress/part7/1609_XXXIII-part7.pdf
11) http://www.tric.u-tokai.ac.jp/ISPRScom8/TC8/TC8_CD/headline/JAXA_Special_Session%20-%206/JTS64_20100608144600.pdf

Semester - I
Course Title: BASICS OF REMOTE SENSING AND PHOTOGRAMMETRY
Course code: PGMP-GIS-DSC-402
Credits: 4
Marks: 100
Duration 90 Hours
Prerequisite courses: NIL
Course objective
1. Give foundational knowledge about remote sensing and its types and different sensors used for remote sensing which will focus on comprehension of the physical, computational, and perceptual basis for remote sensing.
2. Gain familiarity with a variety of physical, biological, and human geographic applications of remote sensing.
3. Gain basic experience in the hands-on application of remote sensing data through visual interpretation and digital image processing exercises.

Course Learning Outcome
After successful completion of a course in student will be able

CLO1: Students will be able to understand the concept of remote sensing and EMR apart from this basic level of fundamental physical principles of remote sensing, including the electromagnetic spectrum; the emission, scattering, reflection, and absorption of electromagnetic (EM) radiation; how EM radiation interactions vary across a limited number of substances, geometries, and temperatures; and geometric properties of photographs and imagery.
CLO2: To be able use these skills to identify and analyzed real world problem and preparing them for a successful career in geospatial industry and research institute
CLO3: Be equipped with practical skills and the ability to apply their theoretical concept to design, perform experiments, analyze and interpret data and thus develop proficiency in lab management
CLO4: Develop an tendency towards research through the compulsory internship in industry /research/ academic institutes which promote and inculcate professional ethics and code of practice among students, enabling them to work in a team with multidisciplinary approach.

Course content

Module	Topics	Hours	
		T	**P**
		30	**60**
I	**Fundamental of Remote Sensing**	**10**	**20**
	• Introduction, History, development,		
	• stages of remote sensing, EMR & EMR spectrum, EMR Quantities, Energy sources and radiation principles,		
	• Theories of EMR, Concept of Energy interactions in the atmosphere, energy Black body, atmospheric windows		
	• types of remote sensing interactions with the earth surface features, Spectral reflectance of vegetation, Soil and water,		

| II | **Platform, Orbit and sensor** | 10 | 20 |

- Platform: Ground based, air-borne, space-borne,
- Orbit: Geostationary satellite and polar orbiting satellite, Sensor:
- Types of sensor and cameras, processes of sensor & its characteristics, Whiskbroom and Push broom cameras

| III | **Techniques of interpretation** | 10 | 20 |

- Aerial photo interpretation, satellite image interpretation,
- Recognition elements: Tone, Color, Texture, Pattern, Shape, Size and associated features

Aerial photographyTypes, Geometry, Scale, Height and Process of Aerial Photograph, basic requirement of Aerial Photograph, planning & execution of photographic flight, aerial cameras, relief displacement, stereo vision, stereo model & stereoscope, parallax & parallax measurement

References books
Mandatory Reading

1. Campbell, J.B. (2002). Introduction to remote sensing, 3rd ed., The Guilford Press. ISBN 1-57230-640-8.
2. Curran Paul, J. (2000) Principles of Remote Sensing UK: ELBS.
3. Joseph, George (2007) Fundamentals of Remote Sensing Universities Press India
4. Lillesand, T.M.; R.W. Kiefer, and J.W. Chipman (2007). Remote sensing and image interpretation, 5th ed., Wiley. ISBN 0-471-15227-7.

Supplementary Reading

1. Moffitt, F. H. (2000). Photogrammetry. 3rd Ed, Harper & Row, NY.
2. Sabins Floyd F Remote Sensing: Principles and Interpretation New York: WH Freeman and Company
3. Wolf, P. R. (2004). Elements of Photgrammetry. McGraw-Hill, NY.
4. Zorn, H. C. (2006). Introductory Course in Photogrammetry. 6th Ed. ITC, Netherlands.

Online resources

1) https://www.nrsc.gov.in/
2) https://www.iirs.gov.in/
3) http://www.undp.org/popin/wdtrends/wdtrends.htm
4) https://www.isprs.org/proceedings/xxxiii/congress/part7/1609_XXXIII-part7.pdf
5) http://www.tric.u-tokai.ac.jp/ISPRScom8/TC8/TC8_CD/headline/JAXA_Special_Session%20-%206/JTS64_20100608144600.pdf
6) https://www.semanticscholar.org/paper/Role-of-Remote-Sensing-in-Disaster-Management-Nirupama-Simonovic/da84562b2057ca5866d933d47ee8815a06f0229c

Course Title: ADVANCED GEOSTATISTICS
Course code: PGMP-GIS-DSC-403
Credits: 4
Marks: 100
Duration 90 Hours
Prerequisite courses: NIL
Course objective
1. The course is designed to process geospatial data and use of statistics in the field of GIS.
2. The course focuses on the development of the skills using statistical techniques in understanding, organizing, interpolation, analyzing and interpretation of geostatistical data and to develop the firm foundation to apply it in various fields.

Course Learning Outcome
After successful completion of a course in student will be able
CLO5: After completion of the course students will understand various types of datasets and applying different statistical techniques to different data sets.
CLO6: This will systematically access, analyze and evaluate information and ideas from multiple sources in order to identify underlying assumptions, and formulate conclusions. The course will enhance skills like solving quantitative problems and statistical queries.
CLO7: Develop an tendency towards research through the compulsory internship in industry /research/ academic institutes which promote and inculcate professional ethics and code of practice among students, enabling them to work in a team with multidisciplinary approach.
CLO8: Workplace competencies are strengthened as students apply the analytical and evaluative tools to GIS mapping and apps

Course content

Module	Topics	Hours T	P
		30	60
I	**Introduction to Statistics**	10	20
	• Statistical and Graphical foundation, data classification		
	• Univariate (Measures of Central Tendency, Measures of Dispersion)		
	• Moments (Skewness, Kurtosis)		
II	• **Bivariate and Matrices**	10	20
	• Co-relation Methods (Co-relation Methods)		
	• Regressions (Linear, Exponential, Power)		
	• Matrices (Types, Addition, Subtraction, Multiplication, Simultaneous Equation with algebra and elimination Method, Co-factor Method,		
III	**Geostatistical uncertainty, probability and Multivariate**	10	20
	• Probability		
	• Multiple Regression		
	• Multiple Co-relation		
	• Principle Component Analysis.		

Reference Books:
Mandatory Reading

1. Simon W. Houlding, (2000) Practical Geostatistics: Modeling and Spatial Analysis, Springer, Berlin
2. Thurston, J., Poiker, T.K. and J. Patrick Moore. (2003). Integrated Geospatial Technologies: A Guide to GPS, GIS, and Data Logging. Hoboken, New Jersey: Wiley.
3. Roy, P.S. (2006). Geoinformatics for Tropical Ecosystems Bishen Singh Mahendra Pal Singh, Dehradun

Supplementary Reading

1. Ricardo A. Olea (2000) Geostatistics for Engineers and Earth Scientist, Kluwer Academic Publishers, Boston
2. Richard Webstar and Margaret A. Oliver: Geostatistics for Environmental Scientists, Statistics in Practice (2nd ed) J. Wiley
3. Ott, T. and Swiaczny, F. (2001). Time-integrative GIS. Management and analysis of spatio-temporal data. Berlin / Heidelberg / New York: Springer.
4. Thurston, J., Poiker, T.K. and J. Patrick Moore. (2003). Integrated Geospatial Technologies: A Guide to GPS, GIS, and Data Logging. Hoboken, New Jersey: Wiley.
5. Roy, P.S. (2006). Geoinformatics for Tropical Ecosystems Bishen Singh Mahendra Pal Singh, Dehradun

Online resources
https://elearning.iirs.gov.in/https://elearning.iirs.gov.in/
https://www.esri.com/en-us/home
https://www.intergraph.com/
https://www.sac.gov.in/Vyom/index.jsp
https://bhuvan.nrsc.gov.in/bhuvan_links.php
https://glovis.usgs.gov/
https://www.nrsc.gov.in/EO_Agr_Objective
https://www.nrsc.gov.in/aboutus_campus_nrscrc/rrsc_east?language_content_entity=en
https://www.iirs.gov.in/

Course Title: ADVANCED DIGITAL CARTOGRAPHY
Course code: PGMP-GIS-DSC-404
Credits: 4
Marks: 100
Duration 90 Hours
Prerequisite courses: NIL
Course objective
1. The course gives emphasis on the art, science, and technologies of cartography and Photogrammetry.
2. It develops the user's ability to understand how maps are created traditionally and digitally. Representation and communicate spatial phenomena and their relationships through photogrammetric perspective which emphasis on skills like making of map, map reading signs and symbols etc..

Course Learning Outcome
After successful completion of a course in student will be able
CLO1:   Students will understand different types of projections and datum used in various locations. Proficiency and conceptual understanding in using Manual and computer techniques to carry out thematic maps and special purpose maps.
CLO2:   Remote sensing, image processing and analysis through a series of laboratory exercises and report
CLO3:   Be able to demonstrate proficiency in quantitative reasoning and analytical skills
CLO4:   Acquire of fundamental and advanced knowledge of the different aspect in cartography with the means ability to specialize in a specific field.

Course content

		Hours	
Module	Topics	**T**	**P**
		30	**60**
I	**Introduction to Cartography**	**10**	**20**
	• Basics of Map		
	• Fundamentals of direction, scale, types, sources		
	• Elementary geodesy- Datum and Projection		
	• Projection coordinates		
	• WGS 84		
II	**Thematic Cartography Characteristics of geographical phenomena**	**10**	**20**
	• Principles of colour perception		
	• Colour scheme for Univariate choropleth and Isorithmic maps, proportional symbol mapping		
	• Interpolation methods for smooth continuous phenomena symbolizing smooth continuous phenomena. Dot and asymmetric mapping		
III	**Geographic representation**	**10**	**20**
	• Map and mapping, map design, symbolization, conventional signs		
	• map layout, map referencing and indexing, scale of maps and map contents		

- Field work techniques, socio – economic survey and attribute data.

Reference Books
Mandatory Reading

1. ESRI. 2004. ESRI Cartography: Capabilities and Trends. Redlands, CA. White Paper
2. Sircar, D.C.C. (January 2000). Studies in the Geography of Ancient and Medieval India. Motilal Banarsidass Publishers. ISBN 8120806905.
3. Slocum, T. (2003). Thematic Cartography and Geographic Visualization. Upper Saddle River, New Jersey: Prentice Hall. ISBN 0-130-35123-7. Wilford, John Noble (2000). The Mapmakers. Vintage Books. ISBN 0-375-70850-2**.**

Supplementary Reading

1. Kraak, Menno-Jan and Allan Brown (2001): Web Cartography – Developments and prospects, Taylor & Francis, New York, ISBN 0-7604-0869-X.
2. MacEachren, A.M. (2005). Some Truth with Maps: A Primer on Symbolization & Design. University Park: The Pennsylvania State University. ISBN.
3. Monmonier, Mark (2004). How to Lie with Maps. Chicago: University of Chicago Press. ISBN 0-226-53421-9.
4. Monmonier, Mark (2004). Mapping It Out. Chicago: University of Chicago Press. ISBN.
5. Pickles, John (2003). A History of Spaces: Cartographic Reason, Mapping, and the Geo-Coded World. Taylor & Francis. ISBN 0-415-14497-3
6. Sircar, D.C.C. (January 2000). Studies in the Geography of Ancient and Medieval India. Motilal Banarsidass Publishers. ISBN 8120806905.
7. Slocum, T. (2003). Thematic Cartography and Geographic Visualization. Upper Saddle River, New Jersey: Prentice Hall. ISBN 0-130-35123-7. Wilford, John Noble (2000). The Mapmakers. Vintage Books. ISBN 0-375-70850-2**.**

Online resources

https://elearning.iirs.gov.in/https://elearning.iirs.gov.in/
https://www.esri.com/en-us/home
https://www.intergraph.com/
https://www.sac.gov.in/Vyom/index.jsp
https://bhuvan.nrsc.gov.in/bhuvan_links.php
https://glovis.usgs.gov/
https://www.nrsc.gov.in/EO_Agr_Objective
https://www.nrsc.gov.in/aboutus_campus_nrscrc/rrsc_east?language_content_entity=en
https://www.iirs.gov.in/

Course Title: PRINCIPLES OF COMPUTER AND PROGRAMMING
Course code: PGMP-GIS-DSE-401
Marks: 100
Duration 90 Hours
Prerequisite courses: NIL

Course objective
1. The course will explore the Application of computer in the field of GIS, DBMS and programming for GIS customization.
2. The main focus is on introduction to computers-DBMS, basics of programming languages.

Course Learning Outcome.
After successful completion of a course in student will be able

CLO1: Students will demonstrate proficiency and conceptual understanding in data creation and storage, languages or manuscripts techniques to carry out geographical data for developing and designing application and use of Programming in GIS.
CLO2: To be able use these skills to identify and analyzed real world problem and preparing them for a successful career in gis industry and research institute.
CLO3: Develop an tendency towards research through the compulsory internship in industry /research/ academic institutes which promote and inculcate professional ethics and code of practice among students, enabling them to work in a team with multidisciplinary approach.
CLO4: Workplace competencies are strengthened as students apply the analytical and evaluative tools to geospatial mapping and apps

Course content

Module	Topics	Hours T	P
		30	60
I	**Introduction to Computers**	10	20
	• Hardware and Software, System requirement, configuration and operating systems and Computer Applications		
	• Algorithms and Programming in Computers		
	• MS ACCESS and applications		
II	**Introduction to simple programming in C**	10	20
	• Developing programming techniques and solutions for spatial algorithms and problem-solving using VB		
	• Getting started with HTML, flash		
III	**Introduction to Python**	10	20

Reference Books:
Mandatory Reading
1. Benjamin C. Pierce (2002). Types and Programming Languages, The MIT Press.

2. Bruce J. MacLennan (2000). Principles of Programming Languages: Design, Evaluation, and Implementation, Oxford University Press.
3. Michael L. Scott (2005). Programming Language Pragmatics, Morgan Kaufmann Publishers

Supplementary Reading

1. Daniel P. Friedman and Mitchell Wand (2001). Christopher Thomas Haynes: Essentials of Programming Languages, The MIT Press.
2. David Gelernter and Suresh Jagannathan (2005). Programming Linguistics, The MIT Press.
3. Goldschlager, L. (2000). A Lister Computer Science - a modern Introduction Prentice Hall.
4. John C. Mitchell (2002). Concepts in Programming Languages, Cambridge University Press.
5. Michael L. Scott (2005). Programming Language Pragmatics, Morgan Kaufmann Publishers.
6. Ravi Sethi (2000). Programming Languages: Concepts and Constructs, 2nd ed., Addison-Wesley.
7. James S. McKeown (2010), Programming in Visual Basic 2010: The Very Beginner's Guide
8. Richard Mansfield (2003), Visual Basic .NET All in One Desk Reference for Dummies

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https://www.intergraph.com/
https://www.sac.gov.in/Vyom/index.jsp
https://bhuvan.nrsc.gov.in/bhuvan_links.php
https://glovis.usgs.gov/
https://www.nrsc.gov.in/EO_Agr_Objective
https://www.nrsc.gov.in/aboutus_campus_nrscrc/rrsc_east?language_content_entity=en
https://www.iirs.gov.in/

Semester - I
Course Title: Applications of GIS Techniques in Entrepreneurship
Course code: PGMP-GIS-DSE-402
Credits: 4
Marks: 100
Duration 90 Hours
Prerequisite courses: NIL
Course objective -
1. The course focuses on the fundamentals concept Map Objects, and techniques of VBA
2. Introducing the Visual Basic code, Elements, processing and analysis of Arc object beyond VBA.

