File Ref.No.24795/GA - IV - J2/2013/CU

UNIVERSITY OF CALICUT

Abstract

M.Sc Programme in Geography-Credit Semester System PG (CUCSS-PG-2010)-Affiliated Colleges-Modified Scheme and Syllabus-approved-implemented-w.e.f 2017 admissions- Approved-Orders issued.

G & A - IV - J

U.O.No. 13515/2017/Admn Dated, Calicut University.P.O, 23.10.2017

Read:-1. U.O.No. GA IV/J1/1373/08 dated 23.07.2010
2. U.O.No. GA IV/J2/5166/08 dated 22.09.2010
3. U.O.No. GA IV/J2/5166/08 dated 07.07.2011
4. Item no. 2(a) & 2(b) in the minutes of the meeting of the Board of Studies in Geography held on 07.07.2017
5. Item No. I in the minutes of the meeting of Faculty of Science held on 10.07.2017
6. Item No. II(H) in the minutes of the LXXVI meeting of Academic Council held on 17.07.2017
7. Orders of the Vice Chancellor in the file No. 191466/GA IV/J1/2013/CU dated 27.07.2017

ORDER

The Credit Semester System was implemented for Post Graduate Programmes in affiliated colleges under University of Calicut w.e.f 2010 admissions, vide paper read as (1).

The Scheme and Syllabus of M.Sc programme in Geography under Credit Semester System for 1st and 2nd semesters vide paper read as (2) and for 3rd and 4th semesters vide paper read as (3), had been implemented in affiliated colleges w.e.f. 2010 admissions.

Vide paper as (4), the Board of Studies in Geography recommended to modify the Syllabus for M.Sc programme in Geography, under Credit Semester System in affiliated colleges w.e.f 2017 admissions.

Faculty of Science vide paper read as (5) and the Academic Council vide paper read as (6) have approved the recommendations of the Board.

Vice-Chancellor, has accorded sanction to implement the resolutions of the Academic Council vide paper read as (7).

Sanction has, therefore, been accorded for implementing the modified Syllabus of M.Sc Programme in Geography under Credit Semester System (CUCSS-PG-2010) in affiliated colleges w.e.f 2017 admissions.

Orders are issued accordingly.

Ajitha P.P

Joint Registrar

To

All Affiliated Colleges offering M.Sc Geography
Copy to: Pareekha Bhavan/ Digital wing

Forwarded / By Order

Section Officer

M.Sc. Geography Syllabus

2017 Admission Onwards

M.Sc. GEOGRAPHY

CREDIT SEMESTER SYSTEM

M.Sc. Geography programme consists of four semesters. First two semesters have four core courses and two practical is included. During Third semester two core courses and one elective course and two practical is included. During Fourth semester two core course, one elective course, two practical and one dissertation is included.

Practical examination will be conducted by the University at the end of Second and Fourth Semesters. A comprehensive viva-voce is also included in the Fourth Semester. Study tour/filed trip is also part of curriculum and is to be evaluated at the end of Forth Semester.

All Core, Elective, Practical Courses and Dissertation have 4 credits each. Viva –voce will be of 3 credits. Study tour/Field trip will have one credit on submission of report.

M.Sc. DEGREE PROGRAMME (GEOGRAPHY)

CREDIT DISTRIBUTION FOR EACH SEMESTER

Semester	Course Code	Course Title	Instructional hours / Week	Continuous Assessment (internal) (in %)	End Semester Evaluation (in %)	Credit
I	GR 1 C 01	Geomorphology	5	25	75	4
	GR 1 C 02	Climatology	4	25	75	4
	GR 1 C 03	Concepts and Trends in Geography	4	25	75	4
	GR 1 C 04	Physical Geography of India	4	25	75	4
	GR 2 P 01	Practical I – Geomorphology and Climatology	4	*	*	*
	GR 2 P 02	Practical II – Geographic Information System	4	*	*	*
		Total	**25**	**-**	**-**	**16**
II	GR 2 C 05	Geographic Information System	4	25	75	4
	GR 2 C 06	Regional Planning	5	25	75	4
	GR 2 C 07	Research Methods in Geography	4	25	75	4
	GR 2 C 08	Population Geography	4	25	75	4
	GR 2 P 01	Practical I – Geomorphology and Climatology	4	25	75	4
	GR 2 P 02	Practical II – Geographic Information System	4	25	75	4
		Total	**25**	**-**	**-**	**24**
III	GR 3 C 09	Principles of Remote Sensing	5	25	75	4
	GR 3 C 10	Urban Geography	4	25	75	4
	ELECTIVE GR 3 E 01	Economic Geography	4	25	75	4
	ELECTIVE GR 3 E 02	Medical Geography				
	ELECTIVE GR 3 E 03	Cultural Geography				
	GR 4 P 03	Practical III – Quantitative Techniques in Geography	4	*	*	*
	GR 4 P 04	Practical IV – Remote Sensing and Cartography	4	*	*	*
	GR 4 (Pr)	Dissertation / Project*	4	*	*	*
		Total	**25**	**-**	**-**	**12**
IV	GR 4 C 11	Environmental Geography	5	25	75	4
	GR 4 C 12	Agricultural Geography	4	25	75	4
	ELECTIVE GR 4 E 04	Geography Tourism	4	25	75	4
	ELECTIVE GR 4 E 05	Industrial Geography				
	ELECTIVE GR 4 E 06	Geography of Water Resource				
	GR 4 P 03	Practical III – Quantitative Techniques in Geography	4	25	75	4
	GR 4 P 04	Practical IV – Remote Sensing and Cartography	4	25	75	4
	GR 4 (Pr)	Dissertation / Project*	4	-	100	4
	GR 4 (Cv)	Comprehensive Viva - Voce	-	-	75	3
	GR 4 (St)	Study Tour / Field Trip *	-	-	25	1
		Total	**25**	**-**	**-**	**28**
		Grand Total	**100**	**-**	**-**	**80**

Credit Distribution for Core & Electives of M.Sc. Geography Programme

Semester	Core Course		Elective Course	Total Credits
	Theory	Practical		
I	4+4+4+4	-	-	16
II	4+4+4+4	4+4	-	24
III	4+4	-	4	12
IV	4+4	4+4+4[#]+3*+1**	4	28
Total	**48**	**24**	**8**	**80**
[#]Dissertation *Viva-Voce **Study Tour / Field Trip				

EVALUATION AND GRADING

The evaluation scheme for each course shall contain two parts;

(a) Internal evaluation : 25% weightage shall be given to internal evaluation
(b) External evaluation : 75%to external evaluation

Therefore the ratio and weightage between internal and external is 1:3. Both internal and external shall be carried out using direct grading system.

INTERNAL EVALUATION

The internal evaluation shall be based on predetermined transparent system involving periodic written tests, assignments, seminars, and attendance in respect of theory courses and based on written tests, lab skills, records, viva and attendance in respect of practical courses.

The weightage assigned to various components for internal evaluation is as follows:-

Components of Internal Evaluation

SL.NO	COMPONENTS	WEIGHTAGE
1	Assignment	1
2	Seminar	1
3	Attendance	1
4	Test Paper	2

Practical

SL.NO	COMPONENTS	WEIGHTAGE
1	Record	1
2	Viva –voce	1
3	Attendance	1
4	Test Paper	2

ATTENDANCE

Direct Grading is applicable to attendance also.**75% attendance is mandatory** to appear for the examination.

Attendance grading will be as follows:-

% Attendance	Grade
90.1 & above	A
85.1 to 90%	B
80.1 to 85%	C
75.1 to 80%	D

DIRECT GRADING SYSTEM

Direct grading system based on a 5 point scale is used to evaluate the performance (External and Internal Examination of students)

Direct Grading System

Letter grade	Performance	Grade Point	Grade Range
A	Excellent	4	3.50 to 4.00
B	Very Good	3	2.50 to 3.49
C	Good	2	1.50 to 2.49
D	Average	1	0.50 to 1.49
E	Poor	0	0.00 to 0.49

Each course is evaluated by assigning a letter grade (A,B,C,D or E) to that course by the method of direct grading .The internal (weightage =1) and external (weightage =3), components of a course are separately graded and then combined to get the grade of the course after taking into account of their weightage.

Code Details:

Core Subject	GR-Geography
Core course	C
Elective	E
Semester Code	1, 2, 3, & 4
Course No.	01, 02, 03 ….. 12..
Practical	P
Project /Dissertation	(Pr)
Comprehensive Viva-Voce	(Cv)
Study Tour/Field Trip	(St)

DISSERTATION

Code: GR 4 (Pr)

Instructional hours / week: 4

Credit: 4

Dissertation should be carried out by individual students. No group projects shall be accepted. The selected topic has to be of geographical significance. The project should be unique with respect to title, content and layout. The dissertation entails filed work, lab work, report, presentation and viva-voce. The work shall be carried out under the supervision of parent department concerned or prescribed by the Head of the Department.

The dissertation work should be compiled as a report and Three copies to be submitted to Head of the Department at the end of forth semester.

The dissertation / project report has to be as per the guidelines in Annexure I

Table 1: External Evaluation

Sl. No.	*Components of Evaluation*	Credit
1	Dissertation / Project Report*	4
	Total	**4**

COMPREHENSIVE VIVA - VOCE

Code: GR 4 (Cv)
Credit: 3
Comprehensive Viva- Voce may be conducted along with the Practical examination of the fourth Semester. Viva –voce covers questions from all courses from the programme.

Table 1: External Evaluation

Sl. No.	*Components of Evaluation*	Credit
1	Comprehensive Viva-Voce	3
	Total	**3**

STUDY TOUR

Code: GR 4 (St)
Credit: 1
Study Tour: Visit to places/locations of Geographical significance in India. The visits can also be split into two, three or four spells of field visits. Every Student has to submit individual study tour report / field study report describing the geographical learning and experiences accompanied by maps, diagrams and photographs.