Course Learning Outcome:
After completion of this course, students will be able to:
CLO1: Students will demonstrate proficiency and conceptual understanding in using software and automated techniques to carry out thematic maps and analysis through a series of laboratory exercises and creation of reports.
CLO2: Personal effectiveness and workplace competencies are practiced through engagement in discussion boards, following course guidelines, and interactions with the instructor and other students in the class
CLO3: To be able use these skills to identify and analyzed real world problem and preparing them for a successful career in geospatial industry and research institute
CLO4: Develop a tendency towards research through the compulsory internship in industry /research/ academic institutes which promote and inculcate professional ethics and code of practice among students, enabling them to work in a team with multidisciplinary approach

Course content

Module	Topics	Hours	
		L 30	P 60
I	Introduction to MapObjects, Introduction to VBA and Visual studio 200#, Getting Started with ArcObjects, Visual Basic code: How, where, and when?	**10**	**20**
II	Using variables, Programming with class, COM,OMD, Maps and layers, Data access and creation, Geometry and Geoprocessing	**10**	**20**
III	Working with subsets and selections, Symbolizing elements and layers, Working with layout elements, Data management, ArcObjects beyond VBA	**10**	**20**

Reference book
Mandatory Reading
1. Burrough, P.A. and McDonnell, R.A. (1998) Principles of geographical information systems. Oxford University Press, Oxford, 327 pp.
2. Campbell, J.B. (2002). Introduction to remote sensing, 3rd ed., The Guilford Press. ISBN 1-57230-640-8.
3. Chang, K. (2007) Introduction to Geographic Information System, 4th Edition. McGraw Hill.

Supplementary Reading

1. Curran Paul J Principles of Remote Sensing UK: ELBS,
2. Elangovan,K (2006) GIS: Fundamentals, Applications and Implementations. New India Publishing Agency, New Delhi"208 pp.
3. Heywood, I., Cornelius, S., and Carver, S. (2006) An Introduction to Geographical Information Systems. Prentice Hall. 3rd edition.
4. Jensen, J.R. (2000). *Remote sensing of the environment: an Earth resource perspective*. Prentice Hall. ISBN 0-13-609733-1.
5. Joseph, GeorgeFundamentals of Remote Sensing Universities Press India
6. Lillesand, T.M.; R.W. Kiefer, and J.W. Chipman (2003). Remote sensing and image interpretation, 5th ed., Wiley. ISBN 0-471-15227-7.
7. Thurston, J., Poiker, T.K. and J. Patrick Moore. (2003) Integrated Geospatial Technologies: A Guide to GPS, GIS, and Data Logging. Hoboken, New Jersey: Wiley.
8. Wise, S. (2002) GIS Basics. London: Taylor & Francis.

Online resources

1. https://www.nrsc.gov.in/
2. https://www.iirs.gov.in/
3. http://www.undp.org/popin/wdtrends/wdtrends.htm
4. https://www.isprs.org/proceedings/xxxiii/congress/part7/1609_XXXIII-part7.pdf
5. http://www.tric.u-tokai.ac.jp/ISPRScom8/TC8/TC8_CD/headline/JAXA_Special_Session%20-%206/JTS64_20100608144600.pdf
6. https://www.semanticscholar.org/paper/Role-of-Remote-Sensing-in-Disaster-Management-Nirupama-Simonovic/da84562b2057ca5866d933d47ee8815a06f0229c

Annexure D

M.Sc. GEOINFORMATICS
SEMESTER II

Course Title: SPATIAL ANALYSIS AND MODELING
Course code: PGMP-GIS-DSC-405
Credits: 4
Marks: 100
Duration 90 Hours
Prerequisite courses: NIL
Course objective
1. The course focuses on fundamental aspects of spatial data modeling specifically on the aspect of two dimensional and three-dimensional (3D) modeling, structuring of raster and vector analysis and its types.
2. It also looks into integration of non-spatial data and its application.

Course Learning Outcome
After successful completion of a course in student will be able
CLO1:   Student will able to apply spatial tool and techniques in spatial datasets for carry out Surface and 3d analysis.
CLO2:   Students will demonstrate proficiency and conceptual understanding spatial model making process.
CLO3:   Be equipped with practical skills and the ability to apply their theoretical concept to design, perform experiments, analyze and interpret data and thus develop proficiency in lab management
CLO4:   Acquire of fundamental and advanced knowledge of the different aspect in Geoinformatics with the means ability to specialize in a specific field.

Course content

Module	Topics	Hours	
		T	**P**
		30	**60**
I	**Introduction to analysis.**	**10**	**20**
	• Significance of spatial analysis, overview of tools for analysis		
	Spatial analysis of Vector Base		
	• Overlay operations: point in polygon, line polygon, polygon in polygon, Single layer operations, features identification, extraction, classification and manipulation, Multilayer operations: union, Intersection, difference		
	Spatial analysis of raster base		
	• Map algebra, grid based operations, local, focal, zonal and global functions, cost surface analysis, optimal path and proximity search.		
II	**Analysis**	**10**	**20**
	• Network Analysis- Concept of network analysis, Types of network analysis, Evaluation of network complexity using Alpha, Gama indices, Network data model		
	• Point pattern- Method for evaluating point patterns, Clustered and random distribution		

- Surface analysis- Interpolation method, DEM, TIN, variance filter, slope and aspect, relief and hill shading

III Spatial modelling   10   20
- Role of spatial model, explanative, predictive and normative models, handling complex spatial query, case studies.

Reference Books:
Mandatory Reading
1. Alias A. Rahman and Morakot Pilouk (2008)Spatial Data Modeling for 3D GIS, Springer New York
2. Longley, P.A., Goodchild, M.F., Maguire, D.J. and Rhind, D.W. (2005). Geographic Information Systems and Science. Chichester: Wiley. 2nd edition.
3. Thurston, J., Poiker, T.K. and J. Patrick Moore. (2003). Integrated Geospatial Technologies: A Guide to GPS, GIS, and Data Logging. Hoboken, New Jersey: Wiley.

Supplementary Reading

1. Ott, T. and Swiaczny, F. (2001). Time-integrative GIS. Management and analysis of spatio-temporal data. Berlin / Heidelberg / New York: Springer.
2. Thurston, J., Poiker, T.K. and J. Patrick Moore. (2003). Integrated Geospatial Technologies: A Guide to GPS, GIS, and Data Logging. Hoboken, New Jersey: Wiley.
3. M Goodrich (2000). Data Structures and Algorithms in Java, 2nd Edition Wiley.
4. Malczewski, J. (2004). GIS and Multi-criteria Decision Analysis. New York: John Wiley and Sons
5. GIS and Multi-criteria Analysis by Makrewski Jacek, USA, 2002.
6. Principals of GIS by Burrough P.A. MacDonneli R.A. published by Oxford University Press, 2000.
7. Geographical Information Science, vol. I by Roy P.S. Published by IIRS, 2000.
8. Fundamentals of Geographic Information Systems, 2nd Edition by Demers M.N. published by John Wiley & Sons 2000

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https://elearning.iirs.gov.in/https://elearning.iirs.gov.in/
https://www.esri.com/en-us/home
https://www.intergraph.com/
https://www.sac.gov.in/Vyom/index.jsp
https://bhuvan.nrsc.gov.in/bhuvan_links.php
https://glovis.usgs.gov/
https://www.nrsc.gov.in/EO_Agr_Objective
https://www.nrsc.gov.in/aboutus_campus_nrscrc/rrsc_east?language_content_entity=en
https://www.iirs.gov.in/

Semester - II
Course Title: ADVANCED REMOTE SENSING AND GIS
Course code: PGMP-GIS-DSC-406
Credits: 4
Marks: 100
Duration 90 Hours
Prerequisite courses: NIL
Course objective
1. The course will provide latest state of art in remote sensing and GIS technology.
2. It will provide an opportunity Module to understand and work with latest developments remote sensing data base and GIS technology.

Course Learning Outcome
After successful completion of a course in student will be able
> **CLO1:** Students will be able to apply mathematical relationships (at a pre-calculus level) describing fundamental physical, geometric, and computational principles relevant to remote sensing and GIS.
> **CLO2:** They will create Remote sensing application
> **CLO3:** Be equipped with practical skills and the ability to apply their theoretical concept to design, perform experiments, analyze and interpret data and thus develop proficiency in lab management
> **CLO4:** Acquire of fundamental and advanced knowledge of the different aspect in Geoinformatics with the means ability to specialize in a specific field.

Course content

Module	Topics	Hours	
		T	P
		30	60
I	Advanced Remote Sensing	**10**	**20**
	• **Microwave Remote Sensing**		
	• **Thermal Remote Sensing**		
	• **Hyper spectral Remote Sensing**		
	• **LiDAR & Drone**		
II	Advancement in GIS	**10**	**20**
	• **Participatory GIS and Mobile GIS**		
	• **WebGIS (ArcIMS, MapServer, Geomedia, MapGuide**		
	• **GIS servers, Intermediate software and Distributed GIS systems**		
III	Multi-criteria decision making analysis –	**10**	**20**
	• **Ranking**		
	• **Rating**		
	• **Pair wise comparison**		
	Fuzzy logic		

Reference Books:
 Mandatory Reading

1. Asrar Ghassem (2004) Theory and applications of optical remote sensing New York: John Wiley and Sons.

2. Lillesand, T.M.; R.W. Kiefer, and J.W. Chipman (2003). Remote sensing and image interpretation, 5th ed., Wiley. ISBN 0-471-15227-7.

3. Malczewski, J. (*2000*). GIS and Multicriteria Decision Analysis. New York: John Wiley and Sons

Supplementary Reading

1. Mitchel, Tyler (2005): WebMapping Illustrated, O'Reilly, Sebastopol, 350 pages, ISBN 0-569-00865-1. This book discusses various Open Source WebMapping projects and provides hints and tricks as well as examples.
2. Ott, T. and Swiaczny, F. (2001) Time-integrative GIS. Management and analysis of spatio-temporal data, Berlin / Heidelberg / New York: Springer.
3. Peterson, Michael P. (ed.) (2003): Maps and the Internet, Elsevier, ISBN 0-08-044201-3.
4. Skolnik, Merrill I. (2001). Introduction to Radar Systems, McGraw-Hill (1st ed., 1962; 2nd ed., 1980; 3rd ed.), ISBN 0-07-066572-9.
5. Thurston, J., Poiker, T.K. and J. Patrick Moore. (2003) Integrated Geospatial Technologies: A Guide to GPS, GIS, and Data Logging. Hoboken, New Jersey: Wiley.
6. Worboys, Michael, and Matt Duckham. (2004) GIS: a computing perspective. Boca Raton: CRC Press.

Online resources

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https://www.sac.gov.in/Vyom/index.jsp
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https://glovis.usgs.gov/
https://www.nrsc.gov.in/EO_Agr_Objective
https://www.nrsc.gov.in/aboutus_campus_nrscrc/rrsc_east?language_content_entity=en
https://www.iirs.gov.in/

Semester - II
Course Title: DIGITAL IMAGE PROCESSING
Course code: PGMP-GIS-DSC-407
Credits: 4
Marks: 100
Duration 90 Hours
Prerequisite courses: NIL

Course objective

1. This course will introduce fundamental technologies of digital image processing i.e. compression, information extraction and analysis.
2. Students will also gain understanding of algorithm, analytical tools, and practical implementations of various digital image applications.

Course Learning Outcome

After successful completion of a course in student will be able
- **CLO1:** Students will demonstrate proficiency and conceptual understanding in using software or manual techniques which will prove how digital technology has come over traditional technology to carry out remote sensing image processing and analysis through a series of laboratory exercises and reports
- **CLO2:** Acquire of fundamental and advanced knowledge of the different aspect in DIP with the means ability to specialize in a specific field.
- **CLO3:** Workplace competencies are strengthened as students apply the analytical and evaluative tools to GIS mapping and apps
- **CLO4:** Be able to demonstrate proficiency in quantitative reasoning and analytical skills

Course content

Module	Topics	Hours T	P
		30	60
I	**Introduction to Digital Image Processing**	10	20
	• Visual perception, Image sensing and acquisition,		
	• Digital Data Formats Image sampling and Quantization		
	• Basic relationship between pixels.		
	• Development, scope and fundamental steps involved in Digital Image Processing, components of Image Processing		
II	**Image Rectification**	10	20
	• Radiometric and Atmospheric Correction		
	• Geometric Correction, Ortho-rectification, calibration and		

rectification of photo and images,
- Image enhancement in spatial domain and frequency domain, Filtering, Fourier Transform, Noise removal

III   Multispectral Image Processing   10   20
- Colour Image processing, slicing, Image compression, dilation, Segmentation, Spectral rationing, density slicing and image fusion
- Object recognition, classification, object recognition, feature extraction, accuracy, assessment, change detection Accuracy Assessment and integration with GIS

Reference Books:
Mandatory Reading
1. Burger, Wilhelm; Mark J. Burge (2007). Digital Image Processing: An Algorithmic Approach Using Java. Springer. ISBN 1846283795.
2. Campbell, J.B. (2002). Introduction to remote sensing, 3rd ed., The Guilford Press. ISBN 1-57230-640-8.
3. Jensen John R (2007). Introductory Digital Image processing: Remote Sensing Perspective New Jersey: Prentice Hall

Supplementary Reading
1. Damen MCJ, Sicco Smith G and Kerstappen(Ed) (2000). Remote Sensing for Resources Development and Environmental Management 3rd.volume Set Netherlands: Balkema
2. Gonzalez, Rafael C.; Richard E. Woods (2005). Digital Image Processing. ISBN 0-201-50803-6.
3. Jensen John R (2007). Introductory Digital Image processing: Remote Sensing Perspective New Jersey: Prentice Hall
4. Joseph, George (2007). Fundamentals of Remote Sensing Universities Press India
5. Lillesand, T.M.; R.W. Kiefer, and J.W. Chipman (2007). Remote sensing and image interpretation, 5th ed., Wiley. ISBN 0-471-15227-7.
6. Pratt, William K. (2003). Digital Image Processing. ISBN 0-471-01888-0.
7. Romeny, Bart M. (2003). Front-End Vision and Multi-Scale Image Analysis. ISBN1-4020-1507-0.
8. Umbaugh, Scott E (2005). Computer Imaging: Digital Image Analysis and Processing. ISBN 0-84-932919-1

Web reference
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https://www.nrsc.gov.in/aboutus_campus_nrscrc/rrsc_east?language_content_entity=en
https://www.iirs.gov.in/

Semester - II
Course Title: FIELD TECHNIQUES AND REPORT WRITING
Course code: PGMP-GIS-DSC-408
Credits: 4
Marks: 100
Duration 90 Hours
Prerequisite courses: NIL
Course objective
1. The course is designed to develop field and Survey techniques using different survey instruments and Interpretation of topo sheets and maps.
2. This includes field techniques and importance of field survey in GIS.

Course Learning Outcome
After successful completion of a course in student will be able
- **CLO1:** Students will describe a survey method and different instruments and it's assembled and summarizes relevant survey for relevant work which will skill development in using different instruments.
- **CLO2:** Report writing and Interpretation of Maps will focus on writing skills.
- **CLO3:** Be equipped with practical skills and the ability to apply their theoretical concept to design, perform experiments, analyze and interpret data and thus develop proficiency in lab management
- **CLO4:** Acquire of fundamental and advanced knowledge of the different aspect in Geoinformatics with the means ability to specialize in a specific field.