Study tour can be conducted as per convenience anytime during the course period. The Study tour / Field study should not exceed a total 20 days.

Table 1: External Evaluation

Sl. No.	*Components of Evaluation*	Credit
1	Tour Report / Field Study Report*	1
	Total	**1**

**Study tour is compulsory and part of curriculum. Under unavoidable circumstances, in case a student is unable to participate in study tour he/she has to take a short term field study and submit a report.*

CORE COURSES

GR 1 C01 GEOMORPHOLOGY

Instructional Hours /Week: 5 **Credits: 4**

Modules	Themes	Topics
1	Development of Geomorphology	Introduction to geomorphology,
		Terminologies and definitions. scope,
		Content and recent trends in geomorphology.
		Geomorphic system basic concepts in geomorphology.
		Approaches to geomorphology static, dynamic and applied
2	Structure Process and Form	Large-scale tectonic and structural landforms
		Small-scale tectonic and structural landforms
		Weathering and related landforms
		Hill slopes - Mass movement
		Karst landscapes
		Fluvial landscapes
		Glacial and glacio-fluvial landscapes
		Periglacial landscapes
		Aeolian landscapes
		Coastal landscapes
3	Historical changes Among the Landforms	Quaternary landscapes-Pleistocene and Holocene changes
		Fluvial landscapes
		Aeolian landscapes
		Coastal landscapes
		Ancient landscapes -old plains
		Ancient landforms (relict, exhumed, and stagnant)
		Evolving landscapes
4	Land Form Evolution	Cycle of erosion- views of W.M Davis- W. Penk- L.C King and
		Evolution in different environments
		Concept of slopes- evolution, slope elements
		Theories of slope – slope decline, slope replacement and parallel retreat of slope models.
5	Applied Geomorphology	Climatic geomorphology –
		Diagnostic land forms-
		Morphogenetic regions-
		Anthropogenic geomorphology-
		Human intervention on geomorphic processes-
		Applied geomorphology:
		Meaning and concept- application in hydrology engineering projects.

Web References

1. https://pubs.usgs.gov/pp/0500b/report.pdf
2. http://www.cec.uchile.cl/~fegallar/Fundamentals_of_Geomorphology.pdf
3. https://instaar.colorado.edu/~andersrs/The_little_book_010708_web.pdf
4. https://www.wikiwand.com/en/Geomorphology
5. http://www.uio.no/studier/emner/matnat/geofag/GEG2130/h08/undervisningsmateriale/GEG2130%20Periglacial%20geomorphology.pdf
6. https://www.journals.elsevier.com/geomorphology/
7. http://www.sciencedirect.com/science/journal/0169555X?sdc=1
8. http://geomorphology.org.uk/what-geomorphology-0

Suggested Reading

#	Book Title	Author
1	Principles of Physical Geography	Monkhouse, F.J
2	Geomorphology	Sparks, B.W
3	Modern Physical Geography	Strahler, A.N. and Strahler, A.H
4	Principles of Geomorphology	Thornbury, W.D.
5	The Physical Basis Geography – An outline of Geomorphology	Wooldridge, S.W. and Morgan, R.S
6	Geomorphology: A Systematic Analysis of Late Cenozoic Landforms	Bloom, A. L.
7	Fundamentals of Geomorphology	Richard John Huggett
8	Geology of India and Burma	M S Krishnan
9	Field Geology	Lahee
10	Fluvial Processes in Geomorphology	John P. Miller and Luna Bergere Leopold

GR 1 C 02 CLIMATOLOGY

Instructional Hours / Week: 4 **Credit: 4**

Module	Theme	Topics
1	Fundamentals	Nature, Scope and Content of Climatology
		Definitions – Weather, Climate, Meteorology
		Earths Spheres- Geosphere, Atmosphere, Hydrosphere, Biosphere
		Earth Sun Relationship
		Solar Radiation , Distribution of Solar Radiation
		Terrestrial Radiation – Albedo, Terrestrial heat balance
		Weather, Climate and Climatic Element, Climate Control
		General Atmospheric Circulation – Single Cell Model of General Circulation, Triple or Three Cell Model of General Circulation
		Effects of land and sea on pressure, wind, Temperature and Moisture distribution
		Equatorial Trough and Inter-tropical Convergence Zone
2	Stability and Instability	Jet Streams – characteristics, types of jet streams, relation with surface weather
		Stability – stability and daily weather, changes in stability
		Temperature inversion, types of temperature inversions
		Air Masses – Source Regions, Properties of Masses, Classification, Air Masses Modifications
		Fronts – Polar Front Theory, Warm Front, Cold front, Stationary Fronts, Occluded Fronts, Dry lines, ; Baroclinal Theory, Baroclinal v/s Barotrophy
		Oceans and Inter-annual Variations in Climate – Ocean Currents-Walker Circulation of The Equatorial Pacific Ocean- ElNino, Counterpoint –LaNina, Inter-annual Variations in the Monsoons
3	Extreme Weather Phenomenon	Thunderstorms, Cloud Bursts, Squall Line, Super cell thunderstorms and formations of Tornado, Downburst and Derecho
		Tropical Cyclone, Extra-Tropical Cyclones
		Water Sprout, Dust Storm, Wildfires, Hail Storms, Silver Storms, Blizzards, Heat Waves
		Concentrated Heavy Rainfall and Flooding, Heat and Drought
		Forecasting and tracking of Extreme Weather Phenomenon
4	Climatic Classification and Applied Climatology	Climatic classification of Trewartha, Thornthwaite, Koeppen
		Critical Appraisal of all three classifications
		Application of all the classification with respect to India
		Agro-climatology-Agro climatic regions of India and special focus on Kerala
		Weather patterns and agriculture production and productivity and food security. weather forecasts
		Micro and macro climates: Urban climates- Urban heat island effects Introductions to Instruments and measurements techniques of weather elements and analysis of weather data.
5	Climate Change	Climatic changes in the past and present-Theories -Evidences- Possible causes – Ozone depletion Major environmental (physical and biological and cultural) impacts of greenhouse gases.
		Global atmospheric composition: Greenhouse gases and aerosols
		The greenhouse effect –impacts on the ecosystems and species interactions
		Extreme weather events, sea level rise;
		Climate projections and their uncertainties
		Climate impacts, vulnerability and risks Assessing climate impacts on key sectors and systems (heat stress, water resources, coastal zones, agricultural systems)
		Climate mitigation and policy Economics of climate change,
		Low Carbon Strategies

Web References

1. http://www.imd.gov.in
2. http://www.imdtvm.gov.in/
3. https://www.wikiwand.com/en/Climatology
4. http://drought.unl.edu/DroughtBasics/WhatisClimatology.aspx
5. http://danida.vnu.edu.vn/cpis/files/Books/Encyclopedia%20of%20World%20Climatology.pdf
6. http://samples.jbpub.com/9781284032307/9781284028775_CH01_Rohli3e_SECURE.pdf
7. http://metnet.imd.gov.in/Welcome%20to%20Intra-IMD/welcome.php
8. https://www.coursera.org/courses?languages=en&query=climate
9. https://ufonline.ufl.edu/courses/geo3250-climatology/
10. https://www.bookyards.com/en/book/details/13816/Climatology#

Suggested Reading

#	Book Title	Author
1	Atmosphere, Weather and Climate	Barry, R.G. and Chorley P.
2	General climatology	Critchfield, J.H
3	Monsoons National	Das, P.K
4	Monsoon	Fein, J.S. and Stephens, P.N
5	Climatologically Tables of Observatories in India	IMD
6	Climatology	Lal, D.S
7	The Climate of the Earth	Lydolph, P.E
8	Our Weather	Menon, P.A
9	Introduction to Meteorology	Peterson, S
10	contemporary climatology	Robinson, P.J.& Henderson, S
11	Applied Climatology, principles and practice	Thompson, R.D. and Perry A
12	Climatology and Atmospheric Science	Oliver, J.J
13	An Introduction to Climate	Trewartha, G.T
14	Lecture notes on Climatology (IMD Training Material)	A D Tathe

GR 1 C 03 CONCEPTS AND TRENDS IN GEOGRAPHY

Instructional Hours/Week: 4 **Credit: 4**

Module	Theme	Topics	
1	**Development of Geography as a Discipline**	Nature and Scope of Geography;	
		Geography as a science	
		Place of Geography in classification of Sciences	
		concept of space and concept of landscape (Regional & cultural),	
		Historical development	Ancient And Medieval Period
			Contribution Of Greek,
			Roman
			Indian
			Arabs And Renaissance
			Exploration and Discoveries
2	**Modern Geographical Thinking**	Development Of Geography In Modern Period German School	
		French School	
		British School	
		American School	
		Contribution Of	Humboldt
			Ritter
			Blache
		Dualism and dichotomy in Geography	
		Social Darwinism in Geography	
3	**Explanation in Geography**	Fundamental concepts of aerial differentiation	
		spatial organization	
		regionalism and spatial science	
		Spatial thinking Traditions in Geography	Man – Land
			Area Studies
			Spatial
			Earth Science Traditions
		Scientific explanation: inductive and deductive approaches	
		Geography of Inequality	
		Social Justice and Welfare Geography	
		Geography of Gender	
		Colonialism	
		World Wars and Post Colonial Developments in Geography Critical Geography	
		Ideas of David Harvey	
4	**Quantification in Geography**	Conceptual and methodological development during 2oth century	
		Quantitative revolution	
		location analysis,	
		Paradigms, laws theory and models	
		Theory in Geography: structure, nature, type and applications in geography	
		human-environment interactions	
		Philosophical debates in Contemporary Geography	Critical understanding of modern themes in geographical thought positivism
			Behaviouralism
			Marxism
			Structuralism

			post-structuralism
			post-modernism
		Kuhn's model	
		Liberals and Radicals	
		Feminist Geography	
5	**Recent trend in Geographic studies**	Methods in Geographical Analysis	Epistemology of geography
			Geography as a integrating discipline
			physical geography and natural geography and natural science
			geography and social science
		Cartographic methods in Geography	Remote sensing
			GIS,
			GPS
		Resource Management	EIA
			Risk analysis
			Human rights and conflict resolution.

Web References

1. https://www.wikiwand.com/en/History_of_geography
2. https://www.wikiwand.com/en/Philosophy_of_geography
3. https://www.wikiwand.com/en/Quantitative_revolution
4. http://www.eurogeographyjournal.eu/articles/2_2_CHANGING%20PARADIGMS%20OF%20GEOGRAPHY_KOUTSOPOULOS.pdf
5. https://www.wikiwand.com/en/Paradigm_shift

Suggested Readings

#	Book Title	Author
1	Spatial Organisation : The Geographer's View of the World	Ronald Abler, John S Gould, Adams , Peter
2	The Geography of the Puranas	S.M Ali
3	An Introduction to Scientific Reasoning in Geography	Duglas Amedeo
4	The Art and Science of Geography Integrated Readings	R.D Dikshit
5	Explanations in Geography	David Harvey
6	Perspectives of Nature of Geography	R Hartshorne
7	Evolution of Geographic Thought	M Husain
8	Philosophy and Human Geography	R.J Johnson
9	The Future of Geography	R.J Johnson
10	The Changing Nature of Geography	R Minshull

GR 1 C 04 PHYSICAL GEOGRAPHY OF INDIA

Instructional Hours/Week: 4 **Credit: 4**

Module	Theme	Topics	
1	**Indian Subcontinent Evolution**	Geography of India Scope and Significance of Study	
		India – Geographic Location – Spatial Significance	
		Morpho-Tectonic Framework of India – Geology and Physiography, Geomorphology, Main tectonic features , Evolution of Indian Platform	
		Global Plate Tectonics and India Subcontinent	
		Seismicity and Earthquakes, Isostasy and Gravity	
2	**The Geodiversity of India**	**Evolution and Characteristics**	The Himalayas
			The Aravali
			The Great Indian Plain
			The Great Indian Desert
			The Extra Peninsular Plateaus and hills
			Mountain Ranges of Peninsula
			The Deccan Plateau
			The Hills and plateaus of North Eastern India
			The Coastal Plains
			The Islands
		Geology and Minerals distribution	
3	**The Indian Monsoon**	Monsoon -Definition, Economic and Environmental importance	
		Origin of Monsoon – Thermal Concept(Sir Edmund Halley 1686), Aero-logical (R. Scherhag1948) , Fohn's concept (1951)	
		Classical Theory of Indian Monsoon, Summer Monsoon and Winter Monsoon	
		Driving Mechanism -Differential heating of land and sea, Compressibility of atmosphere, Effects of rotation and moisture, Annual cycle of Summer Monsoon	
		Features of Summer Monsoon: Pressure patterns on land and sea, Monsoon Trough creation, Surface Temperature patterns land and Sea, Surface winds and upper air circulation.	
		Monsoon System - On-set of Monsoon, Withdrawal of Monsoon, Break in Monsoon, Monsoon depressions, Mid-troposphere cyclone, Off-shore trough along west coast of India, Easterly Jet, Westerly Jets and Tibetan Anticyclone	
		Global Connections: El Niño-Southern Oscillation (ENSO), Walker Cell, Eurasian Snow Cover, Role of Ocean and upper atmosphere	
		Monsoon Variability: Distribution of Rainfall, Intra seasonal Breaks, Extremes of floods, drought and famine,	
		Forecasting Monsoon:, Regional Conditions, ENSO indicators, Cross Equatorial flow of winds, Global/hemispheric condition, Parametric and Multiple power regression model, MONEX model, Coupled Dynamical Model	
4	**Soil and Vegetation**	Vegetation - Classification	
		Soils of India – Classification (Joint Classification Soil Survey of India National Bureau Soil Survey and Land Use Planning (ICAR)	
		Bio-geographical zones of India	
		Relief v/s Drainage , The Great Indian Water Divide	
		The Drainage Network – critical appraisal of Indo Brahma theory	
		Comparative study of Himalayan and Peninsular River Systems	
		Major River System – Indus, Ganges, Brahmaputra, Godavari, Krishna, Cauvery, Mahanadi and Narmada	
		Drainage Regionalization	
5	**Contemporary Issues**	Territorial Conflicts – India and Pakistan, India and China, India-Bangladesh	

Web Resources

1. https://www.wikiwand.com/en/Geology_of_India
2. http://www.portal.gsi.gov.in
3. http://www.geosocindia.org/

Suggested Readings

#	Book Title	Author
1	A Manual of the Geology of India	H B Medlicott and WT Blanford
2	Geology of India for Students	D N Wadia
3	Geography of India	R L Singh
4	Geography and Geology of the Himalayan Mountains and Tibet	Colonel S G Burrard and H H Hayden
5	The Physical Geology of India	S M Mathur
6	The Origin of Himalaya Mountains	Colonel S G Burrard
7	Geology of India and Burma	M. S. Krishnan
8	Indica	Pranay Lal
9	The Monsoons	P K Das
10	The Global Monsoon System – Research and Forecast	Chih-Pei Chang
11	Soils in India Text Book of Soil Science	P C Das
12	Flora of India	Alfred Byrd Graf

GR 2 C 05 GEOGRAPHIC INFORMATION SYSTEM

Instructional Hours/Week: 4 **Credit: 4**

Module	Theme	Topics
1	Introduction	Basic Concepts- Definition and Scope
		Historical Development of GIS
		GIS Architecture, Components and approaches
		Representing Geographic Space; Discrete and Continuous
		Representation of Spatial and Temporal Relationships
		Data Generalization - about places and properties
		Data Collection; Workflow- Primary geographic data capture, Secondary geographic data capture, Obtaining data from external sources, Capturing attribute data
		Data Classification; Feature Codes and Feature Coding
		Geographic Data Precision and Data Organization
		Ethics of using GIS data Metadata, Standards and significance, Data catalogues, - Indian standards, NSDI metadata standards, NSDI vision 2020
2	Establishing a spatial network	Co-ordinate systems; Geographic, Rectangular and non – co-ordinate system
		Ellipsoid and Geoid; Datums; Geodetic and Vertical; Global and Local,
		Relationship between co-ordinate systems and map projections
		Acquisition of spatial data
		Collection of Attribute data, Scales of Measurement
3	Managing Data and the Database	Data file Management: Simple list, Ordered sequential file and Indexed files.
		Database Management Systems, Types, Functions and Components of a Database System,
		Geographic DBMS Extensions, Relational database model; SQL
		Geographic Database design; Conceptual, Logical and Physical
		Storage of GIS data: Hybrid and Integrated data model
		Object based models: Attribute model; Entity-Relationship, Location based, Entity based and Time based representation
4	Modelling Spatial Data	Graphical representation - Raster data representation; Nature and characteristics, Coding and storing raster data
		Types of raster models; GRID, IMGRID and MAP Model
		Compression of raster data; Run-length encoding, Raster chain encoding, Block encoding, Quadtree and Wavelet.
		Vector data representation; Nature and characteristics, Simple features, Topological relations, Use of Topological relationships
		Non-Topological model: Shapefile, Spaghetti model, Compact vector models; Storing vector data
5	Spatial Data analysis	Geovisualization and spatial query, Cartograms. Dasymetric maps, 2D and 3D Representations.
		Raster based data analysis- Local operations; Overlay: Neighbourhood operations – Measurement of distance, Proximity and Connectivity; Buffering; Viewshed analysis: Regional operations; Calculation of area, perimeter and Shape
		Spatial interpolation- Thiessen polygons, IDW, Kriging
		Vector based data analysis- Attribute database query, Calculation of areas, perimeters and distances, Feature-based overlay, buffering; layer – based overlay, Network analysis-its applications

Web References

1. https://www.coursera.org/specializations/gis
2. http://www.qgistutorials.com/en/
3. https://docs.qgis.org/2.2/en/docs/training_manual/
4. www.gpsinindia.com:
5. https://www.gislounge.com/learn-gis-for-free/
6. https://www.coursera.org/learn/gis
7. https://www.esri.com/training/
8. http://index-of.es/Programming/Pragmatic%20Programmers/Desktop%20GIS.pdf
9. http://www.geoforall.org/
10. http://opensourcegeospatial.icaci.org/
11. http://www.mdpi.com/journal/ijgi/special_issues/science-applications
12. http://giscommons.org/

Suggested Reading

#	Book Title	Author
1	Geographic Information Systems & Science	Rhind Maguire Goodchild Longley
2	Practical GIS	Gabor Farkas
3	A Practical Guide to Geostatistical Mapping	Tomislav Hengl
4	Principles of geographical Information Systems for Land Resources	Burrough P A
5	Remote Sensing and Geographical Information Systems'	Anji Reddy
6	geographic Information Systems: A Management Perspective	Aronoff S
7	Exploring Geographic Information System	Chrisman N .R
8	Geographic Information Systems	Fraser, Taylor D R
9	Computer Assisted Cartography	Mark S Monmonier
	Introductory Reading in Geographic Information Systems	Peuquet D J and D F Marble
10	Geographic Information Systems: An Introduction	Star J and j Estes