Course content

Module	Topics	Hours	
		L **30**	**P** **60**
I	**Introduction to Field Survey** Importance of field instrument survey - scope and purpose, principles and application of selected survey instruments. Chain and Plane Table Survey**:** Chain survey: use of tapes- open traverse, triangulation survey; Plane table; plan preparation, Resection -one point and two point problem; threepoint problem; tracing paper method.	10	20
II	**Dumpy level, Auto level and Theodolite Survey** Dumpy level: traverse survey, contour plan preparation. Theodolite - horizontal, land vertical (height) measures, accessible and inaccessible method.	10	20
III	**Village Survey and Report writing** - Fundamentals of Village survey, prerequisites of village survey, preparation of questionnaires, data entry, basic analysis in Microsoft excel - Interpretation of surveyed maps and Report writing.	10	20

Reference book
Mandatory Reading
1. Clendening, J. Principles and use of Surveying Instruments. 2nd edition, Blockie. A 2000.

2. Negi, Balbir Singh. Practical Geography Third revised Ed. Kedar Nath and Ram Nath, Meerut &Delhi, 2006.
3. Sandover,J.A. Plane Surveying. Arnold 2007.

Supplementary Reading
1. Hotine, Major M. The re-triangulation of Great Britain. Empire survey review 2005.
2. Mitra,R.P. and Ramesh A : Fundamentals of Cartography Revised Edition, Concept Publication, New Delhi.
3. Monkhouse - Maps and diagrams Methuen 2004.
4. Negi, Balbir Singh. Practical Geography Third revised Ed. Kedar Nath and Ram Nath, Meerut &Delhi, 2006.
5. Sandover,J.A. Plane Surveying. Arnold 2007.
6. Singh &Karanjta - Map work and Practical Geography Central Book Dept Allahabad 2009.
7. Singh, R.L.andDutt, P.K. Elements of Practical Geography, Students Friends, Allahabad.2003.

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https://glovis.usgs.gov/
https://www.nrsc.gov.in/EO_Agr_Objective
https://www.nrsc.gov.in/aboutus_campus_nrscrc/rrsc_east?language_content_entity=en
https://www.iirs.gov.in/

Semester - II
Course Title: PROGRAMING & CUSTOMIZATION
Course code: PGMP-GIS-DSE-403
Credits: 4
Marks: 100
Duration 90 Hours

Prerequisite courses: NIL

Course objective
1. The course is designed to develop programming skills using a spatial data to automate the analysis process.
2. This includes the programming workflow in spatial domain, python for application and various scripting languages.

Course Learning Outcome
After successful completion of a course in student will be able
CLO1: Student will develop new tools and software also customizes open source software.
CLO2: They design and built web base platform for geospatial database.
CLO3: Be able to demonstrate proficiency in quantitative reasoning and analytical skills
CLO4: Be equipped with practical skills and the ability to apply their theoretical concept to design, perform experiments, analyze and interpret data and thus develop proficiency in lab management
Course content

Module	Topics	Hours	
		T 30	P 60
I	**Using raster data** Generating cell size obtaining with width and height of raster Counting raster band and swapping raster bands querying ,creating ,raster based analysis	10	20
II	**Dynamic maps** Map canvas, map Modules, iterating over layers, graduated layer symbol renderer, map, book mark SVG for layer symbol, map layer transparency, mouse coordinate tracking tool, composing static map analysis data using algorithm	10	20
III	**Introduction to Google Earth Engine**	10	20

Reference books:
 Mandatory Reading
1 Kang-Tsung Chang, Programming ArcObjects with VBA: a task-oriented approach, 2, illustrated, CRC Press, 2007, ISBN 0849392837, 9780849392832
2 Robert Burke (2003) ,Getting to know ArcObjects, programming ArcGIS with VBA,Esri Pr,ISBN-10: 158960018X,ISBN-13: 9781589600186

3   Michael Dawson (2010), Python Programming for the Absolute Beginner, 3rd Edition

Supplementary Reading

1. Rick Leinecker, Vanessa L. Williams,Visual Studio 2008 All-In-One Desk ,For Dummies 2008, ISBN0 470191082, 9780470191088
2. Bruce Ralston,Developing GIS Solutions With MapObjects and Visual Basic,OnWord Press; 1 edition (October 31, 2001),ISBN-10: 0766854388 ,ISBN-13: 978-766854383
3. Swaroop CH, A Byte of Python
4. John Walkenbach, Excel VBA Programming or Dummies
5. John Zelle (2010), Python Programming
6. Michael Dawson (2010), Python Programming for the Absolute Beginner, 3rd Edition
7. Zhi Jun Lio, David Percy, Larry V Stanislawski. GIS Programming: Concepts and Applications

Online resources

https://elearning.iirs.gov.in/https://elearning.iirs.gov.in/
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https://bhuvan.nrsc.gov.in/bhuvan_links.php
https://glovis.usgs.gov/
https://www.nrsc.gov.in/EO_Agr_Objective
https://www.nrsc.gov.in/aboutus_campus_nrscrc/rrsc_east?language_content_entity=en
https://www.iirs.gov.in/

Semester - II
Course Title: GIS for Business and Service Planning
Course code: PGMP-GIS-DSE-404
Credits: 4
Marks: 100
Duration 90 Hours
Prerequisite courses: NIL
Course objective
1. The course is designed to develop programming skills using a spatial data to automate the analysis process.
2. This includes the programming workflow in spatial domain, python for application and various scripting languages.

Course Learning Outcome
After successful completion of a course in student will be able
    CLO5: Student will develop new tools and software also customizes open source software.
    CLO6: They design and built web base platform for geospatial database.
    CLO7: Be able to demonstrate proficiency in quantitative reasoning and analytical skills
    CLO8: Be equipped with practical skills and the ability to apply their theoretical concept to design, perform experiments, analyze and interpret data and thus develop proficiency in lab management
    Course content

Module	Topics	Hours	
		T 30	P 60
I	Geography ad business link, GIS for Business Services, Planning and management, Developments and prospects Micro and macroeconomics Organizational structures, Human resources management Geodemographics and lifestyle approaches, Geolifestyles Marketing spatial analysis, spatial decision support systems 'business geographics' Business censuses and the modeling of customer targeting, Manipulation and merging business application databases	**10**	**20**
II	Customized versus proprietary solutions to business application Databases consultancy applications of GIS, Enterprise resource planning	**10**	**20**

III	Internet platform for GIS Customer facing GIS: web, eCommerce and mobile solutions, Online mapping Applications Supporting business decision, Enterprise applications, Customized spatial decision support systems Ethical Legal and Security issues of spatial technology	**10**	**20**

Reference books:
Mandatory Reading
1 Kang-Tsung Chang, Programming ArcObjects with VBA: a task-oriented approach, 2, illustrated, CRC Press, 2007, ISBN 0849392837, 9780849392832
2 Robert Burke (2003) ,Getting to know ArcObjects, programming ArcGIS with VBA,Esri Pr,ISBN-10: 158960018X,ISBN-13: 9781589600186
3 Michael Dawson (2010), Python Programming for the Absolute Beginner, 3rd Edition

Supplementary Reading
1. Rick Leinecker, Vanessa L. Williams,Visual Studio 2008 All-In-One Desk ,For Dummies 2008, ISBN0 470191082, 9780470191088
1. Bruce Ralston,Developing GIS Solutions With MapObjects and Visual Basic,OnWord Press; 1 edition (October 31, 2001),ISBN-10: 0766854388 ,ISBN-13: 978-766854383
2. Swaroop CH, A Byte of Python
3. John Walkenbach, Excel VBA Programming or Dummies
4. John Zelle (2010), Python Programming
5. Michael Dawson (2010), Python Programming for the Absolute Beginner, 3rd Edition
6. Zhi Jun Lio, David Percy, Larry V Stanislawski. GIS Programming: Concepts and Applications

Online resources

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https://bhuvan.nrsc.gov.in/bhuvan_links.php
https://glovis.usgs.gov/
https://www.nrsc.gov.in/EO_Agr_Objective
https://www.nrsc.gov.in/aboutus_campus_nrscrc/rrsc_east?language_content_entity=en
https://www.iirs.gov.in/

Annexure D

M.Sc. GEOINFORMATICS
SEMESTER III

SEMESTER III
Course Title: APPLICATIONS OF GIS IN URBAN AND REGIONAL PLANNING
Course Code: PGMP-GIS-DSE-501
Credits: 04
Marks: 100
Duration 90 Hours
Prerequisite course: NIL
Course objective
- The course is aimed to introduce the concept of urban and regional planning and applications of GIS in it. It consists of collection, processing, analysis and development of solution from urban and regional problems.

Course Learning Outcome
CLO1:   Students will describe a remote sensing application and assemble and summarize relevant literature in a written assignment, case study and development of models in various urban environmental activities.
CLO2:   Develop a tendency towards research through the compulsory internship in industry /research/ academic institutes which promote and inculcate professional ethics and code of practice among students, enabling them to work in a team with multidisciplinary approach.
CLO3:   To be able use these skills to identify and analyzed real world problem and preparing them for a successful career in geospatial industry and research institute.
CLO4:   Be able to demonstrate proficiency in quantitative reasoning and analytical skills
Course content

Module	Topics	Hours T 30	P 60
I	• Define urban, Urban area in India, purpose of urban planning, classification of urban settlement, geospatial application urban planning and innovative technology urban planning, National urban information system • Urban land use inventory, urban sprawl growth and trends, network analysis, urban environment analysis and suitability analysis	10	20
II	• Data visualization and mapping design, Visualization for displaying and accessing urban information Groupware in urban planning, web sites for urban planning	10	20
III	• Region, characterization of region, Need for region planning dataset of region planning • Urban landscape changing model Real time information systems for urban environment and risk monitoring	10	20

Reference Book

Mandatory Reading

1. Ayse Pamuk (2008) Mapping Global Cities, GIS Methods In Urban Analysis. ESRI Press. New York
2. Frederick R Steiner and Kent Butter (ed) (2007) Planning and Urban Design Standards, John Wiley and Sons New Jersey, Canada.
3. Juliana Maantay and John Ziegler (2001) GIS for Urban Environment

Supplementary Reading

1. Bhat, L.S. et al: Micro-Level Planning: A Case Study of Karnal Area, Haryana, K. B. Publications, New Delhi, 2001
2. Bhat, L.S.: Regional Planning in India, Statistical Publishing Society, Calcutta, 2000
3. Chorley, R.J. and Haggett, P. (ed): Network Analysis in Geography, Arnold, 2001
4. Edward J Kaiser, David R. Godschalk,(2007)
5. hypothetical City Workbook, Exercise, Spreadsheets, and GIS Data to Accompany Urban Land Use Planning (4th ed) Board of Trustees of University of Illinois, USA
6. Frederick R Steiner and Kent Butter (ed) (2007) Planning and Urban Design Standards, John Wiley and Sons New Jersey, Canada.
7. Juliana Maantay and John Ziegler (2001) GIS for Urban Environment
8. Kuklinski, A.R. (ed.): Growth Poles and Growth Centres in Regional Planning, Mouton, The Hague. 19

Online resources

1. ISO TC 211 (2003) ISO TC 211 homepage. http://www.isotc211.org
2. OGC (2003) The Open Geospatial Consortium Homepage, http://www. opengeospatial.org
3. Open Geospatial Consortium Inc. http://www.opengeospatial.org/docs/02-058.pdf
4. ISO/IEC DIS 14772, 2000, The Virtual Reality Modeling Language: (VRML 97), http://www.vrml.org/technicalinfo/specifications/vrml97/index.htm
5. VRML-Streaming Working group, http://www.web3d.org/WorkingGroups/vrml-streams/

Course Title: Advanced Research Methodology
Course Code: PGMP-GIS-RSE-501
Credits: 04
Marks: 100
Duration 90 Hours
Prerequisite Course: NIL
Course Objectives:
1. The course aims to introduce the students to various research designs and techniques and to identify the sources of information for data collection and literature review.

Course Learning Outcome: After successful completion of the course, students will be able to

CLO1:	Understand the importance of review of literature in research
CLO2:	Develop skills of writing review of literature
CLO3:	Understand and use different referencing skills
CLO4:	Create hypothesis/formulate
CLO5:	Critically assess literature review/research paper

Course content

Module	Topics	Hours	
		T	P
		30	60
		10	20
I	**Introduction to Research:** Research and its types, Research process and steps, Essential components of Literature Review, definition of problem, Objectives & strategies of research		
	Methods of Data Collection : Types of data collection and classification, designing questionnaires and schedules, digital organization of data, preprocessing		
II	**Sampling Methods:** Probability sampling, random sampling, systematic sampling, stratified sampling and cluster sampling Non-probability sampling, quota sampling	10	20
	Data Analysis: Statistical measures and their significance: Central tendencies, variation, skewness, Kurtosis, time series analysis, correlation and regression, Testing of Hypotheses: Chi Square, ANOVA		
III	**Report writing:** Pre writing considerations, Format of report writing, Abstract Writing, Synopsis Writing, Thesis writing, Chapterization, Format of publications in research journals.	10	20

References book
Mandatory Reading
1. Kothari C.K. (2004), 2/e, Research Methodology- Methods and Techniques (New Age International, New Delhi)

2. Hira, D.S. System Simulation, S. Chand & Co., New Delh.
3. B.E. Vieux (2005). Distributed Hydrologic Modeling Using GIS, ISBN-13: 978-0792370030
4. Proctor, T. (2003) "Essentials of Marketing Research", 3rd edition, Prentice Hall

Supplementary Reading

1 Montgomery, Douglas C. (2007), 5/e, Design and Analysis of Experiments, (Wiley India)
2 Montgomery, Douglas C. &Runger, George C. (2007), 3/e, Applied Statistics &Probability for Engineers (Wiley India)
3 Krishnaswamy, K.N., Sivakumar, AppaIyer and Mathiranjan M. (2006), Management Research Methodology; Integration of Principles, Methods and Techniques (Pearson Education, New Delhi)
4 Hira, D.S. System Simulation, S. Chand & Co., New Delh.
5 B.E. Vieux (2005). Distributed Hydrologic Modeling Using GIS, ISBN-13: 978-0792370030
6 Proctor, T. (2003) "Essentials of Marketing Research", 3rd edition, Prentice Hall

Web reference

1. https://www.scribbr.com/dissertation/methodology/
2. https://www.researchgate.net/publication/270956555_CHAPTER_3_-_RESEARCH_METHODOLOGY_Data_collection_method_and_Research_tools
3. https://research-methodology.net/research-methodology/
4. Adapted from: Miles & Huberman (1994, p. 40). Qualitative Data Analysis, available at http://wilderdom.com/research/QualitativeVersusQuantitativeResearch.html
5. **https://elearning.iirs.gov.in/https://elearning.iirs.gov.in/**
6. **https://www.esri.com/en-us/home**
7. **https://www.intergraph.com/**
8. **https://www.sac.gov.in/Vyom/index.jsp**

Course Title: RESEARCH APPLICATIONS IN RESOURCE MANAGEMENT
Course Code: PGMP-GIS-RSE-502
Credits: 04
Marks: 100
Duration 90 Hours
Prerequisite course: NIL
Course objective
1. The course is aimed to introduce the concept of land, water and coastal management. Taxation and to learn how GIS can be applied in resource management sector.