GR 2 C 06 REGIONAL PLANNING

Instructional Hours /Week: 5 **Credit: 4**

Module	Theme	Topics
1	**Concept of Regional Planning**	Region: Meaning, Types Characteristics and Hierarchy.
		Planning: Definition, Concept, Types and Characteristics.
		Regional Planning: Scope, objective, Principles, Methods, techniques, characteristics, significance
		Types of Regional Planning
		Delimitations of regions
		Purposes of regional planning
		Regional growth and development
		Regional planning processes
		Norms and Standards for Regional planning
2	**Theories in Regional Planning**	Economic Systems
		Classical theory of economic development
		Marxian theory of economic development
		Schumpeterian theory of economic development
		Myrdal theories of circular causation
		Leontief-input output model
		Francis Perroux - Growth pole theory
		Hirschman theory of Balanced and unbalanced growth
		Core Peripheral model (J. Friedmann) and Growth Foci (R P Mishra)
		Export Base Theory by Doughlass C North
3	**Regional Development**	Meaning and concept of modern economic growth
		Indicators and measurement of development.
		sustainable development-meaning, objectives
		policies, programmes
		theory of limits to Growth Model
		Theory Beyond the Limits
		Millennium Development Goals
		UN Agenda 21
4	**Regional Imbalance**	Regional inequalities
		obstacles of regional imbalance
		Factors of regional imbalance
		Characteristics of underdeveloped
		Vicious cycle of poverty
		The dependency theory of underdevelopment.
		Human capital formation and manpower.
		Studies in regional imbalance-Bimaldas Gupta, Hemalatha Rao, Ashok Mehta and V.Nadh
5	**Regional Planning in India**	History of planning in india,
		Five year Plans and Niti Ayog
		Micro and Multilevel planning
		Rural and urban planning
		Decentralized Planning
		73rd CAA, Government Planning Programmes in India
		Watershed Based Planning

Web References

1. https://www.wikiwand.com/en/Regional_planning
2. http://niti.gov.in/
3. http://tcpomud.gov.in/
4. https://www.wikiwand.com/en/TCPO
5. http://planningcommission.gov.in/
6. https://www.wikiwand.com/en/Planning_Commission_(India)

Suggested Reading

#	Book Title	Author
1	Indian Economy ,Problems of Development and Planning	Agarwal,A.N
2	Problems of Regional Economic Planning	Boudeville,J.R
3	Regional Planning in India	Chand.M,Puri.V.K
4	The Colonial Legacy", in The Indian Economy Problems and Prospects,	Chandra,Bipin
5	Planning Regions in India, Town and Country Planning Organization	Chandrasekhara,C.S.and Sundaram.K.V
6	Metropolitan Centres and Regions in India,21 st International Geographical Congress, Metropolitan Growth and Planning	Chandrasekhara,C.S.and Sundaram.K.V
7	City and Region: A geographical interpretation	Dickinson.R.E
8	City , Region and Regionalism, A geographical Contribution to Human ecology	Dickinson.R.E,
9	Economic Development and Social Opportunity	Dreze.J and Sen A.
10	Indian Economy	Dutta,R. & K.P.M,Sundaram,
11	Geography: Realms Regions and Concepts	De Blij, H.J. and Muller, P.O
12	Regional Planning:Concepts,Techniques,Policies and Case Studies	Misra,R.P
13	Regional Development Planning In India, A New Strategy	Misra.R.P,Sundaram.K.V& VLS Prakash Rao
14	Indian Economy	Misra,S.K,and Puri,V.K.
15	Levels of Regional Development in India	Mitra,A
16	Economic Development :Past and Present	Gill,R
17	An Introduction to Regional Planning	Glasson,J.
18	Introduction to Regional Science	Walter,Issard
19	An Introduction to Development and Regional Planning	Ray Chaudhuri,Jayasri

GR 2 C 07 RESEARCH METHODS IN GEOGRAPHY

Instructional Hours /Week: 4 **Credit: 4**

Module	Theme	Topics
1	**Initiating Geographical Research**	Introduction to Research Methods in Geography
		Nature of Geographical Research
		Scope and Content
		Ethical Practice in Geographical Research
	Research Paradigms in Geography	Ontology; Epistemology;
		Research Paradigms in Geography - Spatial Science, Humanistic Geography, Critical Realism, Monism, Dualism, Poststructuralist Geographies, Paradigms and Modern era of Geo-Spatial Technologies
2	**Fundamentals of Research**	Identifying research problem, defining a problem,
		Literature Review – Purpose of Literature Review, Framework of searching, Managing your search, Search Tools: Library Catalogs, Abstracts and Reviews, Citation Indexes, Bibliographies, Websites, Other Literature Sources, Evaluating the Literature
		Formulation of Hypothesis and Methodology
		Research Proposal Writing
		Philosophy of Research and importance of Research Design
		Research Scheduling
3	**Generating and Working with Data in Human Geography**	Data Sources - Primary and Secondary Data, Finding Historical Sources
		Quantitative and Qualitative Data
		Conducting Questionnaire Surveys
		Semi-structured Interviews and Focus Group Discussions
		Ethnography of Participant Observation
		Participatory Research Methods
		Sampling in Geography
		Human Environment Field Study
		Modelling in Human Geography: Understanding Explanation and Prediction in Human Geography
4	**Generating and Working with Data in Physical Geography**	Getting Information about the Past
		Making Observations and Measurements in the Field
		Importance Field Book and Maps
		Analyzing a Natural System
		Modelling in Physical Geography: Understanding Explanation and Prediction in Physical Geography
5	**Representing, Analyzing, Interpreting, Visualizing**	Data Handling and Representation, Analyzing – Meaning, Interpretations
		Tables, Graphs, Diagrams and Maps
		Using Statistics to Describe and Explore Data – Descriptive Statistics, Explanatory Statistics
		Introduction to Geostatistics
		Computer Assisted Qualitative and Quantitative Data analysis
		Using Remotely Sensed Imagery
		Using Geographic Information System
		Writing Essays, Articles, Paper, Reports and Dissertations
		Thesis, Chapter formulation, Language, Layout and Structure, Illustrations, Tables and Foot notes
		Oral Presentation
		Intellectual Property Rights

Web References

1. http://obohcom.net/home/read?filename=Research%20method%20in%20Geography.pdf
2. https://orca.cf.ac.uk/59957/1/report-130906041556-.pdf
3. http://www.modares.ac.ir/uploads/Agr.Oth.Lib.17.pdf
4. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.133.5983&rep=rep1&type=pdf
5. http://research.ncl.ac.uk/forum/v2i1/Problems%20and%20Methods%20of%20Environmental%20Research.pdf
6. http://www.statcan.gc.ca/pub/12-587-x/12-587-x2003001-eng.pdf
7. http://www1.geo.ntnu.edu.tw/~moise/Data/Books/Social/05%20social%20geography%20theory/social%20geography%20participatory%20research.pdf

Suggested Readings

#	Book Title	Author
1	An Introduction to Scientific Research Methods in Geography and Environmental Studies	Daniel Montello, Paul Sutton
2	Doing Urban Research.	Andranovich, G.D., & Riposa, G.
3	The Survey Research Handbook	Alreck, P.L., & Settle, R.B.
4	Asking the Right Questions: A Guide to Critical Thinking	Browne, M.N., & Keeley, S.M.
5	Handbook of Qualitative Research	Denzin, N.K., & Lincoln, Y.S.
6	Methods in Human Geography.	Flowerdew, R., & Martin, D.
7	Research Methods: Planning, Conducting and Presenting Research.	Devlin, A.S.
8	Qualitative Research Methods in Geography.	Hay, I
9	History and Things: Essays on Material Culture.	Lubar, S., & Kingery, W.D.
10	Research Methodology	C R Kothari
11	Research Methods in Social Relations	Judd, C., Smith, E., & Kidder, L.H.
12	Survey Research.	Sapsford, R.

GR 2 C 08 POPULATION GEOGRAPHY

Instructional Hours/Week: 4 **Credit: 4**

Module	Theme	Topics	
1	Development of Population Geography	Scope and Content of Population Geography	
		Sources of Population Data	
		National Censuses and Registration Systems	
		Surveys	World Fertility Surveys
			Demographic and Health Surveys
			Other fertility surveys
			Current Population Survey
		National Survey of Family Growth	
		American Community Survey	
		Attributes of Population – Demographic, Social and Economic –Distribution	
		The future of the planet earth	Ecological Considerations
			Sociological Considerations
			Philosophical Considerations
2	World Population Change over Time	Major Writings and Theories	Malthusian Theory
			Marxian Theory
			Comparison of the Malthusian and Marxian Positions
			Demographic Transition Theory
			Other Contributions to Population Theory
		Doubling time and halving time	
		World Population Growth	
		Population growth before 1650	
		Population change since 1650	
		The Future Population of the Earth2010	
		Population resource regions by Ackerman	
		Methods, Measures, and Tools: Measuring Fertility and mortality	
3	Migration and Migration Theories	Internal Migration -Theories of Internal Migration (macro adjustment theories and micro behavioural theories of migration)	
		Migrant Selectivity and Migrant Characteristics -The Migration Process	
		International Migration Flows: Immigrants and Transnational Migrants-Major International Flows	
		Theories of Immigration(neoclassical economic theory- New Economics of Migration Theory- dual-labour market theory- social network theory- Myrdal's cumulative causation theory- institutional theory)	
		The Impacts of Immigration-Immigration Policy -Transnational Migrants	
		Migration in the Modern Period- Defining Refugees	
		Alternatives for Refugees: No Easy Way Home	
		Internally Displaced Persons -The Future of Refugees and IDPs	
4	Age and Sex Composition	Concepts of Age and Sex	
		Definition of age and sex	
		Biological definitions of sex	
		Intersex	
		Changing sex	
		Sex determination, self-identification, and the Olympic Games Sex versus gender	
		Theoretical and Substantive Issues of Age and Sex	
		Age and sex and the demographic processes	

		Demographic theories of age and sex
		Methods for Analyzing Age and Sex Distributions
		The population pyramid
		Age dependency
		Age heaping
		Sex structure
		Sex Ratio at Birth
		Population Aging
5	**Cultural Adaptation and Growth, Population policy and contemporary issues**	Cultural Adaptation Processes
		Assimilation versus Pluralism
		Assimilation
		Cultural pluralism
		Melting pot
		Recent Patterns of Cultural Adaptation
		Pluralistic Assimilation
		Immigration and Growth
		Immigration Policy Internal Migration
		Fertility Policies Economic Policy as Population Policies.
		Contemporary Issues – Ageing of Population; Declining Sex Ratio; HIV/AIDS.