Course Learning Outcome: After successfully completion of the course, students will be able to

CLO1: Understanding importance of nature resources and its categorizes
CLO2: To be able use these skills to identify and analyzed real world problem and preparing them for a successful career in geospatial industry and research institute
CLO3: Acquire of fundamental and advanced knowledge of the different aspect in Geoinformatics with the means ability to specialize in a specific field.
CLO4: Develop a tendency towards research through the compulsory internship in industry /research/ academic institutes which promote and inculcate professional ethics and code of practice among students, enabling them to work in a team with multidisciplinary approach.

Course content

Modu le	Topics	Hours T 30	P 60
I	• **Techniques for research in** forest resource Management Cadastral Mapping, Land Registration Workflow, Parcel management, Land Parcel Data Model, data capture, data management and processing	10	20
II	• **Techniques for research in** Land Capability Mapping and Limitations, Public Access, Land classifications, Land use planning, Taxation	10	20
III	• **Techniques for research in** Water Resources- Watershed Management, Flood management and Damage Assessment, Zone Mapping, Groundwater recharge mapping, Water Quality, Watershed Erosion Modeling	10	20

Reference Books:
Mandatory Reading

1. Michael G. Wing, Pete Bettinger (2008),Geographic Information Systems: Applications in Natural Resource Management, Oxford University Press, USA

Supplementary Reading
1. Ali S.A. Resources for Future Economic Growth, Vikas Publications House, New Delhi, 2004.
2. Ress J. Natural Resources, Allocation, Economics & Policy, Rout Ledge, London, 2000.
3. Turner R.K. Sustainable Environmental Management, Belhaven Press, London, 2006.
4. Nancy von Meyer (2004), GIS and Land Records, ESRI press
5. Laura Lang (2004), Managing Natural Resources with GIS, ESRI Press, ISBN 1-879102-53-6
6. Roger Tomlinson (2007), Thinking about GIS, ESRI Press
7. John G. Lyon (2002). GIS for Water Resource and Watershed Management, Taylor & Francis

Web reference
1. ISO TC 211 (2003) ISO TC 211 homepage. http://www.isotc211.org
2. OGC (2003) The Open Geospatial Consortium Homepage, http://www. opengeospatial.org
3. Open Geospatial Consortium Inc. http://www.opengeospatial.org/docs/02-058.pdf
4. ISO/IEC DIS 14772, 1997, The Virtual Reality Modeling Language: (VRML 97), http://www.vrml.org/technicalinfo/specifications/vrml97/index.htm

VRML-Streaming Working group, http://www.web3d.org/WorkingGroups/vrml-streams/

Course Title: Research Applications in Agriculture and Soil
Course Code: PGMP-GIS-RSE-503
Credits: 04
Marks: 100
 Duration 90 Hours

Prerequisite   NIL

Course objective
1. The course is aimed to introduce the concept of Agriculture, Soil and land   management. Develop model and decision support system for different Agriculture system.

Course Learning Outcome: After successfully completion of the course, students will be able to

CLO1:	Understanding importance of Agriculture resources and its categories.
CLO2:	To be able use these skills to identify land use and land cover problem.
CLO3:	Develop and built application in agriculture sector.
CLO4:	Critically think geospatial technology aspect.

Course content

Module	Topics	Hours T 30	P 60
I	**Techniques for research in Agriculture** -Spectral characteristic of crop, crop inventory ,crop yield modeling , crop water management, agro ecological zoning	10	20
II	**Techniques for research in Soil**– crop acreage and production estimation model, ground water potential zone ,recharge and identification	10	20
III	**Techniques for research in Land** -Land evaluation, physiographic soil mapping, soil type identification, soil moisture mapping **Case study-** Review case studies in Geosciences, Water Recourse, Agriculture, Soil	10	20

Reference Books:
 Mandatory Reading

1. Vincent RK (2000) Fundamentals of Geological and Environmental Remote Sensing New Jersey: Prentice Hall
2. Kondratyev K Ya, Buznitov AA and Pokrovoky OM (2000). Global Change and Remote Sensing: John Wiley and Sons.

3. Roy, P.S. Geoinformatics for Tropical Ecosystems Bishen Singh Mahendra Pal Singh, Dehradun
4. Skidmore Andrew (2000) Environmental Modeling with GIS and Remote Sensing Taylor and Francis

Supplementary Reading
1. Cracknell A P(ed) (2000) Remote Sensing in Meteorology, Oceanography and Hydrology. Chichester: Ellis Horwood Limited
2. Damen MCJ, Sicco Smith G and Kerstappen(Ed) (2004) Remote Sensing for Resources Development and Environmental Management 3rd.volume Set Netherlands: Balkema
3. *Jensen, J.R. (2000). Remote sensing of the environment: an Earth resource perspective. Prentice Hall. ISBN 0-13-609733-1.*
4. Kondratyev K Ya, Buznitov AA and Pokrovoky OM (2000). Global Change and Remote Sensing: John Wiley and Sons.
5. Roy, P.S. Geoinformatics for Tropical Ecosystems Bishen Singh Mahendra Pal Singh, Dehradun
6. Skidmore Andrew (2000) Environmental Modeling with GIS and Remote Sensing Taylor and Francis
7. Steven MD and Clark JA (2001). Applications of Remote Sensing in Agriculture London Butterworths.

Web reference

https://elearning.iirs.gov.in/https://elearning.iirs.gov.in/
https://www.esri.com/en-us/home
https://www.intergraph.com/
https://www.sac.gov.in/Vyom/index.jsp
https://bhuvan.nrsc.gov.in/bhuvan_links.php
https://glovis.usgs.gov/
https://www.nrsc.gov.in/EO_Agr_Objective
https://www.nrsc.gov.in/aboutus_campus_nrscrc/rrsc_east?language_content_entity= en
https://www.iirs.gov.in/

Course Title: WEB GIS AND DEVELOPMENT OF WEB APPLICATION
Course Code: PGMP-GIS-GE-501
Credits: 04
Marks: 100
 Duration 90 Hours
Prerequisite course: Passing of competency test is Mandatory Reading (40%)
Course Objective:
1. Provide students with a comprehensive and up-to-date overview of Web GIS, including the basic concepts, principles, related fields (e.g. mobile GIS) and frontiers.
2. Provide students with the state-of-art technical skills to build Web GIS applications and the knowledge needed to choose from various Web GIS development options.

Course Learning Outcome:
After Successful completion of the course, students will be
CLO1: Critically assess the organizational benefits and challenges of developing Web GIS applications;
CLO2: Explain the difference between Web GIS, geospatial web services, mashups, mobile GIS solutions, geoportals, and how these are applicable to e-business and e-government;
CLO3: Evaluate current technologies or architectures that support Web GIS;
CLO4: Design and implement an independent Web GIS application.

Course content

Module	Topics	Hours	
		T 30	**P 60**
I	**Web Based Architecture and Scripting Environments** Roles of Clients & Servers, Basics of web GIS, Architecture, geospatial web services, OGC, Open source and proprietary web-based scripting and mapping environments, KML, GeoJSON, and other formats for drawing vector data in the browser,	10	20
II	Application Programming Interfaces (APIs), GeoServer, NSDI, Census GIS, BHUVAN, Crowd Sourcing.	10	20
III	**Mobile GIS and Open Data Kit** Architecture of Mobile GIS, Operating systems for Mobile GIS, Wireless web, customization of Mobile GIS, softwares, Libraries, SDK packages and advantages,	10	20

Reference Books:
Mandatory Reading
1. DuVander A 2010. Map Scripting 101: An Example-Driven Guide to Building Interactive Maps with Bing, Yahoo!, and Google Maps
2. Markus Neteler And Helena Mitasova (2007): Open Source GIS: A GRASS approach, Springer-Verlag Berlin, Heidelberg

3. Andrew Cutts, Anita Graser (2018): Learn QGIS ,

Supplementary Reading

1. PindeFu,(2018) Getting to Know Web GIS,(3rd Ed),Esri Press, Redlands, CA.
2. Markus Neteler And Helena Mitasova (2007): Open Source GIS: A GRASS approach, Springer-Verlag Berlin, Heidelberg
3. Andrew Cutts, Anita Graser (2018): Learn QGIS ,

Online resources

1. https://www.packtpub.com/application development/learn-qgis-fourth-edition
2. ArcGIS Resource Center Web APIs, http://resources.arcgis.com/content/web/web-apis
3. ArcGIS JavaScript APIs, http://help.arcgis.com/en/webapi/javascript/arcgis/
4. ArcGIS JavaScript API Samples, https://developers.arcgis.com/en/javascript/jssamples
5. https://mangomap.com/web-gis

Annexure D

M.Sc. GEOINFORMATICS
SEMESTER IV

Semester IV

PGMP-GIS- I 501	Project / Internship	400	16
PGMP-GIS-DSE-502	Applications of GIS in Disaster Management/Agriculture/Urban Planning/Tourism etc. (Online)	100	4

DISSERTATION/INTERNSHIP
1) the Dissertation/Internship shall be spread over the Third and/or Fourth Semesters. However, in case of two-year Programmes, the DFC may consider reducing it to one Semester if the student is eligible to complete the Masters Programme in Three Semesters.
2) The DFC shall decide the modalities relating to Dissertation/Internship.
3) The topic of the Dissertation shall be finalized by the student in consultation with the Research Supervisor/Research Mentor by the beginning of the Academic Year in which they are pursuing their Dissertation.
4) The DFC shall decide the distribution/number of students to be allotted to a Research Supervisor.
5) A student shall declare, in the prescribed proforma, that the Dissertation is her/his own original work and that all the sources used are duly acknowledged.
6) The Research Supervisor shall certify, in the prescribed proforma, that the Dissertation is a work of the student completed under her/his supervision.
7) A student shall submit their Dissertations to the School /College through the Research Supervisor not later than one week before the end of the Semester. Ordinarily, no student shall be permitted to submit the Dissertation after the due date.
8) A student shall submit a soft copy and a spiral bound copy of the Dissertation to the College in the standard format as notified by Goa University for the Project is the part of paper **PGMP-GIS- I 501.** Fourth semester is fully devoted to project work.
9) Project will cover 300 Credits and 4month durations
10) The student for the fulfillment of M.Sc.- Geoinformatics must carry outIndividual dissertation work.
11) Comprehensive Viva Voce
12) Viva Voce will be conducted to the student by Department on the topic of the dissertation carried out by the student.

Guidelines for Dissertation

1	Problem identification and literature review	Credits 3
2	Data acquisition and collection	Credits 2
3	Field work	Credits 3
4	Data processing	Credits 2
5	Result and interpretation	Credits 2
6	Report writing	Credits 2
7	Presentation	Credits 2

Course Title: APPLICATIONS OF GIS IN DISASTER MANAGEMENT/AGRICULTURE/ URBAN PLANNING/ TOURISM ETC**. (ONLINE)**
Course Code: PGMP-GIS-DSE-502
Credits: 04
Marks: 100
Duration : 90 Hours

Prerequisite courses: NIL

Course objectives:
1. Provide students with the state-of-art technical skills to build disaster and hazard applications.
2. This course helpful in mitigation strategies and preparedness plans. Real time geographic data can improve the allocation of resources for response. A GIS technology is much useful in modelling of disaster risks and human adaptations to hazards.

Course outcome:
After completion of this course, students will be able to:
CLO1: Be equipped with practical skills and the ability to apply their theoretical concept to design, perform experiments, analyze and interpret data and thus develop proficiency in lab management.
CLO2: It is provides decision support system in disaster management and making model reduce risk and Hazard. Students will handle different disaster project like Flood, landslideing, fire and drought.
CLO3: To be able use these skills to identify and analyzedDisaster and preparing them for a successful career in geospatial industry and research institute.
CLO4: Acquire of fundamental and advanced knowledge of the different aspect in Geoinformatics with the means ability to specialize in a specific field.

Course content

Module	Topics	Hours L 30	P 60
I	• Disaster management, types of hazard and disaster, risk and vulnerability assessment	10	20
II	• Disaster management measures –Structural and Non-structuraldisaster,prevention,mitigation,preparedness,response,recovery and rehabilitation, Disaster zonation of world –climatic, geological &Geomorphologic hazard	10	20
III	• Strategies of risk reduction –disaster preparedness, support system, organization,awareness programs,disaster policy and planning in India • Case study –landslide,flood,cyclone and drought	10	20

Reference Books
Mandatory Reading
1. Alexander, D. (1993). Natural disasters. UCL Press Ltd., University College London. 632.
2. Van Westen, C.J. (1993) Application of Geographic Information Systems to Landslide Hazard Zonation. ITC-Publication Number 15, ITC, Enschede, The Netherlands, 305 pp.
3. Pelling, M. (2003). The Vulnerability of Cities: Natural Disaster and Social Resilience, Earthscan, London.
4. Pike, R.J., (2000). Geomorphometry - diversity in quantitative surface analysis. Progress in Physical Geography 30 (1), 1-20.

Supplementary Reading
1 Adler, R.F. and A.J. Negri, 1988. A satellite infrared technique to estimate tropical convective and stratiform rainfall. J. Appl. Meteorol., 27: 30-51.
2 Anagnostou, E.N., A.J. Negri and R.F. Adler, 1999. A satellite infrared technique for diurnal rainfall variability studies. J. Geophy. Res., 104: 31477-31608.
3 Barrett, E.C., (1996) The storm project: using remote sensing for improved monitoring and prediction of heavy rainfall and related events. Remote Sensing Reviews, vol 14, 282 pp.
4 Van Westen, C.J. (1993) Application of Geographic Information Systems to Landslide Hazard Zonation. ITC-Publication Number 15, ITC, Enschede, The Netherlands, 305 pp.
5 Pelling, M. (2003). The Vulnerability of Cities: Natural Disaster and Social Resilience, Earthscan, London.
6 Pike, R.J., (2000). Geomorphometry - diversity in quantitative surface analysis. Progress in Physical Geography 30 (1), 1-20.