Web References

1. http://censusindia.gov.in/
2. http://www.nios.ac.in/media/documents/316courseE/ch26.pdf
3. https://www.wikiwand.com/en/Uncontacted_peoples
4. https://www.wikiwand.com/en/Population_geography
5. https://www.wikiwand.com/en/Race_(human_classification)
6. http://humangeography.wikispaces.com/Population+Geography
7. https://www.gfmer.ch/SRH-Course-2011/family-planning/pdf/Principles-population-demography-Moazzam-Ali-2011.pdf
8. https://www.wikiwand.com/en/Human_migration
9. https://www.wikiwand.com/en/Refugee

Suggested Reading

#	Book Title	Author
1	Geography of Population; Concept, Determinants and Patterns	Chandana, R.C.
2	Geography of Population	Garnier, B.J
3	Principles of Population and Development	Crook, John I
4	Population Geography	York Clarke, John I
5	Population Geography	I. Singh
6	Migration and Economic Development of Kerala	K.V Joseph
7	Census of India	Census of India
8	Population in India's Development(1947 – 2000);	Bose, Ashish
9	India's Population Problem	Mamoria C.B
10	Geography of Population Selected Essays	S.L Kayastha
11	Human Geography Issues for the 21st Century	Peter Daniels, Michael Bradshaw Denis Shaw, James Sidaway
12	Population	William Petersen,
13	Principles in Demography	Bogue, D.J
14	Statistical Methods for Geography	Rogerson
15	Quantitative Geography Techniques and Presentations	Ashis Sarkar
16	Land, Work and Resources An Introduction to Economic Geography	J.H. Paterson
17	Statistical Techniques in Geographical Analysis	Danies Wheeler, Gareth Shaw, Stewart Bar

GR 3 C09 PRINCIPLES OF REMOTE SENSING

Instructional Hours /Week: 5 **Credit: 4**

Module	Theme	Topics
1	Concepts and Foundations of Remote sensing	Basic Concepts: Energy Sources; Wave model of Electromagnetic Energy; Quantum theory of electromagnetic radiation
		Energy interactions in the atmosphere – Refraction, Scattering Absorption, Reflectance
		Energy interactions with earth surface features – Spectral reflectance Curve, Spectral reflectance of Vegetation, soil and water
		Atmospheric influences on spectral response patterns; Spectral Information and resolution, Spatial Information and resolution, Temporal Information and resolution, Radiometric Information and Resolution, Polarization Information, Angular Information,
		Historical Development of Remote Sensing as a technology; The early age, The middle age, The modern age; Commercial remote sensing platforms; Types of Remote Sensing
		Concept of swath, Nadir; Data acquisition principles and interpretation
		Advantages and limitations of Remote Sensing, An ideal remote sensing system
2	Principles of Photogrammetry	Development of Photogrammetry; Basic principles, Elements of photographic system- Types, Scales and ground coverage, resolution, radiometric characteristics, films, filters and aerial cameras
		Elements of Image interpretation; Collateral information, Convergence of evidence, The Multi- Concept
		Geometric fundamentals of Photogrammetry; Elements of Vertical Photograph; Relief displacement, Image Parallax, Stereo model- Photo mosaics; Image interpretation Keys; Ground Control for Aerial Photography
3	Satellite Remote Sensing	Satellite Remote Sensing; Multispectral imaging; Using Discrete Detectors and Scanning mirrors- Landsat- MMS, TM, ETM+; NOAA- GOES, NOAA-AVHRR; SeaWiFS
		Multispectral imaging Using Linear Arrays; SPOT 1, 2, 3 HRV, SPOT 4, 5 HRVIR; IRS-LISS III and LISS IV; ASTER; Quick Bird
		Imaging Spectrometry using Linear and Area Arrays; AVIRIS, MODIS
		Digital Frame Cameras Based on Area Arrays
		Astronaut Photographic Systems
		Thermal Infrared Remote Sensing; Principles; Radiation properties, thermal infrared atmospheric windows; Applications
		Active and Passive Microwave Remote Sensing; Principles; Synthetic Aperture Radar Systems; Principles; Applications of Microwave Remote Sensing
		LIDAR Remote Sensing; Principles and applications
4	Digital Image Processing	Types of Imagery; Image rectification and restoration-Geometric correction, Radiometric correction, Noise removal
		Image enhancement- Contrast manipulation, spatial feature manipulation, Multi-image manipulation
		Contrast manipulation- Grey-Level thresholding, Level slicing, Contrast stretching
		Spatial Feature Manipulation- Spatial filtering, Convolution, Edge enhancement, Fourier Analysis
		Multi–image manipulation – Spectral ratioing, Principal and Canonical component transformation, IHS enhancement, Decorrelation stretching
		Image Classification; Supervised classification, Minimum-distance-to-means, Parallelepiped, Gaussian maximum likelihood: Assembling the training data; graphical representation of spectral response patterns, Quantitative expressions of category separation, Self-classification of training data set, Interactive preliminary classification, Representative subscene classification
		Unsupervised classification; Hybrid classification; Classification of mixed pixels- Spectral mixture analysis, Fuzzy classification; Post-classification smoothing
5	Applications of Remote Sensing in	Vegetation
		Watershed Management
		Agriculture
		Geology
		Urban Planning
		Disaster Management

Web Resources

1. http://www.iirs.gov.in/
2. https://www.wikiwand.com/en/Indian_Remote_Sensing
3. http://srtm.csi.cgiar.org/
4. https://asterweb.jpl.nasa.gov/gdem.asp
5. https://earthexplorer.usgs.gov/
6. http://www.eorc.jaxa.jp/en/hatoyama/experience/rm_kiso/mecha_sensortype_e.html
7. http://bhuvan.nrsc.gov.in/bhuvan_links.php
8. https://nrsc.gov.in/IRS_Data_Products
9. https://earthdata.nasa.gov/user-resources/remote-sensors
10. http://www.geo-informatie.nl/courses/grs10306/Materials/Practical/1%20Manual/000%20Practical%20manual%202010.pdf

Suggested Readings

#	Book Title	Author
1	Fundamentals of Remote Sensing and Air Photo interpretation	Barrett E C and L F Curtis
2	Introduction to Remote Sensing	Compbell J
3	Principles of Remote Sensing	Curran P J
4	Digital Image Processing of Remotely Sensed Data	Hord R M
5	Remote Sensing of the environment	John R. Jenson
6	Remote sensing and Image interpretation	Lillisand T M and R W Kiwdwe
7	Remote Sensing for Earth Resources, Association of Exploration Geophysicist	Rao D P
8	Remote Sensing : Principles and Interpretation	Sabins F F Jr

GR 3 C 10 URBAN GEOGRAPHY

Instructional Hours/Week: 4 **Credit: 4**

Module	Theme	Topics
1	History of Urbanization	Nature, Scope and content of Urban Geography
		Urbanization – Definitions, Terminologies and Urban Jargons
		Geographical approach to study of Urbanization
		History of Urbanization in India – Prehistoric (2300-1800BC), Early Historic (600BC-AD500), Medieval Period (AD600-1800), British Colonial Period (1800-1947), Post Independence Period till 2004, Contemporary Period 2005 Onwards
		World Urbanization – The Classic City, The Medieval city, The Neoclassical City
		Colonization, Industrial Revolution and Urbanization
		Defining Space and Place, Identity of a Place, Space-Place relationships
		Definition of Urban Place and Areas- Identification and Spatial limits of Urban Areas. Census of India definition of Urban Area
2	Patterns and Classification	Patterns of Urbanization in India –Levels of Urbanization –Structural Patterns Macro-Spatial Patterns
		Classification of Urban Place – Based on Physical Characteristics, Functional, Socio-Cultural, Historical.
		Ashok Mitra's Classification of Indian Cities
		Land Use Models: - Burgess Model, Sector Model, Multiple Nuclei Model, Urban Realms Model (James E Vance Jr.), Grid Model or Hippodamian Plan
		Urban Demographic Model – Density Model
3	Settlement Systems	Behavioural and Normative Settlement Systems
		Primate City Settlement System, Settlement System and Rank Size Rule,
		Central Place Settlement Systems
		Spacing of Settlement Systems – Entropy of Settlement Systems, Identification of Central Places Functions, Measurement of Range of a Good, Thresholds, Centrality, Settlement Hierarchies, rural –urban travel behaviour
4	Urban Development and Planning	Basics of Urban Planning – Definition, Concepts and Approaches
		Urban Planning in India - Master Planning and City Development Plan
		Urban Policy of India
		Urban Renewal and Development Programmes in India – JnNURM, Post JnNURM – Smart Cities, HRIDAY, AMRUT, NERUDP, Urban Transport, Swachh Bharat Mission
		City and Region – City-Region Relationship, Structure, Areas of Influence, Areas of Dominance, City Regions in India, City Region and Planning
		Rural Urban Fringe
5	Urban Governance and Urban Problems in India	Urban Governance :-Definition, Concepts, Components, Administrative Structure-hierarchy and structure
		Institutional frame and mechanism for urban governance as envisaged in the 74th Constitutional Amendment Act
		Urban Problems: Safe Drinking Water, Water, Air, Sound Pollution, Solid and Liquid Waste Management
		Urban Sprawl, Over Crowding and Urban Housing:- Slum and Squatter Settlements, Slum Redevelopment
		Unemployment, Urban Informal Sectors, Urban Crimes
		Urban Disasters
		Cities and Climate Change – Towards Sustainable Future

Web References

1. MoUD - http://moud.gov.in/
2. MoHUPA - http://mhupa.gov.in/Default.aspx?ReturnUrl=%2f
3. NUIA - https://www.niua.org/
4. https://unhabitat.org/
5. http://uni.unhabitat.org/
6. Urban Update Magazine - https://issuu.com/urbanupdatemag/docs/uu_may_2017
7. http://mit-ocw.kmeacollege.ac.in/courses/urban-studies-and-planning/
8. https://www.coursera.org/learn/smart-cities
9. IGBC - https://igbc.in/igbc/
10. GRIHA- http://www.grihaindia.org/index.php?option=com_content&view=article&id=87

Suggested Reading

#	Book Title	Author
1	Urbanization and Urban Systems in India	R Ramachandran
2	Urban Geography - An Introductory Analysis	James H. Johnson
3	Cities: Steering Towards Sustainability	Pierre Jacquet
4	Re-Visioning Indian Cities – Urban Renewal Mission	K C Srinivasan
5	The Urban Pattern – City Planning and Design	Arthus B Gallion, Simon Eisner
6	New Forms of Urban Governance in India	I S A Baud , J De Wit
7	Introduction to Settlement Geography	Sumita Ghosh
8	Town Planning	Rangwala
9	Urban and Regional Planning	K S Rame Gowda

GR 4 C 11 ENVIRONMENTAL GEOGRAPHY

Instructional hours/week: 5 **Credit: 4**

Sl. No	Themes	Topics
1	Concepts in Environmental Geography	The concept of environment. Environmental Thought. Early environmental thinking. Environmentalism.
		Man and Environment relationship
		Development and scope, Human-Ecological adaptations. Recent concepts
		Ecosystem-types and functions. Biodiversity
2	Human interference in Biosphere	Human impacts on Land, water and air. Human impacts on Agricultural and Industrial environment. Human Settlement and its impact on environment..
		Environmental Pollution: Water and Soil Pollution-types, sources and consequences
		Methodology of wastewater disposal on land in India. Impact of usage of land for solid waste disposal
3	Global Environmental Issues-Eco crisis	Eco-crisis. Global environmental issues and International laws: Global warming, Ozone depletion, Acid rains, hazardous waste, Biodiversity Loss.
	International Laws	Role of UN authorities in protection of Global Environment, Multinational authorities and agreements, Stockholm Conference, Nairobi Declaration, Rio Conference, Rio+5 and the Rio+10, Conference of Parties, International Protocols, Future of International laws-Paris conference. Syndromes with environment, Environmental refugee.
	Environmental Policy and Management	Environmental management and planning –Goals, needs, themes and problems in ecosystem management. Leopold Matrix.
		Environmental Impact Assessment, Environmental Mapping: Application of Remote Sensing and GIS.
4	Environmental Policy and Management in India	National Environmental Policy: National Policy on EIA and Regulatory Framework. Green Tribunal.
	Environmental Acts in India	Anti Pollution Acts: The water Act. 1974. The Air Act 1981. The Environment Protection Act 1986. Role of Central & State Pollution Control Boards .
	Environment movements in India	Environment movements /Reports in India with special reference to Himalayan and Western Ghats Ecology .Protection of Biodiversity in India-measures.
5	Environmental Sustainability	Sustainable Development: Definition and concepts of sustainable development, Equity Environment versus Development. Critical review of drawbacks in traditional evaluation of development. Cost benefits analysis.
		Environmental Health and Toxicology.
		Recent Concepts: Environmental Justice. Ecological Footprint. Green Economy. Green rating Project. Eco-mark Scheme. Polluter Pays Principle. Ecocide Act.

Web References

1. http://envfor.nic.in/
2. https://www.wikiwand.com/en/Integrated_geography
3. http://www.unep.org/
4. http://en.unesco.org/
5. http://www.cseindia.org/
6. https://www.uv.mx/personal/fpanico/files/2011/04/AA.-VV.-Environmental-geography.pdf
7. https://www.wikiwand.com/en/Human_impact_on_the_environment
8. https://www.wikiwand.com/en/Environmentalism

Suggested Readings

#	Books	Author
1	Fundamentals of Ecology	Odum,E.P.
2	Environmental impact statements.	Bregman, J.I. and Mackenthum
3	Environmental impact assessment.	Canter, W. Larry
4	Environmental impact assessment: principles and Procedures	Munn, R.E.
5	Soils in Our Environment,	Raymond W. Miller and Roy L. Donalvee.
6	Water Pollution.	Sharma.B.K.
7	Environmental Law and Policy in India	Divan, Sand Rosencranz.A.
8	Environmental Management Systems	ISO 14004
9	Environmental Ethics.	Misra.R.P.
10	Environmental Geo Science	Strahler A.N. and Strahler A.H.
11	Geography and Man's Environment	Strahler A.N. and Strahler A.H.
12	The Earth Report	Goldsmith Edward et al.
13	Principles of Environmental Science	William P.Cunningham. Mary Ann Cunningham-
14	Environmental Management	Saxena HM.

GR 4 C 12 AGRICULTURAL GEOGRAPHY

Instructional Hours/Week: 4 **Credits: 4**

Module	Theme	Topics	
1	Concept of Agricultural Geography	Definition	
		Nature and Scope of Agricultural Geography	
		Approaches of Agricultural Geography	
		Significance of the study of agricultural geography.	
		Elements of Agriculture,	
		Origin and Evolution of Agriculture,	
		Diffusion of Crops,	
		Agricultural Types and Systems.	
		Determinants of agriculture-Physical and Non- Physical Factors.	
2	Theories in Agriculture Geography	Von Thunan Theory of Agricultural Location, Application of Von	
		Thunan Model in India,	
		Game theory by Neuman and Morgenstein,	
		Agriculture Landuse theories - L.D Stamp, G. Becker, S.P. Chatterjee, M. Shafi.	
		Transforming Traditional Agriculture by Schultz, Mellor's Theory of Agricultural Development	
		Boserup's Theory of Agricultural Development-Lewis Model of Economic Development	
3	Measurement in agriculture Geography	Agricultural Regionalization-Cropping Pattern,	
		Crop combination, Crop diversification,	
		Intensity of cropping-degree of commercialization	
		Crop concentration	
		Crop Ranking	
		Agricultural productivity.	
		Land use survey	
		Land Capability Survey	
		International land use survey	
		Techniques of land use survey	
		Crop suitability analysis, land suitability evaluation survey,	
		Agricultural planning.	
		Agriculture Classification by D.Whittelesey, Agro-Climatic Regions, Agro Ecological Regions	
4	Contemporary Strategies in Agriculture Issues	Agricultural and economic development	
		Instability of Agriculture	
		GATT, WTO and FAO, Agricultural Policy	
		Food Security, Sustainable Agricultural Development	
		Agriculture Ecology	Agriculture support and environmentalism
			Principles behind agri-environment schemes
			Landscape and farmscape ecology.
		Farm Management	Tools of analysis of farm management
			Farm conservation planning
			Measures of farm efficiency
		Application of Remote Sensing and Geographic Information Systems in agriculture	
5	Indian Agriculture Prospects and Problems	Agricultural planning regions in India	
		Agro-climatic and Agro ecological regions of India	
		Land Reforms in India – Theoretical Issues, Critical evaluation of Green revolution in India	
		Agriculture Development in India under the Five year plans,	
		New Agriculture Policies and Problems	
		New dimensions in Indian agriculture	

Web References

1. http://agriculture.gov.in/
2. http://www.keralaagriculture.gov.in/
3. http://www.icar.org.in/
4. http://nptel.ac.in/courses/126104005/
5. https://www.coursera.org/learn/sustainable-agriculture
6. https://www.wikiwand.com/en/Agricultural_geography
7. http://www.kissankerala.net/home.jsp

Suggested Reading

#	Book Title	Author
1	An introduction to Agricultural Geography	Grigg, David
2	Agricultural Geography	Jasbir Singh and Dhillon S.S.
3	Agricultural Geography	Symons, Leslie
4	The Geography of Economic Systems	Berry.B.J.L
5	Agricultural Geography	Chauhan,D
6	The Changing World Food Prospects- The Nineties and Beyond	Brown,L.R.
7	Population and Food – Global Trends and Future Prospects	Dyson,T
8	Regional Perspectives on Agricultural Development	Gobind,N
9	Geography of Agriculture	Gregory,H.F
10	The Agricultural Systems of the World	Grigg F.D.B
11	Agricultural Geography	Hussain,M
12	Systematic Agricultural Geography	Hussain,M
13	Agricultural Geography,	Jasbir,S. and Dhillon,S.S
14	Agriculture and Environment Change	Mannion, A.M. 1995
15	Agricultural Geography	Shafi,M
16	Agricultural Productivity and Regional Imbalances- A Study of Uttar Pradesh	Shafi, M.