Online resources
1) https://www.nrsc.gov.in/
2) https://www.iirs.gov.in/
3) http://www.undp.org/popin/wdtrends/wdtrends.htm
4) https://www.isprs.org/proceedings/xxxiii/congress/part7/1609_XXXIII-part7.pdf
5) http://www.tric.u-tokai.ac.jp/ISPRScom8/TC8/TC8_CD/headline/JAXA_Special_Session%20-%206/JTS64_20100608144600.pdf
6) https://www.semanticscholar.org/paper/Role-of-Remote-Sensing-in-Disaster-Management-Nirupama-Simonovic/da84562b2057ca5866d933d47ee8815a06f0229c

Annexure E
SYLLABUS FOR POSTGRADUATE DEGREE
PROGRAMME IN POST GRADUATE DIPLOMA GEOINFORMATICS
(Implemented from the Academic Year 2023-2024 onwards)

SEMESTER	COURSE CODE	TITLE OF THE COURSE	NOMENCLATURE/TYPE OF COURSE	CREDITS
1	PGDP-GIS-DSC-401	Basics of GIS and GPS	DSC	4
	PGDP-GIS-DSC-402	Basics of Remote Sensing and Photogrammetry	DSC	4
	PGDP-GIS-DSC-403	Applications of Geostatistics	DSC	4
	PGDP-GIS-DSC-404	Advanced Digital Cartography	DSC	4
	PGDP-GIS-DSE-401	Principles of Computer and Programming	DSE	4
	PGDP-GIS-DSE-402	Applications of GIS Techniques in Entrepreneurship	DSE	4
2	PGDP-GIS-DSC-405	Spatial Analysis & Modeling	DSC	4
	PGDP-GIS-DSC-406	Advanced Remote Sensing and GIS	DSC	4
	PGDP-GIS-DSC-407	Digital Image Processing	DSC	4
	PGDP-GIS-DSC-408	Applications of GIS for Natural Resource management	DSC	4
	PGDP-GIS-DSE-403	Pilot Project, Field Work and Tour	DSE	4
	PGDP-GIS-DSE-404	Programming and Customization	DSE	4

Annexure E
PROGRAMME IN POST GRADUATE DIPLOMA GEOINFORMATICS
(Implemented from the Academic Year 2023-2024 onwards)

Course Code	Course Title	Marks	Credits
Semester I		Theory and Practical components 50+50	T & P (2+2=4)
PGDP-GIS-DSC-401	Basics of GIS and GPS	**100**	**2+2**
PGDP-GIS-DSC-402	Basics of Remote Sensing and Photogrammetry	**100**	**2+2**
PGDP-GIS-DSC-403	Applications of Geostatistics	**100**	**2+2**
PGDP-GIS-DSC-404	Advanced Digital Cartography	**100**	**2+2**
PGDP-GIS-DSE-401	Principles of Computer and Programming	**100**	**2+2**
PGDP-GIS-DSE-402	Applications of GIS Techniques in Entrepreneurship	**100**	**2+2**
Total		**500**	**20**
Semester II			
PGDP-GIS-DSC-405	Spatial Analysis & Modeling	**100**	**2+2**
PGDP-GIS-DSC-406	Advanced Remote Sensing and GIS	**100**	**2+2**
PGDP-GIS-DSC-407	Digital Image Processing	**100**	**2+2**
PGDP-GIS-DSC-408	Applications of GIS for Natural Resource management	**100**	**2+2**
PGDP-GIS-DSE-403	Pilot Project, Field Work and Tour	**100**	**2+2**
PGDP-GIS-DSE-404	Programming and Customization	**100**	**2+2**
Total		**500**	**20**

Annexure E
POST GRADUATE DIPLOMA GEOINFORMATICS
SEMESTER I

Course Title: BASICS OF GIS AND GPS
Course code: PGDP-GIS-DSC-401
Credits: 4
Marks: 100
Duration 90 hours
Prerequisite courses: NIL
Course objective -
5. The course focuses on the fundamentals concept Geographical Information System, and Global Positioning System
6. Introducing the spatial data, non- spatial data, hardware and software used in collection, processing and analysis of geospatial data.

Course Learning Outcome:
    After completion of this course, students will be able to:
CLO9:   Students will demonstrate proficiency and conceptual understanding in using software and automated techniques to carry out thematic maps and analysis through a series of laboratory exercises and creation of reports.
CLO10:   Personal effectiveness and workplace competencies are practiced through engagement in discussion boards, following course guidelines, and interactions with the instructor and other students in the class
CLO11:   To be able use these skills to identify and analyzed real world problem and preparing them for a successful career in geospatial industry and research institute
CLO12:   Develop an tendency towards research through the compulsory internship in industry /research/ academic institutes which promote and inculcate professional ethics and code of practice among students, enabling them to work in a team with multidisciplinary approach

Course content

Module	Topics	Hours L	P
		30	60
I	Introduction to GIS	10	20
	• **History and development.**		
	• **Components and Applications trends of GIS.**		
	• **Data models: vector and raster**		
	• **Data type, structure, Spatial and attribute, point, line, polygon-arc, nodes, vertices, and topology. Attribute data.**		
	• **Data processing systems, input and output devices, editing and attributing and linking**		
II	Spatial dada inputs	10	20
	• **Digitization**		
	• **Error identification**		
	• **Types and sources of error**		

- **Correction editing and topology building**

III   Introduction to GPS   10   20

- **History of Positioning System GPS System Description, Error Sources & Receiver**
- **Introduction to DGPS and Total Station, GPS Performance and Policy Applications**
- **Introduction to open source GIS**

Reference book
Mandatory Reading

10. Burrough, P.A. and McDonnell, R.A. (1998) Principles of geographical information systems. Oxford University Press, Oxford, 327 pp.
11. Campbell, J.B. (2002). Introduction to remote sensing, 3rd ed., The Guilford Press. ISBN 1-57230-640-8.
12. Chang, K. (2007) Introduction to Geographic Information System, 4th Edition. McGraw Hill.
13. Curran Paul J Principles of Remote Sensing UK: ELBS,
14. Elangovan,K (2006) GIS: Fundamentals, Applications and Implementations. New India Publishing Agency, New Delhi"208 pp.

Supplementary Reading

14. Curran Paul J Principles of Remote Sensing UK: ELBS,
15. Elangovan,K (2006) GIS: Fundamentals, Applications and Implementations. New India Publishing Agency, New Delhi"208 pp.
16. Heywood, I., Cornelius, S., and Carver, S. (2006) An Introduction to Geographical Information Systems. Prentice Hall. 3rd edition.
17. Jensen, J.R. (2000). *Remote sensing of the environment: an Earth resource perspective*. Prentice Hall. ISBN 0-13-609733-1.
18. Joseph, George Fundamentals of Remote Sensing Universities Press India
19. Lillesand, T.M.; R.W. Kiefer, and J.W. Chipman (2003). Remote sensing and image interpretation, 5th ed., Wiley. ISBN 0-471-15227-7.
20. Thurston, J., Poiker, T.K. and J. Patrick Moore. (2003) Integrated Geospatial Technologies: A Guide to GPS, GIS, and Data Logging. Hoboken, New Jersey: Wiley.
21. Wise, S. (2002) GIS Basics. London: Taylor & Francis.

Online resources

12) https://www.nrsc.gov.in/
13) https://www.iirs.gov.in/
14) http://www.undp.org/popin/wdtrends/wdtrends.htm
15) https://www.isprs.org/proceedings/xxxiii/congress/part7/1609_XXXIII-part7.pdf
16) http://www.tric.u-tokai.ac.jp/ISPRScom8/TC8/TC8_CD/headline/JAXA_Special_Session%20-%206/JTS64_20100608144600.pdf

17) https://www.semanticscholar.org/paper/Role-of-Remote-Sensing-in-Disaster-Management-Nirupama-Simonovic/da84562b2057ca5866d933d47ee8815a06f0229c

Course Title: BASICS OF REMOTE SENSING AND PHOTOGRAMMETRY
Course code: PGDP-GIS-DSC-402
Credits: 4
Marks: 100
Duration 90 hours
Prerequisite courses: NIL
Course objective

4. Give foundational knowledge about remote sensing and its types and different sensors used for remote sensing which will focus on comprehension of the physical, computational, and perceptual basis for remote sensing.
5. Gain familiarity with a variety of physical, biological, and human geographic applications of remote sensing.
6. Gain basic experience in the hands-on application of remote sensing data through visual interpretation and digital image processing exercises.

Course Learning Outcome
After successful completion of a course in student will be able

CLO5:   Students will be able to understand the concept of remote sensing and EMR apart from this basic level of fundamental physical principles of remote sensing, including the electromagnetic spectrum; the emission, scattering, reflection, and absorption of electromagnetic (EM) radiation; how EM radiation interactions vary across a limited number of substances, geometries, and temperatures; and geometric properties of photographs and imagery.

CLO6:   To be able use these skills to identify and analyzed real world problem and preparing them for a successful career in geospatial industry and research institute

CLO7:   Be equipped with practical skills and the ability to apply their theoretical concept to design, perform experiments, analyze and interpret data and thus develop proficiency in lab management

CLO8:   Develop an tendency towards research through the compulsory internship in industry /research/ academic institutes which promote and inculcate professional ethics and code of practice among students, enabling them to work in a team with multidisciplinary approach.

Course content

Module	Topics	Hours	
		T	P
		30	60
I	**Fundamental of Remote Sensing**	10	20
	• Introduction, History, development,		
	• stages of remote sensing, EMR & EMR spectrum, EMR Quantities, Energy sources and radiation principles,		
	• Theories of EMR, Concept of Energy interactions in the atmosphere, energy Black body, atmospheric windows		
	• types of remote sensing interactions with the earth surface features, Spectral reflectance of vegetation, Soil and water,		

II	**Platform, Orbit and sensor**	**10**	**20**

- Platform: Ground based, air-borne, space-borne,
- Orbit: Geostationary satellite and polar orbiting satellite, Sensor:
- Types of sensor and cameras, processes of sensor & its characteristics, Whiskbroom and Push broom cameras

III	**Techniques of interpretation**	**10**	**20**

- Aerial photo interpretation, satellite image interpretation,
- Recognition elements: Tone, Color, Texture, Pattern, Shape, Size and associated features

Aerial photographyTypes, Geometry, Scale, Height and Process of Aerial Photograph, basic requirement of Aerial Photograph, planning & execution of photographic flight, aerial cameras, relief displacement, stereo vision, stereo model & stereoscope, parallax & parallax measurement

References books
Mandatory Reading

5. Campbell, J.B. (2002). Introduction to remote sensing, 3rd ed., The Guilford Press. ISBN 1-57230-640-8.
6. Curran Paul, J. (2000) Principles of Remote Sensing UK: ELBS.
7. Joseph, George (2007) Fundamentals of Remote Sensing Universities Press India
8. Lillesand, T.M.; R.W. Kiefer, and J.W. Chipman (2007). Remote sensing and image interpretation, 5th ed., Wiley. ISBN 0-471-15227-7.
9. Sabins Floyd F Remote Sensing: Principles and Interpretation New York: WH Freeman and Company

Supplementary Reading

5. Moffitt, F. H. (2000). Photogrammetry. 3rd Ed, Harper & Row, NY.
6. Sabins Floyd F Remote Sensing: Principles and Interpretation New York: WH Freeman and Company
7. Wolf, P. R. (2004). Elements of Photgrammetry. McGraw-Hill, NY.
8. Zorn, H. C. (2006). Introductory Course in Photogrammetry. 6th Ed. ITC, Netherlands.

Online resources

7) https://www.nrsc.gov.in/
8) https://www.iirs.gov.in/
9) http://www.undp.org/popin/wdtrends/wdtrends.htm
10) https://www.isprs.org/proceedings/xxxiii/congress/part7/1609_XXXIII-part7.pdf
11) http://www.tric.u-tokai.ac.jp/ISPRScom8/TC8/TC8_CD/headline/JAXA_Special_Session%20-%206/JTS64_20100608144600.pdf
12) https://www.semanticscholar.org/paper/Role-of-Remote-Sensing-in-Disaster-Management-Nirupama-Simonovic/da84562b2057ca5866d933d47ee8815a06f0229c

Course Title: ADVANCED GEOSTATISTICS
Course code: PGDP-GIS-DSC-403
Credits: 4
Marks: 100
Duration 90 hours
Prerequisite courses: NIL
Course objective
3. The course is designed to process geospatial data and use of statistics in the field of GIS.
4. The course focuses on the development of the skills using statistical techniques in understanding, organizing, interpolation, analyzing and interpretation of geostatistical data and to develop the firm foundation to apply it in various fields.

Course Learning Outcome
After successful completion of a course in student will be able
CLO9:   After completion of the course students will understand various types of datasets and applying different statistical techniques to different data sets.
CLO10:   This will systematically access, analyze and evaluate information and ideas from multiple sources in order to identify underlying assumptions, and formulate conclusions. The course will enhance skills like solving quantitative problems and statistical queries.
CLO11:   Develop an tendency towards research through the compulsory internship in industry /research/ academic institutes which promote and inculcate professional ethics and code of practice among students, enabling them to work in a team with multidisciplinary approach.
CLO12:   Workplace competencies are strengthened as students apply the analytical and evaluative tools to GIS mapping and apps

Course content

Module	Topics	Hours T	P
		30	60
I	**Introduction to Statistics**	10	20
	• Statistical and Graphical foundation, data classification		
	• Univariate (Measures of Central Tendency, Measures of Dispersion)		
	• Moments (Skewness, Kurtosis)		
II	• **Bivariate and Matrices**	10	20
	• Co-relation Methods (Co-relation Methods)		
	• Regressions (Linear, Exponential, Power)		
	• Matrices (Types, Addition, Subtraction, Multiplication, Simultaneous Equation with algebra and elimination Method, Co-factor Method,		
III	**Geostatistical uncertainty, probability and Multivariate**	10	20
	• Probability		
	• Multiple Regression		
	• Multiple Co-relation		
	• Principle Component Analysis.		

Reference Books:
Compulsory

4. Simon W. Houlding, (2000) Practical Geostatistics: Modeling and Spatial Analysis, Springer, Berlin
5. Ravi Sethi (2000). Programming Languages: Concepts and Constructs, 2nd ed., Addison-Wesley.
6. James S. McKeown (2010), Programming in Visual Basic 2010: The Very Beginner's Guide
7. Richard Mansfield (2003), Visual Basic .NET All in One Desk Reference for Dummies

Supplementary Reading

6. Ricardo A. Olea (2000) Geostatistics for Engineers and Earth Scientist, Kluwer Academic Publishers, Boston
7. Richard Webstar and Margaret A. Oliver: Geostatistics for Environmental Scientists, Statistics in Practice (2nd ed) J. Wiley
8. Ott, T. and Swiaczny, F. (2001). Time-integrative GIS. Management and analysis of spatio-temporal data. Berlin / Heidelberg / New York: Springer.
9. Thurston, J., Poiker, T.K. and J. Patrick Moore. (2003). Integrated Geospatial Technologies: A Guide to GPS, GIS, and Data Logging. Hoboken, New Jersey: Wiley.
10. Roy, P.S. (2006). Geoinformatics for Tropical Ecosystems Bishen Singh Mahendra Pal Singh, Dehradun

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https://glovis.usgs.gov/
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https://www.nrsc.gov.in/aboutus_campus_nrscrc/rrsc_east?language_content_entity=en
https://www.iirs.gov.in/

Course Title: ADVANCED DIGITAL CARTOGRAPHY
Course code: PGDP-GIS-DSC-404
Credits: 4
Marks: 100
Duration 90 hours
Prerequisite courses: NIL

Course objective
3. The course gives emphasis on the art, science, and technologies of cartography and Photogrammetry.
4. It develops the user's ability to understand how maps are created traditionally and digitally. Representation and communicate spatial phenomena and their relationships through photogrammetric perspective which emphasis on skills like making of map, map reading signs and symbols etc..

Course Learning Outcome
After successful completion of a course in student will be able
   CLO5:   Students will understand different types of projections and datum used in various locations. Proficiency and conceptual understanding in using Manual and computer techniques to carry out thematic maps and special purpose maps.
   CLO6:   Remote sensing, image processing and analysis through a series of laboratory exercises and report
   CLO7:   Be able to demonstrate proficiency in quantitative reasoning and analytical skills
   CLO8:   Acquire of fundamental and advanced knowledge of the different aspect in cartography with the means ability to specialize in a specific field.

Course content

Module	Topics	Hours	
		T	**P**
		30	**60**
I	**Introduction to Cartography**	**10**	**20**
	• Basics of Map		
	• Fundamentals of direction, scale, types, sources		
	• Elementary geodesy- Datum and Projection		
	• Projection coordinates		
	• WGS 84		
II	**Thematic Cartography Characteristics of geographical phenomena**	**10**	**20**
	• Principles of colour perception		
	• Colour scheme for Univariate choropleth and Isorithmic maps, proportional symbol mapping		
	• Interpolation methods for smooth continuous phenomena symbolizing smooth continuous phenomena. Dot and asymmetric mapping		
III	**Geographic representation**	**10**	**20**
	• Map and mapping, map design, symbolization, conventional signs		

- map layout, map referencing and indexing, scale of maps and map contents
- Field work techniques, socio – economic survey and attribute data.