ELECTIVE COURSES

GR 3 E 01 ECONOMIC GEOGRAPHY

Instructional hours/week: 4 **Credit: 4**

Module	Theme	Topics
1	Introduction to Economic Geography	Scope, Content and Recent Trends in Economic Geography
		Approaches- Classification of Economies Developed, Developing, and Least Developed
		Sectors of Economy - Primary, Secondary and Tertiary
		Factors of location of Economic Activities – Physical, Social, Economic and Cultural
2	Primary sector	Agriculture: Factors affecting agriculture- Types, World pattern
		Forestry: World forests - Types
		Fishing, Major Fishing grounds
		Major Dairying and Mining Regions.
3	Industries	Classification of industries: Resource based and Foot loose industries. Theories of industrial location - Weber, Losch and Isard
		Case studies of selected industries: Iron & steel, Aluminum, chemical, oil, Refining and Petro-Chemical, Textile, Engineering, and Knowledge based industries.
	Transportation	Modes of transportation, Accessibility and Connectivity. Land, Air and Water Transport. Major International Transport Routes and International Ports.
4	World Economic Development	Globalization, Liberalization, and Privatization- Merits and Demerits. Global Market world
		Trade Blocks- WTO, ASEAN, OPEC & SAARC
		lmpact of Information Technology on global economy
5	Economic Development of India	Regional Disparities- Globalization and Indian Economy, Emerging Economic Regions -SEZ and IT Hubs

Web Resources

1. http://commerce.gov.in/
2. http://www.mnre.gov.in/
3. http://mines.nic.in/
4. https://data.gov.in/
5. http://www.finmin.nic.in/
6. http://texmin.nic.in/
7. https://www.india.gov.in/information-department-economic-affairs
8. http://dea.gov.in/
9. http://eands.dacnet.nic.in/
10. http://www.indianrailways.gov.in/railwayboard/
11. http://www.civilaviation.gov.in/
12. https://www.wikiwand.com/en/Economic_geography
13. https://data.worldbank.org/country/india
14. http://databank.worldbank.org/data/reports.aspx?source=2&country=IND
15. http://164.100.133.129:81/eCONTENT/Uploads/World_Economic_Geography.pdf
16. https://www.free-ebooks.net/ebook/Economic-geography-1915/pdf

Suggested Reading

#	Book Title	Author
1	Geography of Market Centres and Retail Distribution	Berry J.L
2	Economic Geography of Asia, Allied Book Agency	Chatterjee, S.P
3	Network Analysis in Geography	Chorley, R.J. and Haggett, P
4	India-Economic Development and Social Opportunity	Dreze, J. and Sen, A
5	Markets, the State and the Environment	Eckarsley, R.
6	A Geography of Marketing	Garnier. B.J. and Delobez
7	The Stages of Economic Growth	Rostow, W.W.:
8	Economic Geography	Wheeler, J.O
9	The Scope of Geography	Rhoads Murphy
10	Economic Geography	Hartshorn, T. A.& Alexander, J.W

.

GR 3 E 02 MEDICAL GEOGRAPHY

Instructional Hours /Week: 4 **Credit: 4**

Module	Theme	Topics	
1	**Development of Medical geography**	Definition, nature and scope, objectives of medical geography elements	
		Growth and developments of medical Geography	
		Methods and techniques- Geographic information system	
2	**The Human Ecology of Disease**	Health -The Triangle of Human Ecology	
		Transmission and Creation of Infectious Disease	
		Nutrition and Health	
		Geological Sources of Nutrients	Mineral Elements Needed for Good Health
			Dietary Sources of Essential Mineral Elements
			Mineral Element Bioavailability
			Quantitative Estimates of Mineral Needs and Safe Exposures
			Clinical Assessment of Mineral Status
			Ecological Aspects of Mineral Nutrition
3	**Landscape Epidemiology**	Regions	
		Transmissible Disease Systems	
		The Landscape Epidemiology Approach	
		The Cultural Dimension of Water-Based Disease Transmission -	
		The Cultural Ecology of Tick-Borne and Other Transmissible Diseases	
		Regionalization -Ecological Complications	
4	**Climate and Weather: Influences on Health**	Direct Biometeorological Influences	
		The Influences of the Weather	
		Seasonality of Death and Birth	
		Climate Change - Health and Disease	
5	**Political Ecology of Non communicable Diseases and Disease Diffusion in Space**	The Dimension of Mortality	
		The Poverty Syndrome	
		Race in the Study of Health Risks	
		Gender: Women's Health	
		Causal Reasoning and Epidemiological Design	
		Disease Ecology: Cancer	
		Disease Ecology: Cardiovascular Disease	
		Unknown Etiology and Other Questions	
		The Precautionary Principle and Some Political Ecology of Research	
		Disease Diffusion	
		Modeling Disease Diffusion	
		Influenzas Geographic Approaches to the Pandemic of AIDS &Other Epidemics	

Web References

1. https://www.wikiwand.com/en/Health_geography
2. http://www.who.int/en/
3. https://humangeography.wikispaces.com/Medical+Geography+and+Epidemiology
4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2530998/
5. https://www.esri.com/library/ebooks/geomedicine.pdf

Suggested Reading

#	Book Title	Author
1	Agriculture, Environment and Health,	Ashraf, S.W.A.,
2	Geo-Ecology of Cholera in West Bengal	Banerjee, b and Hazra J.,
3	Implementing Health Policy, Centre for Policy Research	Chatterjee Mera
4	Atlas of Diseases distribution	Cliff, A. & Stewart, L.,
5	Health Care Planning in Developing Centres	Hazra, J
6	Patterns of Diseases and Hunger – A Study in Medical Geography	Learmonth, A.T.A.
7	Ecology and Human Diseases	. May, J.M
8	Studies in Disease Ecology	May, J.M
9	Medical Geography	Mc. Glashan. N.D
10	Medical Geography of India	Misra, R.P
11	Geomorphic aspect of health and diseases in India	Rais, A and Learmonth, A.T.A
12	The Geography of Life and Death	Stamp, L.D.,

GR 3 E 03 CULTURAL GEOGRAPHY

Instructional Hours/Week: 4 **Credits: 4**

Module	Theme	Topics
1	Nature of Cultural Geography	The Nature of Cultural Geography
		The evolutionary approach in cultural geography
		The evolution of cultural Geography
		The Framework of cultural Geography
		Themes in cultural Geography
		The Cultural Region
		Cultural Adaptation and Environmental perception
		Man as modifier of the earth,
		Cultural Integration
		The cultural landscape
		Cultural history of mankind
2	Humanisation of the Earth	Humanisation of the Earth
		Pleistocene inheritance
		The environmental changes during the Pleistocene,
		The Impact of glaciations
		Shifting life zone of Pleistocene
		Human ancestors
		Food gathering and Hunting
		Discovery of fire and building of shelter
		Homo sapiens their rise and dominance.
		Man's deployment over the continents
		Culture as a new method of evolution and interrelationships in human living.
3	The Evolution of Civilizations	The beginning of plant domestication, origin of agriculture, evolution of cropping system,
		origin of Animal Domestication, the Regions of Animal Domestication, The Consequences of Animal Domestication. The evolution of system of Animal Husbandry.
		The origin of Metal Extracting and the Diffusion of metal smelting Technology.
		The evolution of civilization, The Main culture Hearths- Mesopotamia, The Nile Valley, The Indus valley and the North China.
		The main cultural regions of the world with special reference to India and Southeast Asian cultural regions.
4	Geography of Languages and Religion	The Geography of Language
		the major linguistic families and their distribution in the world
		The Geography of Religion -The major religions of the world and their distribution
		The Health of semetic and Hindu religion. Places of pilgrimage.
		Religions Landscape. Cultural Integration in Religion.
5	Development of Settlements	Settlements-origin, patterns- Clustered, Semi clustered and dispersed
		Building Materials and house types
		Rural and urban settlements - Types
		Quality of life in rural and urban Centers

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Web References

1. https://en.wikipedia.org/wiki/Category:Cultural_geography
2. http://www.harpercollege.edu/mhealy/g101ilec/intro/clt/cltclt/cltcltfr.htm
3. https://www.wikiwand.com/en/Cultural_geography
4. https://www.wikiwand.com/en/Carl_O._Sauer
5. https://www.wikiwand.com/en/Richard_Hartshorne
6. https://www.wikiwand.com/en/Natural_landscape
7. https://www.wikiwand.com/en/Cultural_landscape
8. https://merlepatchett.wordpress.com/2010/09/03/cultural-geography/
9. https://www.wikiwand.com/en/World_Heritage_Site
10. http://www1.geo.ntnu.edu.tw/~moise/Data/Books/Social/05%20social%20geography%20theory/rematerializing%20social%20and%20cultural%20geography.pdf

Suggested Reading

#	Book Title	Author
1	A Geography of Mankind	Broek, J.C. and Webb, J.W
2	Cultural Geography	Crang, Mike
3	Dimensions in Human Geography	Hazra,
4	Human Geography Today	Massey
5	India: Culture, society and Economy, Inter-lndia	Mukherjee, A.B. and Aijazuddin, A
6	Readings in Cultural Geography	Philit Wegener & Mitchel,
7	Introducing Cultural Geography	Spencer & Thomas
8	Cultural Geography	R.K. Tripathi
9	Man's role in changing the face of the earth Vol. I & ll	Thomas

GR 4 E 04 GEOGRAPHY OF TOURISM

Instructional Hours/Week: 4 **Credit: 4**

Module	Theme	Topics
1	Concept of Tourism	Concept, nature, scope & definition of tourism
		Components of tourism
		Types of tourism
		Socio, economic and political significance of tourism
		Role of Geography in tourism
2	Motivations for Travel	Travel motivations
		Factors influencing the growth of tourism
		Accommodation - Types of hotels, Supplementary accommodations
		Role of travel agency in tourism
		Tour itinerary
		International organizations
		Travel formalities - Visa, Passport, Credit cards.
3	Impact of Tourism	Economic, Socio-cultural & Environmental impacts
		Multiplier effect on the economy
		Tourism planning
		Major natural & cultural attractions of UK, Mexico, Switzerland, Hong Kong, & Malaysia
4	Tourism in India	Growth & development
		Tourism organization in India
		Major natural & cultural attractions -
		Problems & prospects
5	Tourism in Kerala	major natural & cultural tourist centers
		Eco tourism
		Rural tourism
		Monsoon tourism
		Medical tourism in Kerala
		Tourism as an industry in Kerala
		Problems & prospects.