Reference Books:
Mandatory Reading

4. ESRI. 2004. ESRI Cartography: Capabilities and Trends. Redlands, CA. White Paper
5. Ravi Sethi (2000). Programming Languages: Concepts and Constructs, 2nd ed., Addison-Wesley.
6. James S. McKeown (2010), Programming in Visual Basic 2010: The Very Beginner's Guide
7. Richard Mansfield (2003), Visual Basic .NET All in One Desk Reference for Dummies

Supplementary Reading

8. Kraak, Menno-Jan and Allan Brown (2001): Web Cartography – Developments and prospects, Taylor & Francis, New York, ISBN 0-7604-0869-X.
9. MacEachren, A.M. (2005). Some Truth with Maps: A Primer on Symbolization & Design. University Park: The Pennsylvania State University. ISBN.
10. Monmonier, Mark (2004). How to Lie with Maps. Chicago: University of Chicago Press. ISBN 0-226-53421-9.
11. Monmonier, Mark (2004). Mapping It Out. Chicago: University of Chicago Press. ISBN.
12. Pickles, John (2003). A History of Spaces: Cartographic Reason, Mapping, and the Geo-Coded World. Taylor & Francis. ISBN 0-415-14497-3
13. Sircar, D.C.C. (January 2000). Studies in the Geography of Ancient and Medieval India. Motilal Banarsidass Publishers. ISBN 8120806905.
14. Slocum, T. (2003). Thematic Cartography and Geographic Visualization. Upper Saddle River, New Jersey: Prentice Hall. ISBN 0-130-35123-7. Wilford, John Noble (2000). The Mapmakers. Vintage Books. ISBN 0-375-70850-2**.**

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https://www.sac.gov.in/Vyom/index.jsp
https://bhuvan.nrsc.gov.in/bhuvan_links.php
https://glovis.usgs.gov/
https://www.nrsc.gov.in/EO_Agr_Objective
https://www.nrsc.gov.in/aboutus_campus_nrscrc/rrsc_east?language_content_entity=en
https://www.iirs.gov.in/

Course Title: PRINCIPLES OF COMPUTER AND PROGRAMMING
Course code: PGDP-GIS-DSE-401
Credits: 4
Marks: 100
Duration 90 hours
Prerequisite courses: NIL

Course objective
3. The course will explore the Application of computer in the field of GIS, DBMS and programming for GIS customization.
4. The main focus is on introduction to computers-DBMS, basics of programming languages.

Course Learning Outcome.
After successful completion of a course in student will be able
CLO5: Students will demonstrate proficiency and conceptual understanding in data creation and storage, languages or manuscripts techniques to carry out geographical data for developing and designing application and use of Programming in GIS.
CLO6: To be able use these skills to identify and analyzed real world problem and preparing them for a successful career in gis industry and research institute.
CLO7: Develop an tendency towards research through the compulsory internship in industry /research/ academic institutes which promote and inculcate professional ethics and code of practice among students, enabling them to work in a team with multidisciplinary approach.
CLO8: Workplace competencies are strengthened as students apply the analytical and evaluative tools to geospatial mapping and apps

Course content

Module	Topics	Hours T 30	P 60
I	**Introduction to Computers**	**10**	**20**
	• Hardware and Software, System requirement, configuration and operating systems and Computer Applications		
	• Algorithms and Programming in Computers		
	• MS ACCESS and applications		
II	**Introduction to simple programming in C**	**10**	**20**
	• Developing programming techniques and solutions for spatial algorithms and problem-solving using VB		
	• Getting started with HTML, flash		
III	**Introduction to Python**	**10**	**20**

Reference Books:
Mandatory Reading
4. Benjamin C. Pierce (2002). Types and Programming Languages, The MIT Press.
5. Bruce J. MacLennan (2000). Principles of Programming Languages: Design, Evaluation, and Implementation, Oxford University Press.

6. Ravi Sethi (2000). Programming Languages: Concepts and Constructs, 2nd ed., Addison-Wesley.
7. James S. McKeown (2010), Programming in Visual Basic 2010: The Very Beginner's Guide
8. Richard Mansfield (2003), Visual Basic .NET All in One Desk Reference for Dummies

Supplementary Reading
9. Daniel P. Friedman and Mitchell Wand (2001). Christopher Thomas Haynes: Essentials of Programming Languages, The MIT Press.
10. David Gelernter and Suresh Jagannathan (2005). Programming Linguistics, The MIT Press.
11. Goldschlager, L. (2000). A Lister Computer Science - a modern Introduction Prentice Hall.
12. John C. Mitchell (2002). Concepts in Programming Languages, Cambridge University Press.
13. Michael L. Scott (2005). Programming Language Pragmatics, Morgan Kaufmann Publishers.
14. Ravi Sethi (2000). Programming Languages: Concepts and Constructs, 2nd ed., Addison-Wesley.
15. James S. McKeown (2010), Programming in Visual Basic 2010: The Very Beginner's Guide
16. Richard Mansfield (2003), Visual Basic .NET All in One Desk Reference for Dummies

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https://www.intergraph.com/
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https://glovis.usgs.gov/
https://www.nrsc.gov.in/EO_Agr_Objective
https://www.nrsc.gov.in/aboutus_campus_nrscrc/rrsc_east?language_content_entity=en
https://www.iirs.gov

Course Title: Applications of GIS Techniques   in Entrepreneurship
Course code: PGDP-GIS-DSE-402
Credits: 4
Marks: 100
Duration 90 hours
Prerequisite courses: NIL
Course objective -
7. The course focuses on the fundamentals concept Map Objects, and techniques of VBA
8. Introducing the Visual Basic code, Elements, processing and analysis of Arc object beyond VBA.

Course Learning Outcome:
   After completion of this course, students will be able to:
CLO13:   Students will demonstrate proficiency and conceptual understanding in using software and automated techniques to carry out thematic maps and analysis through a series of laboratory exercises and creation of reports.
CLO14:   Personal effectiveness and workplace competencies are practiced through engagement in discussion boards, following course guidelines, and interactions with the instructor and other students in the class
CLO15:   To be able use these skills to identify and analyzed real world problem and preparing them for a successful career in geospatial industry and research institute
CLO16:   Develop a tendency towards research through the compulsory internship in industry /research/ academic institutes which promote and inculcate professional ethics and code of practice among students, enabling them to work in a team with multidisciplinary approach

Course content

Module	Topics	Hours L 30	P 60
I	Introduction to MapObjects, Introduction to VBA and Visual studio 200#, Getting Started with ArcObjects, Visual Basic code: How, where, and when?	**10**	**20**
II	Using variables, Programming with class, COM,OMD, Maps and layers, Data access and creation, Geometry and Geoprocessing	**10**	**20**
III	Working with subsets and selections, Symbolizing elements and layers, Working with layout elements, Data management, ArcObjects beyond VBA	**10**	**20**

Reference book
Mandatory Reading
4. Burrough, P.A. and McDonnell, R.A. (1998) Principles of geographical information systems. Oxford University Press, Oxford, 327 pp.
5. Campbell, J.B. (2002). Introduction to remote sensing, 3rd ed., The Guilford Press. ISBN 1-57230-640-8.
6. Chang, K. (2007) Introduction to Geographic Information System, 4th Edition. McGraw Hill.

Supplementary Reading

9. Curran Paul J Principles of Remote Sensing UK: ELBS,
10. Elangovan,K (2006) GIS: Fundamentals, Applications and Implementations. New India Publishing Agency, New Delhi"208 pp.
11. Heywood, I., Cornelius, S., and Carver, S. (2006) An Introduction to Geographical Information Systems. Prentice Hall. 3rd edition.
12. Jensen, J.R. (2000). *Remote sensing of the environment: an Earth resource perspective*. Prentice Hall. ISBN 0-13-609733-1.
13. Joseph, GeorgeFundamentals of Remote Sensing Universities Press India
14. Lillesand, T.M.; R.W. Kiefer, and J.W. Chipman (2003). Remote sensing and image interpretation, 5th ed., Wiley. ISBN 0-471-15227-7.
15. Thurston, J., Poiker, T.K. and J. Patrick Moore. (2003) Integrated Geospatial Technologies: A Guide to GPS, GIS, and Data Logging. Hoboken, New Jersey: Wiley.
16. Wise, S. (2002) GIS Basics. London: Taylor & Francis.

Online resources

7. https://www.nrsc.gov.in/
8. https://www.iirs.gov.in/
9. http://www.undp.org/popin/wdtrends/wdtrends.htm
10. https://www.isprs.org/proceedings/xxxiii/congress/part7/1609_XXXIII-part7.pdf
11. http://www.tric.u-tokai.ac.jp/ISPRScom8/TC8/TC8_CD/headline/JAXA_Special_Session%20-%206/JTS64_20100608144600.pdf
12. https://www.semanticscholar.org/paper/Role-of-Remote-Sensing-in-Disaster-Management-Nirupama-Simonovic/da84562b2057ca5866d933d47ee8815a06f0229c

Annexure E
POST GRADUATE DIPLOMA GEOINFORMATICS
SEMESTER II

Course Title: SPATIAL ANALYSIS AND MODELING
Course code: PGDP-GIS-DSC-405
Credits: 4
Marks: 100
Duration 90 hours
Prerequisite courses: NIL
Course objective
3. The course focuses on fundamental aspects of spatial data modeling specifically on the aspect of two dimensional and three-dimensional (3D) modeling, structuring of raster and vector analysis and its types.
4. It also looks into integration of non-spatial data and its application.

Course Learning Outcome
After successful completion of a course in student will be able
CLO5: Student will able to apply spatial tool and techniques in spatial datasets for carry out Surface and 3d analysis.
CLO6: Students will demonstrate proficiency and conceptual understanding spatial model making process.
CLO7: Be equipped with practical skills and the ability to apply their theoretical concept to design, perform experiments, analyze and interpret data and thus develop proficiency in lab management
CLO8: Acquire of fundamental and advanced knowledge of the different aspect in Geoinformatics with the means ability to specialize in a specific field.
Course content

Module	Topics	Hours	
		T	P
		30	60
I	**Introduction to analysis.**	10	20
	• Significance of spatial analysis, overview of tools for analysis		
	Spatial analysis of Vector Base		
	• Overlay operations: point in polygon, line polygon, polygon in polygon, Single layer operations, features identification, extraction, classification and manipulation, Multilayer operations: union, Intersection, difference		
	Spatial analysis of raster base		
	• Map algebra, grid based operations, local, focal, zonal and global functions, cost surface analysis, optimal path and proximity search.		
II	**Analysis**	10	20
	• Network Analysis- Concept of network analysis, Types of network analysis, Evaluation of network complexity using Alpha, Gama indices, Network data model		
	• Point pattern- Method for evaluating point patterns, Clustered and random distribution		

- Surface analysis- Interpolation method, DEM, TIN, variance filter, slope and aspect, relief and hill shading

III   Spatial modeling   10   20

- Role of spatial model, explanative, predictive and normative models, handling complex spatial query, case studies.

Reference Books:
Mandatory Reading

4. Alias A. Rahman and Morakot Pilouk (2008)Spatial Data Modeling for 3D GIS, Springer New York
5. Longley, P.A., Goodchild, M.F., Maguire, D.J. and Rhind, D.W. (2005). Geographic Information Systems and Science. Chichester: Wiley. 2nd edition.
6. Ott, T. and Swiaczny, F. (2001). Time-integrative GIS. Management and analysis of spatio-temporal data. Berlin / Heidelberg / New York: Springer.
7. Thurston, J., Poiker, T.K. and J. Patrick Moore. (2003). Integrated Geospatial Technologies: A Guide to GPS, GIS, and Data Logging. Hoboken, New Jersey: Wiley.

Supplementary Reading

9. Ott, T. and Swiaczny, F. (2001). Time-integrative GIS. Management and analysis of spatio-temporal data. Berlin / Heidelberg / New York: Springer.
10. Thurston, J., Poiker, T.K. and J. Patrick Moore. (2003). Integrated Geospatial Technologies: A Guide to GPS, GIS, and Data Logging. Hoboken, New Jersey: Wiley.
11. M Goodrich (2000). Data Structures and Algorithms in Java, 2nd Edition Wiley.
12. Malczewski, J. (2004). GIS and Multi-criteria Decision Analysis. New York: John Wiley and Sons
13. GIS and Multi-criteria Analysis by Makrewski Jacek, USA, 2002.
14. Principals of GIS by Burrough P.A. MacDonneli R.A. published by Oxford University Press, 2000.
15. Geographical Information Science, vol. I by Roy P.S. Published by IIRS, 2000.
16. Fundamentals of Geographic Information Systems, 2nd Edition by Demers M.N. published by John Wiley & Sons 2000

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Course Title: ADVANCED REMOTE SENSING AND GIS
Course code: PGDP-GIS-DSC-406
Credits: 4
Marks: 100
Duration 90 hours
Prerequisite courses: NIL
Course objective
3. The course will provide latest state of art in remote sensing and GIS technology.
4. It will provide an opportModuley to understand and work with latest developments remote sensing data base and GIS technology.

Course Learning Outcome
After successful completion of a course in student will be able
CLO5: Students will be able to apply mathematical relationships (at a pre-calculus level) describing fundamental physical, geometric, and computational principles relevant to remote sensing and GIS.
CLO6: They will create Remote sensing application
CLO7: Be equipped with practical skills and the ability to apply their theoretical concept to design, perform experiments, analyze and interpret data and thus develop proficiency in lab management
CLO8: Acquire of fundamental and advanced knowledge of the different aspect in Geoinformatics with the means ability to specialize in a specific field.

Course content

Module	Topics	Hours	
		T	P
		30	60
I	Advanced Remote Sensing	**10**	**20**
	• **Microwave Remote Sensing**		
	• **Thermal Remote Sensing**		
	• **Hyper spectral Remote Sensing**		
	• **LiDAR & Drone**		
II	Advancement in GIS	**10**	**20**
	• **Participatory GIS and Mobile GIS**		
	• **WebGIS (ArcIMS, MapServer, Geomedia, MapGuide**		
	• **GIS servers, Intermediate software and Distributed GIS systems**		
III	Multi-criteria decision making analysis –	**10**	**20**
	• **Ranking**		
	• **Rating**		
	• **Pair wise comparison**		
	Fuzzy logic		

Reference Books:
Mandatory Reading

4. Asrar Ghassem (2004) Theory and applications of optical remote sensing New York: John Wiley and Sons.

5. Lillesand, T.M.; R.W. Kiefer, and J.W. Chipman (2003). Remote sensing and image interpretation, 5th ed., Wiley. ISBN 0-471-15227-7.

6. Malczewski, J. (*2000).* GIS and Multicriteria Decision Analysis. New York: John Wiley and Sons

Supplementary Reading

7. Mitchel, Tyler (2005): WebMapping Illustrated, O'Reilly, Sebastopol, 350 pages, ISBN 0-569-00865-1. This book discusses various Open Source WebMapping projects and provides hints and tricks as well as examples.
8. Ott, T. and Swiaczny, F. (2001) Time-integrative GIS. Management and analysis of spatio-temporal data, Berlin / Heidelberg / New York: Springer.
9. Peterson, Michael P. (ed.) (2003): Maps and the Internet, Elsevier, ISBN 0-08-044201-3.
10. Skolnik, Merrill I. (2001). Introduction to Radar Systems, McGraw-Hill (1st ed., 1962; 2nd ed., 1980; 3rd ed.), ISBN 0-07-066572-9.
11. Thurston, J., Poiker, T.K. and J. Patrick Moore. (2003) Integrated Geospatial Technologies: A Guide to GPS, GIS, and Data Logging. Hoboken, New Jersey: Wiley.
12. Worboys, Michael, and Matt Duckham. (2004) GIS: a computing perspective. Boca Raton: CRC Press.

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https://www.iirs.gov.in/

Course Title: DIGITAL IMAGE PROCESSING
Course code: PGDP-GIS-DSC-407
Credits: 4
Marks: 100
Duration 90 hours
Prerequisite courses: NIL

Course objective

3. This course will introduce fundamental technologies of digital image processing i.e. compression, information extraction and analysis.
4. Students will also gain understanding of algorithm, analytical tools, and practical implementations of various digital image applications.

Course Learning Outcome

After successful completion of a course in student will be able
CLO5: Students will demonstrate proficiency and conceptual understanding in using software or manual techniques which will prove how digital technology has come over traditional technology to carry out remote sensing image processing and analysis through a series of laboratory exercises and reports
CLO6: Acquire of fundamental and advanced knowledge of the different aspect in DIP with the means ability to specialize in a specific field.
CLO7: Workplace competencies are strengthened as students apply the analytical and evaluative tools to GIS mapping and apps
CLO8: Be able to demonstrate proficiency in quantitative reasoning and analytical skills

Course content

Module	Topics	Hours	
		T	**P**
		30	**60**
I	**Introduction to Digital Image Processing**	**10**	**20**
	• Visual perception, Image sensing and acquisition,		
	• Digital Data Formats Image sampling and Quantization		
	• Basic relationship between pixels.		
	• Development, scope and fundamental steps involved in Digital Image Processing, components of Image Processing		
II	**Image Rectification**	**10**	**20**
	• Radiometric and Atmospheric Correction		
	• Geometric Correction, Ortho-rectification, calibration and rectification of photo and images,		
	• Image enhancement in spatial domain and frequency domain, Filtering, Fourier Transform, Noise removal		
III	**Multispectral Image Processing**	**10**	**20**
	• Colour Image processing, slicing, Image compression, dilation,		

Segmentation,   Spectral rationing, density slicing and image fusion
- Object recognition, classification, object recognition, feature extraction, accuracy, assessment, change detection Accuracy Assessment and integration with GIS

Reference Books:
Mandatory Reading
4. Burger, Wilhelm; Mark J. Burge (2007). Digital Image Processing: An Algorithmic Approach Using Java. Springer. ISBN 1846283795.
5. Campbell, J.B. (2002). Introduction to remote sensing, 3rd ed., The Guilford Press. ISBN 1-57230-640-8.
6. Damen MCJ, Sicco Smith G and Kerstappen(Ed) (2000). Remote Sensing for Resources Development and Environmental Management 3rd.volume Set Netherlands: Balkema

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9. Damen MCJ, Sicco Smith G and Kerstappen(Ed) (2000). Remote Sensing for Resources Development and Environmental Management 3rd.volume Set Netherlands: Balkema
10. Gonzalez, Rafael C.; Richard E. Woods (2005). Digital Image Processing. ISBN 0-201-50803-6.
11. Jensen John R (2007). Introductory Digital Image processing: Remote Sensing Perspective New Jersey: Prentice Hall
12. Joseph, George (2007). Fundamentals of Remote Sensing Universities Press India
13. Lillesand, T.M.; R.W. Kiefer, and J.W. Chipman (2007). Remote sensing and image interpretation, 5th ed., Wiley. ISBN 0-471-15227-7.
14. Pratt, William K. (2003). Digital Image Processing. ISBN 0-471-01888-0.
15. Romeny, Bart M. (2003). Front-End Vision and Multi-Scale Image Analysis. ISBN1-4020-1507-0.
16. Umbaugh, Scott E (2005). Computer Imaging: Digital Image Analysis and Processing. ISBN 0-84-932919-1

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https://glovis.usgs.gov/
https://www.nrsc.gov.in/EO_Agr_Objective

Course Title: GIS for Natural Resource Management
Course Code: PGDP-GIS-DSC-408
Credits: 04
Marks: 100
Duration 90 hours
Prerequisite course: NIL
Course objective
2. The course is aimed to introduce the concept of land, water and coastal management. Taxation and to learn how GIS can be applied in resource management sector.

Course Learning Outcome: After successfully completion of the course, students will be able to

CLO5: Understanding importance of nature resources and its categorizes

CLO6: To be able use these skills to identify and analyzed real world problem and preparing them for a successful career in geospatial industry and research institute

CLO7: Acquire of fundamental and advanced knowledge of the different aspect in Geoinformatics with the means ability to specialize in a specific field.

CLO8: Develop a tendency towards research through the compulsory internship in industry /research/ academic institutes which promote and inculcate professional ethics and code of practice among students, enabling them to work in a team with multidisciplinary approach.

Course content

Module	Topics	Credits T 30	P 60
I	• Spatial approach in forest resource Management • Cadastral Mapping, Land Registration Workflow, Parcel management, Land Parcel Data Model, data capture, data management and processing	10	20
II	• Land Capability Mapping and Limitations, Public Access, Land classifications, Land use planning, Taxation	10	20
III	• Water Resources- Watershed Management, Flood management and Damage Assessment, Zone Mapping, Groundwater recharge mapping, Water Quality, Watershed Erosion Modeling • Coastal Zone management, Fisheries, Coral Reefs, Navigation, data storage and access, analysis	10	20

Reference Books:
Mandatory Reading
2. Michael G. Wing, Pete Bettinger (2008),Geographic Information Systems: Applications in Natural Resource Management, Oxford University Press, USA
3. Roger Tomlinson (2007), Thinking about GIS, ESRI Press
4. John G. Lyon (2002). GIS for Water Resource and Watershed Management, Taylor & Francis

Supplementary Reading

8. Ali S.A. Resources for Future Economic Growth, Vikas Publications House, New Delhi, 2004.
9. Ress J. Natural Resources, Allocation, Economics & Policy, Rout Ledge, London, 2000.
10. Turner R.K. Sustainable Environmental Management, Belhaven Press, London, 2006.
11. Nancy von Meyer (2004), GIS and Land Records, ESRI press
12. Laura Lang (2004), Managing Natural Resources with GIS, ESRI Press, ISBN 1-879102-53-6
13. Roger Tomlinson (2007), Thinking about GIS, ESRI Press
14. John G. Lyon (2002). GIS for Water Resource and Watershed Management, Taylor & Francis

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5. ISO TC 211 (2003) ISO TC 211 homepage. http://www.isotc211.org
6. OGC (2003) The Open Geospatial Consortium Homepage, http://www. opengeospatial.org
7. Open Geospatial Consortium Inc. http://www.opengeospatial.org/docs/02-058.pdf
8. ISO/IEC DIS 14772, 1997, The Virtual Reality Modeling Language: (VRML 97), http://www.vrml.org/technicalinfo/specifications/vrml97/index.htm
9. VRML-Streaming Working group, http://www.web3d.org/WorkingGroups/vrml-streams/

Semester - II
Course Title: Pilot Project, Field work and Tour
Course code: PGDP-GIS-DSE-403
Credits: 4
Marks: 100
Duration 90 hours
Prerequisite courses: NIL
Course objective
3. The course is designed to develop field and Survey techniques using different survey instruments and Interpretation of topo sheets and maps.
4. This includes field techniques and importance of field survey in GIS.

Course Learning Outcome
After successful completion of a course in student will be able

CLO5: Students will describe a survey method and different instruments and it's assembled and summarizes relevant survey for relevant work which will skill development in using different instruments.
CLO6: Report writing and Interpretation of Maps will focus on writing skills.
CLO7: Be equipped with practical skills and the ability to apply their theoretical concept to design, perform experiments, analyze and interpret data and thus develop proficiency in lab management
CLO8: Acquire of fundamental and advanced knowledge of the different aspect in Geoinformatics with the means ability to specialize in a specific field.

Course content

Module	Topics	Credits	
		L **30**	**P** **60**
I	**Introduction to Field Survey** Importance of field instrument survey - scope and purpose, principles and application of selected survey instruments.	10	20
II	**Village Survey and Report writing** Fundamentals of Village survey, prerequisites of village survey, preparation of questionnaires, data entry, basic analysis in Microsoft excel Interpretation of surveyed maps and Report writing.	10	20
III	**Pilot project** Site suitability Hot spot analysis Disaster management **Institute visit** NIO,NCPOR,NRSC,IIRS,RRSC	10	20

Reference book
Mandatory Reading

1. Clendening, J. Principles and use of Surveying Instruments. 2nd edition, Blockie. A 2000.
2. Singh &Karanjta - Map work and Practical Geography Central Book Dept Allahabad 2009.
3. Singh, R.L.andDutt, P.K. Elements of Practical Geography, Students Friends, Allahabad.2003.

Supplementary Reading
8. Hotine, Major M. The re-triangulation of Great Britain. Empire survey review 2005.
9. Mitra,R.P. and Ramesh A : Fundamentals of Cartography Revised Edition, Concept Publication, New Delhi.
10. Monkhouse - Maps and diagrams Methuen 2004.
11. Negi, Balbir Singh. Practical Geography Third revised Ed. Kedar Nath and Ram Nath, Meerut &Delhi, 2006.
12. Sandover,J.A. Plane Surveying. Arnold 2007.
13. Singh &Karanjta - Map work and Practical Geography Central Book Dept Allahabad 2009.
14. Singh, R.L.andDutt, P.K. Elements of Practical Geography, Students Friends, Allahabad.2003.

Web reference

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https://www.iirs.gov.in/

Semester - II
Course Title: PROGRAMING & CUSTOMIZATION
Course code: PGDP-GIS-DSE-404
Credits: 4
Marks: 100
Duration 90 hours
Prerequisite courses: NIL
Course objective
3. The course is designed to develop programming skills using a spatial data to automate the analysis process.
4. This includes the programming workflow in spatial domain, python for application and various scripting languages.

Course Learning Outcome
After successful completion of a course in student will be able
CLO9: Student will develop new tools and software also customizes open source software.
CLO10: They design and built web base platform for geospatial database.
CLO11: Be able to demonstrate proficiency in quantitative reasoning and analytical skills
CLO12: Be equipped with practical skills and the ability to apply their theoretical concept to design, perform experiments, analyze and interpret data and thus develop proficiency in lab management

Course content

Module	Topics	Hours	
		T	P
		30	60
I	**Using raster data** Generating cell size obtaining with width and height of raster Counting raster band and swapping raster bands querying ,creating ,raster based analysis	**10**	**20**
II	**Dynamic maps** Map canvas, map Modules, iterating over layers, graduated layer symbol renderer, map, book mark SVG for layer symbol, map layer transparency, mouse coordinate tracking tool, composing static map analysis data using algorithm	**10**	**20**
III	**Introduction to Google Earth Engine**	**10**	**20**

Reference books:
Mandatory Reading
4 Kang-Tsung Chang, Programming ArcObjects with VBA: a task-oriented approach, 2, illustrated, CRC Press, 2007, ISBN 0849392837, 9780849392832
5 Robert Burke (2003) ,Getting to know ArcObjects, programming ArcGIS with VBA,Esri Pr,ISBN-10: 158960018X,ISBN-13: 9781589600186
6 Rick Leinecker, Vanessa L. Williams,Visual Studio 2008 All-In-One Desk ,For Dummies 2008, ISBN0 470191082, 9780470191088

Supplementary Reading

8. Rick Leinecker, Vanessa L. Williams,Visual Studio 2008 All-In-One Desk ,For Dummies 2008, ISBN0 470191082, 9780470191088
9. Bruce Ralston,Developing GIS Solutions With MapObjects and Visual Basic,OnWord Press; 1 edition (October 31, 2001),ISBN-10: 0766854388 ,ISBN-13: 978-766854383
10. Swaroop CH, A Byte of Python
11. John Walkenbach, Excel VBA Programming or Dummies
12. John Zelle (2010), Python Programming
13. Michael Dawson (2010), Python Programming for the Absolute Beginner, 3rd Edition
14. Zhi Jun Lio, David Percy, Larry V Stanislawski. GIS Programming: Concepts and Applications

Web References

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https://www.intergraph.com/
https://www.sac.gov.in/Vyom/index.jsp
https://bhuvan.nrsc.gov.in/bhuvan_links.php
https://glovis.usgs.gov/
https://www.nrsc.gov.in/EO_Agr_Objective
https://www.nrsc.gov.in/aboutus_campus_nrscrc/rrsc_east?language_content_entity=en
https://www.iirs.gov.in/

Annexure F
COURSE STRUCTURE
SYLLABUS FOR THREE/FOUR YEAR UNDERGRADUATE DEGREE <u>HONOURS</u>
PROGRAMME IN B.Sc. (MINOR) GEOGRAPHY
(Implemented from the Academic Year 2023-2024 onwards)

SEMESTER	COURSE CODE	TITLE OF THE COURSE	NOMENCLATURE/ TYPE OF COURSE	CREDITS
I	UG-GEG-DSC(M)-101	Fundamentals of Physical Geography	DSC	4
	UG-GEG-SEC-101	Basic of Geographical Information System (GIS)	SEC	3
II	UG-GEG-DSC(M)-102	Concepts in Geomorphology	DSC	4
	UG-GEG-SEC-102	Remote Sensing and Environment	SEC	3
III	UG-GEG-DSC(M)-201	Dynamics of Atmospheric science	DSC	4
	UG-GEG-SEC-201	Application of Remote in Natural Resource Management	SEC	3
IV	UG-GEG-DSC(M)-202	Ocean and Coastal Studies	DSC	4
V	UG-GEG-DSC(M)-301	Terrestrial Ecological Studies	DSC	4
VI	UG-GEG-DSC(M)-302	Statistical Applications	DSC	4
VII	UG-GEG-DSC(M)-401	Geography of Soil	DSC	4
VIII	UG-GEG-DSC(M)-401	Field Survey and Field Techniques	DSC	4

Annexure F
SYLLABUS FOR THREE/FOUR YEAR UNDERGRADUATE DEGREE <u>HONOURS</u> PROGRAMME IN B.Sc. (MINOR) GEOGRAPHY
(Implemented from the Academic Year 2023-2024 onwards)

SEMESTER	MAJOR CORE	MINOR/ VOCATIONAL	MULTIDISCIPLINARY COURSE (MDC)	VALUE ADDED COURSES (VAC)	ABILITY ENHANCEMENT COURSE (AEC)	SKILL ENHANCEMENT COURSE (SEC)
I		UG-GEG-DSC(M)-101: Fundamentals of Physical Geography				UG-GEG-SEC-101: Basic of Geographical Information System (GIS)
II		UG-GEG-DSC(M)-102: Concepts in Geomorphology				UG-GEG-SEC-102 : Remote Sensing and Environment
III		UG-GEG-DSC(M)-201: Dynamics of Atmospheric science				UG-GEG-SEC-201 : Application of Remote in Natural Resource Management
IV		UG-GEG-DSC(M)-202: Ocean and Coastal Studies				
V		UG-GEG-DSC(M)-301: Terrestrial Ecological Studies				
VI		UG-GEG-DSC(M)-302: Statistical Applications				
VII		UG-GEG-DSC(M)-401: Geography of Soil				

VIII		UG-GEG-DSC(M)-401: Field Survey and Field Techniques				

Annexure F

BSC GEOGRAPHY MINOR

SEMESTER I

MINOR COURSE SEMESTER I
Course Title: Fundamentals of Physical Geography (Theory)
Course Code: UG-GEG-DSC(M)-101
Marks: 75
Credits: 3
Duration: 45 hours
==

Course Objectives:
3. The course aims to introduce fundamental concepts of physical geography.
4. The course focuses of various spheres of the earth and their related concepts.

Course Learning Outcomes: At the end of this course, students will be able to:
CLO1: Understand fundamentals of systems of physical Geography.
CLO2: Understand Basic concepts of solar system and evolution of earth
CLO3: Understand the various processes of Earth movement and soil formation
CLO4: Interpret data related to physical geography.

Modules	Topic	Course Content	
I	General information about the Earth	• Evolution of Earth and Solar system • Geometry of planet Earth: Shape, size, radius, circumference etc. • Theories of origin of the Earth- Tetrahedral and Big bang. • Geological time scale	(15 hours)
II	Earth Movements	• Weathering and erosion • Mass movement • Types of rocks and rock cycle	(15 hours)
III	Soil genesis	• Pedogenesis of soil • Structure of Soil • Types of soil • Soil profile and horizons	(15 hours)

References:

1. Bloom, Arthur L., 2008: Geomorphology – A Systematic Analysis of Late Cenozoic Landforms, Prentice Hall, Engle Wood Cliff, New Jersey.
2. Dayal, P. (2nd edition) 2006: A Textbook of Geomorphology, Shukla Book Depot, Patna
3. Strahler, A.N., 2005: Physical Geography, 3rd Ed., Wiley Publications
4. Singh, S. 2005: Physical Geography, Prayag Pustak Bhawan, Allahabad
5. Sharma, V.K., 2006: Geomorphology, Earth Surface, Process and forms, Tata McGraw Hill, New York

Supplementary:
11. Ahmed, E., 2005: Geomorphology, Kalyani Publishers, New Delhi
12. Chorley, Richard J., 2002: Spatial Analysis in Geomorphology, Harper and Row Publishers, New York, London.
13. Sharma, H.S. (ed), 2002: Perspective in Geomorphology, Vol. I & IV, Concept, New Delhi.

14. Sharma, V.K., 2006: Geomorphology, Earth Surface Processes and Forms, Tata Mc. Graw Hill, New Delhi.
15. Sparks, B.W., 2000: Geomorphology, Longman, London, 2nd edition.
16. Thornbury, W.D., 1969: Principles of Geomorphology, 2nd Ed., Wiley International Edition, Wiley Eastern Reprint, 2004
17. Wooldridge, S.W. and Morgan, R.S., 2008: The Physical Basis of Geography, Longman (First published in 1937)
18. Worcestor, P.G., 2005: A Textbook of Geomorphology, Van Nostrand, 2nd Ed., East West Edition, New Delhi.

Web-based:
1. https://www.space.com/16080-solar-system-planets.html
2. https://www.britannica.com/science/solar-system
3. https://www.nationalgeographic.org/encyclopedia/rock-cycle/
4. http://www.geo.hunter.cuny.edu/~fbuon/GEOL_231/Lectures/Weathering%20and%20Mass%20Wasting%20Part%202.pdf
5. https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/soil-formation

Course Title: Fundamentals of Physical Geography (Practical)
Course Code: UG-GEG-DSC(M)-101
Marks: 25
Credits: 01
Duration: 30 HOURS
==

Module   Title
I   1. Scales & measurements   (30 hours)
                2. Grid systems -Latitude & longitude
                3. Map coordinate
                4. UTM Time calculation
                5. Identification of rocks
                6. Observation of weathering processes on field
                7. Identification of soil horizons on field
                8. Field work and report preparation

References:
Mandatory:
5. Chorley, Richard. J. (ed.), 2009: Water, Earth and Man, Methuen & Co., London
6. King, C.A.M., 2006: Techniques in Geomorphology, Edward Arnold, London
7. Monkhouse, F.J. and Wilkinson, H.R., 2009: Maps and Diagrams, B.I. Publications Pvt. Ltd., New Delhi
8. Singh, R.L. and Singh Rana P.B., 2008, Elements of Practical Geography, Kalyani Publishers, New Delhi

Supplementary:
5. Goudie, Andrew, et al. (eds), 2001: Geomorphological Technique, George Allen &Unwin, London
6. Leopold, L.B, Wolman, M.G. and Miller, J.P., 2004: Fluvial Processes in Geomorphology, Freeman, San Francisco
7. Misra, R.P. and Ramesh, A., 2009: Fundamentals of Cartography, Concept Publishing Co., New Delhi

Web-based:
1. https://www.techtarget.com/whatis/definition/latitude-and-longitude
2. https://geo.libretexts.org/Bookshelves/Ancillary_Materials/Laboratory/Book%3A_Laboratory_Manual_For_Introductory_Geology_(Deline%2C_Harris_and_Tefend)/03%3A_Topographic_Maps/3.6%3A_Drawing_Contour_Lines_and_Topographic_Profiles
3. https://www.vedantu.com/biology/soil-profile
4. https://passel2.unl.edu/view/lesson/edd25385ca3d/1

Skill Enhancement Course (SEC)
Course Title: Basics of Geographical Information System (GIS)
Course Code: UG-GEG-SEC-101
Marks: 75
Credits: 3
Duration: 45 hours

Prerequisite Courses: Students must carry personal laptops.

Course Objectives:
1. **To introduce basic concepts, tools and techniques of GIS,GPS and its integration with Remote Sensing.**

Course Outcomes:
At the end of this course, students will be able to:
CLO1 Understand the basic concept of GIS
CLO2 Apply various tools and data sets used in application of GIS and GPS in different science disciplines.
CLO3 Analyses and monitor various earth based phenomena using GIS
CLO4 Design and create projects using GIS, GPS and remotely sensed data.

Module	Title	No. of hours
I	**Geographic Information Systems**: Nature, emergence of GIS as a spatial tool, components of GIS. Spatial Referencing and positioning Vector Systems: Object Representation, Geometry Raster Systems : Databases, GIS Systems, Hands on training: 1. Spatial referencing, projecting Raster & Vectors 2. Digitization, Editing, Buffering& clipping 3. Overlay function: raster overly, vector overlay	(15 hours)
II	**Spatial data Analysis:,** database management, data input and editing, data analysis, analytical modeling in GIS,Spatial data modeling 1. Network analysis 2. View shade and Watershed analysis 3. Spatial Interpolation	(15 hours)
III	**Positioning Systems** : The Global Positioning System (GPS): GPS Signals, Differential GPS, GSM Mobile phone location Hands on training: 1. Mapping qualitative data 2. Mapping quantitative data 3. Mapping terrain elevation	(15 hours)

References:
Mandatory:
1. Geoffery J. Meaden and José Aguilar-Manjarrez (ed) , 2013: Advances in geographic information systems and remote sensing for fisheries and aquaculture. Food And Agriculture Organization Of The United Nations Rome
2. Gottfried Konecny (2014) Geoinformation Remote Sensing, Photogrammetry, and Geographic Information Systems Second edition . CRC Press Taylor & Francis Group
3. Ian Heywood, Sarah Cornelius and Steve Carver (2011):An Introduction to Geographical Information Systems (4th Ed). Pearson Education Limited. England
4. Kang-tsung Chang (2019): Introduction To Geographic Information Systems. McGraw-Hill Education. USA
5. M. Anji Reddy (2008), Textbook of Remote Sensing and Geographical Information Systems Third Edition. BS Publications, Hyderabad, India
6. Michael Kennedy (2012) Introducing Geographic Information Systems with ArcGISA Workbook Approach to Learning GIS. John Wiley & Sons, Inc., Hoboken, New Jersey.
7. Otto Huisman& Rolf A de By (ed) 2009: Principles of Geographic Information System, An introductory Textbook. The International Institute for Geo-information Science and Earth Observation (ITC), The Netherlands.

Supplementary
1. Margarita N. FavorskayaLakhmi C. Jain (2017) Handbook on Advances in Remote Sensing and Geographic Information Systems Paradigms and Applications in Forest Landscape Modeling. Springer International Publishing AG
2. Paul A. Longley Michael F. Goodchild David J. Maguire David W. Rhind (2004): Geographical Information Systems and Science (2nd Ed). John Wiley & Sons, Ltd
3. Paul Bolstad (2016) GIS Fundamentals A First Text on Geographic Information Systems Fifth Edition. Eider Press White Bear Lake, Minnesota.

Web based
1. https://mgimond.github.io/Spatial/introGIS.html
2. https://eos.com/blog/spatial-analysis/
3. https://www.geos.ed.ac.uk/~gisteac/gis_book_abridged/files/ch33.pdf
4. https://nobelsystemsblog.com/facts-between-gis-gps/
5. https://gisrsstudy.com/gps-for-gis/
6. https://learnz.org.nz/highcountry152/bg-standard-f/GPS-and-GIS-Technology#:~:text=Global%20Positioning%20Systems%20or%20GPS,land%20in%20the%20high%20country.

Annexure F

BSC GEOGRAPHY MINOR SEMESTER II

MINOR SEMESTER II
Course Title: Concepts in Geomorphology (Theory)
Course Code: UG-GEG-DSC(M)-102
Marks: 75
Credits: 3
Duration: 45 HOURS
==
Prerequisite Courses: Nil

Course objectives:
1. To provide the basic concepts, theories and application in geomorphology

Course outcomes:
At the end of this course, students will be able to:
CLO1: Understand the meaning and scope Geomorphology.
CLO2: Understand the types of earth movements.
CLO3: Understand theories of continental drift and plate tectonic.
CLO4: Understand the types of geomorphic process.
CLO5: Identify and distinguish geomorphic processes and landforms river and sea waves on field

Modules   Topic

I
- Meaning, development and scopes of geomorphology   (15 hours)
- Endogenic and exogenetic forces
- Types of faults

II
- Continental drift theory of A. Wegner   (15 hours)
- Theory of plate tectonics,Types of plates, processes of plate movement
- Plate tectonic and mountain building

III
- Processes of denudation   (15 hours)
- Agents, processes and landforms: erosional, transportation and deposition in tropic and polar region

References:
Mandatory:
1. Kale.V.S and Gupta Avijit, (2018) Introduction to Geomorphology. The Orient Blackswan
2. Sharma, H.S. (ed), 2002: Perspective in Geomorphology, Vol. I & IV, Concept, New Delhi
3. Singh, S. 2005 : Geomorphology, PrayagPustakBhawan, Allahabad, India
4. Sparks, B.W., 2000: Geomorphology, Longman, London
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1. Ahmed, E., 2005: Geomorphology, Kalyani Publishers, New Delhi
2. Bloom, Arthur L., 2004: Geomorphology – A Systematic Analysis of Late Cenozoic Landforms, Prentice Hall, Engle Wood Cliff, N.J
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4. Dayal, P. (2nd edition) 2006: A Textbook of Geomorphology, Shukla Book Depot, Patna
5. Sharma, V.K., 2006: Geomorphology, Earth Surface Processes and Forms, Tata Mc. Graw Hill, New Delhi.
6. Sharma, V.K., 2006: Geomorphology, Earth Surface, Process and forms, Tata McGraw Hill, New York
7. Strahler, A.N. 2006: Physical Geography, 3rd Ed., Wiley
8. Worcestor, P.G., 2005: A Textbook of Geomorphology, Van Nostrand, 2nd Ed., East West Edition, New Delhi.

Web-Based:
1. http://shaileshchaure.com/Notes/GEOMCON.pdf
2. https://www.kean.edu/~csmart/Observing/05.%20Plate%20tectonics.pdf
3. https://www.researchgate.net/publication/272510857_Main_Drainage_Systems
4. https://www.researchgate.net/publication/309630899_FLUVIAL_PROCESSES_AND_LANDFORMS
5. https://people.wou.edu/~taylors/g322/glacial.pdf

Course Title: Concepts in Geomorphology (Practical)
Course Code: UG-GEG-DSC(M)-102
Marks: 25
Credits: 01
Duration: 30 hours
===

Modules   TOPIC

I   30 hours
1. Identification of Landforms pattern form SOI toposheets
2.
3. Identification of and River pattern form SOI toposheets
4. Identification of Faults lineaments, Dikes geological maps
5. Longitudinal profile of a river
6. Cross profile: Serial, superimposed and composite.
7. Field work and report preparation

References:
Mandatory:
1. Sarkar, Ashis, 2000: Practical Geography: A Systematic Approach, Orient Longman Pvt. Ltd., Kolkata.
2. Kale V.S. and Gupta Avijit (2000): Introduction to Geomorphology, Orient Black Swan Publications
3. Monkhouse, F.J. and Wilkinson, H.R., 2009: Maps and Diagrams, B.I. Publications Pvt. Ltd., New Delhi
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5. Singh, Savindra (2006): Geomorphology, PrayagPustakBhavan, Allahabad

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1. Chorley, Richard. J. (ed.), 2001: Water, Earth and Man, Methuen & Co., London
2. Goudie, Andrew, et al. (eds),2001: Geomorphological Technique, George Allen & Unwin, London
3. Gregory, K.J. and Walling, D.E., 2003: Drainage Basin – Form and Process, Edward Arnold, London
4. King, C.A.M., 2006: Techniques in Geomorphology, Edward Arnold, London
5. Leopold, L.B, Wolman, M.G. and Miller, J.P., 2004: Fluvial Processes in Geomorphology, Freeman, San Francisco
6. Misra, R.P. and Ramesh, A., 2009: Fundamentals of Cartography, Concept Publishing Co., New Delhi
7. Strahler, A.N., 2000: Physical Geography, 3rd Ed., Wiley.

Web-Based:
1. https://shodhganga.inflibnet.ac.in/bitstream/10603/160201/3/chapter%204.pdf
2. http://www.wvca.us/envirothon/pdf/Drainage%20Patterns.pdf

3. https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/manage/?cid=stelprdb1046651
4. https://www.field-studies-council.org/resources/16-18-biology/fieldwork-techniques/abiotic-factors/slope-profile/#:~:text=Slope%20profiling%20is%20a%20technique,need%20two%20or%20three%20people.
5. https://www.nps.gov/articles/faults-and-fractures.htm

Skill Enhancement Course (SEC)
Course Title: Remote Sensing and Environment
Course Code: UG-GEG- SEC-102
Marks: 75
Credits: 3
Duration: 45 hours

Prerequisite Courses: Students must carry personal laptops.

Course Objectives:
1. To course aims to introduce basic concepts of remote sensing and aerial photography
2. The course focuses on Multispectral Remote Sensing Systemsand Digital image processing.
3. To acquaint the students with the use of remote sensing in field of physical geography.

Course Outcomes:
At the end of this course, students will be able to:
CLO1 Understand the basic science of remote sensing
CLO2 Understand interaction of EMR with Earth surface materials
CLO3 Interpret and analyze remotely sensed data.
CLO4 Create maps using digital image processing and image classification techniques.

Module	Topic	
I	Electromagnetic Radiation Principles. Sensing and ranging concept, sensors and platforms. Resolution, Aerial Photography, Elements of Visual Image Interpretation.	(15 hours)
	Hands on training:	
	1. Geometry, Scale of orthophotographs & images	
	2. Digital image processing, image corrections, mosaic.	
	3. Image interpretation	
II	Multispectral Remote Sensing Systems.	(15 hours)
	Thermal Infrared Remote Sensing.	
	Hands on training:	
	1. image enhancement	
	2. Band combinations, ratios and basic indices.	
	3. Digital image classification	
III	Remote Sensing of Vegetation, Water, Soils, Minerals resources	(15 hours)
	Hands on training:	
	1. Mapping vegetation & forest resources	
	2. Mapping water resources	
	3. Mapping soils and minerals	

References:
Mandatory:
1. J. R. Jensen, (2014) Remote Sensing of Environment, An Earth Resource Perspective, (2ed) Pearson Education Pvt. Ltd., New Delhi.
2. Paul R. Wolf.; Bon A. Dewitt and Benjamin E. Wilkinson (2014) Elements of Photogrammetry with Applications in GIS (4th Ed). McGraw-Hill Education, US.
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