Web References

1. http://tourism.gov.in/
2. https://www.keralatourism.org/
3. https://www.wikiwand.com/en/Kerala_Tourism_Development_Corporation
4. https://www.ktdc.com/
5. https://www.wikiwand.com/en/Tourism_geography
6. http://shora.tabriz.ir/Uploads/83/cms/user/File/657/E_Book/Tourism/Tourism%20Geography.pdf
7. https://www.wikiwand.com/en/Ecotourism
8. http://www.ecotourism.org/what-is-ecotourism

Suggested Reading

#	Book Title	Author
1	Tourism Development: Principles& Practices	Bhatia, A.K.:
2	Hill Tourism: Planning & Development	Chandra R. H
3	Geography of World Tourism	Milton D
4	Tourism Today: A Geographical analysis	Pearce D.G
5	Tourism and the Environment: A Sustainable Relationship	Hunter C and Green H
6	Himalayan Pilgrimages & New Tourism	Kaur J.
7	Tourism and Development in the Third World	Lea J.
8	TourismTo-day:AGeographical Analysis	PearceD.G
9	A Ceography of Tourism	Robinson, H
10	Tourism Planning and Development - A new perspective	Sharrna J.K
11	Critical issues in Tourism-A Geographical Perspective	Shaw G. and Williams A.M.

GR 4 E 05 INDUSTRIAL GEOGRAPHY

Instructional hours / week: 4 **Credit: 4**

Module	Theme	Topics	
1	Nature and Scope	Nature and scope	
		Recent developments of Industries	
		Elements and factors of localization of manufacturing industries	
		centralization and decentralization of industrial enterprises	
		horizontal, vertical and diagonal linkages of modern industries	
2	Industrial Location Theories	Theories and models of industrial location: Weber, Losch, Isard and Hoover' Modern refinements to least-cor t theory;	
		critical review and application of industrial location theories.	
3	Distribution and Spatial Pattern	Distribution and spatial pattern of manufacturing industries in India	Iron and Steel
			Aluminum
			Copper
			Automobile
			Cotton Textiles
			Petrochemicals
			Ship Building
			Pulp and Paper
4	Industrial Regions	Methods of delineating manufacturing regions	
		major manufacturing regions of the world	
		Methods of Measuring Spatial Distribution of manufacturing industries- location quotient, co-efficient of geographic association	
		index of concentration	
		Case studies on application of these methods	
5	Impacts on and of Industries	Environmental degradation caused by manufacturing industries	
		Industrial Hazard and occupational hazard	
		Impact of manufacturing industries on economic development	
		Role of globalization on manufacturing sector	
		Shifting of Industries and its Impact on the urban fringe	
		Changing Industrial Policy	
		Need for industrial Development	

Web References

1. http://commerce.gov.in/
2. http://dipp.nic.in/
3. https://www.wikiwand.com/en/Ministry_of_Commerce_and_Industry_(India)
4. https://www.wikiwand.com/en/Economic_geography
5. http://www.sjsu.edu/faculty/watkins/weber.htm
6. http://www.geographynotes.com/articles/webers-theory-of-location-of-industries-with-diagram/890

Suggested Reading

#	Book Title	Author
1	Location in Space - A Theoretical Approach to Economic Geography	Llyod and Dicken
2	Economic Geography	M C Cart, Linberg Hodder & Lee
3	Industrial Geography	Riley R C
4	Economic Geography	Alexander J W
5	Industrial Activity & Economic Geography	Estall R C
6	The Location of Economic Activity	Hoover E M
7	Industrial Geography of India	Chaoudhary M R
8	Spatial Perspectives on Industrial Organization and Decision Making	Hamilton F E I

.

GR 4 E 06 GEOGRAPHY OF WATER RESOURCES

Instructional Hours/Week: 4 **Credit: 4**

Module	Theme	Topics
1	Fundamentals of Hydrology	Scope and Content of Water Resources Geography
		Definitions – Water Resources Geography, Hydrology
		Hydrological Cycle; Global Water Balance; Water Budget
		Precipitation – Type, Form, Measurement of Rainfall – Spatial measurement methods – Temporal measurement methods – Frequency analysis of point rainfall – Intensity, duration, frequency relationship – Probable maximum precipitation.
		Abstraction from Precipitation –Loss from Precipitation - Evaporation Process –Reservoir Evaporation –Infiltration Process – Effective Rainfall
2	Surface and Ground water	Surface Water Systems, Drainage Basin as Geohydrological unit, – Basin Hydrological Phenomena- overland flow – base flow – stream flow
		Ground water - Origin & age of ground water, rock properties affecting groundwater, permeability groundwater column, zones of aeration & saturation, aquifers and their characteristics/classification, groundwater basins & springs
		Darcy's Law
3	Water Quality	Principles of water quality, Suspended and Dissolved Solids, EC , pH and Trace constituents , BOD and COD of Water
		Indian and International Standards (i.e., BIS and WHO)
		Water Pollution: Definitions of Water Pollution, Types of water pollution – Agriculture, Domestic, Industrial
		Saline water intrusion related pollution of Aquifer
4	Water Management Practices	Concept and Practice of Water Management
		Traditional Water Harvesting, Storing and Management in Northern India, Western India, Eastern India, Central India, Deccan Plateau, Southern India
		Approaches of Surface Water Management - Watershed based approaches
		Rainwater Harvesting –Significance, Types and Methods
		Artificial groundwater recharge - Concept & methods of artificial ground water recharge
		Wetlands and Micro Watershed Management
		Government of India and State Government Initiatives for Water Management
5	Contemporary Issues and Concepts	Water Conflicts – Cauvery, Krishna, Narmada, Indus System, Ganges, and Brahmaputra System
		Water policy of India – Surface Water and Groundwater
		Mapping Water Foot Print
		Waste Water Reuse
		Water, Climate Change and Sustainable Development

Web References

1. Ministry of Water Resources – http://wrmin.nic.in/
2. Ministry of Environment and Forest – http://envfor.nic.in/
3. National Institute of Hydrology - http://www.nihroorkee.gov.in/
4. UNESCO_IHE Delft Institute of Water Education - https://www.un-ihe.org/open-courseware
5. Central Ground Water Board- http://cgwb.gov.in/
6. Center for Water Resources Development and Management –http://www.cwrdm.org/
7. Kerala State Pollution Control Boards: www.keralapcb.nic.in

Suggested Reading

#	Book Title	Author
1	Modern Physical Geography Strahler	Strahler A. and Strahler
2	Basics of Water Resources- Course Book (UNESCO_IHE)	Pieter van der Zaag
3	Hydrology Principles, Analysis and Design	Raghunath, H.M
4	Hydrology in Practice	Van Nostrand Reibhold
5	Introduction to Hydrology	Viessman, W. and Lewis
6	Principles of Hydrology	Mysooru R. Yadupathi Putty
7	Handbook of Applied Hydrology	Chow, V.T
8	Water Conservation Techniques in Traditional Human Settlements	Pietro Laureano
9	Water Resources-An Integrated Approach	Joseph Holden
10	Water Management: Multiple Dimensions	Rakesh Hooja, Ramesh K. Arora, and K.K. Parnami (eds)

CORE PRACTICAL COURSES

GR 2 P 01 GEOMORPHOLOGY & CLIMATOLOGY (PRACTICAL)

Instructional hours / week: 4 **Credit: 4**

Module	Theme	Topics	
1	**Profiles**	Drawing of serial, superimposed, composite, and projected profiles- Longitudinal profile of a stream	
	Drainage basin analysis	Delineation of basins subdivisions- stream ordering- Strahler's and Horton's method-Bifurcation ratio-Drainage density.	
2	**Significance of Slope**	Calculation and determination of slopes by	G.H. Smith's method
			Robinson's method
			Wentworth method
		Trend surface analysis	Area-height curve
			Hypsometric curve
			Clinographic curve
			Altimetric frequency curve.
3	**Block diagrams**	One point perspective and Two point perspective Block diagrams	
		Preparation of block diagrams from contour maps - Multiple section method	
		Block diagrams representing erosion and depositional features produced by	River
			Glacier,
			Wind
			Underground Water
			Waves
4	**Preparation of Isopleths maps**	Isotherms, Isobars, Isohytes, Equipluves, and Equi-Variable maps	
	Preparation of climatic diagrams	Representation of climatic data by columnar and circular graphs, frequency graphs, wind roses. Climographs and Hythergraphs (Foster's Taylor's). Climatograph	
5	**Trend graphs**	Running mean, Adjusted profiles, Relative Temperature curve	
		Deviation graphs & Rainfall dispersion diagrams-identification of breaks -merits & demerits.	
	Concept of water balance	Calculation of water balance and determination of climatic types using Thomthwaite's method	
		Index of Aridity	
		Study of Indian daily weather map.	
		Identification and preparation of cyclonic Tracks	

Web References

1. https://www.wou.edu/las/physci/taylor/g322/drainage_anal.pdf
2. https://www.wou.edu/las/physci/taylor/geog522/rittchp5.pdf
3. https://www2.geog.soton.ac.uk/users/leungs/2016-ola2-0506/pdf/GEOG2016%20Basin%20Morphometry%20%20Lecture%202.pdf
4. http://geohaunt.org/geohaunt/site/CH.php?i=184
5. http://irangeomorphology.ir/files/site1/ybakhshi_67841/files/Geomorphological_Mapping.pdf

Suggested Reading

#	**Book Title**	**Author**
1	Maps & Diagrams	Monkhouse& Wilkinson
2	Practical Geography	Singh L.R
3	Applied Climatology	Subrahmaniam V.P
4	Skin of the Earth	Austin Miller

GR 2 P 02 GEOGRAPHIC INFORMATION SYSTEM (PRACTICAL)

Instructional Hours/Week: 4 **Credit: 4**

Module	Theme	Topics
1	Fundamentals of GIS	**Exercise 1:** Using BHUVAN, Google Earth and Google Maps, Open Street Maps India, MapServer, GeoServer, Map Guide, WRIS
		Introduction to GIS Software (Open Source/ Proprietary as per availability in institution)
		Exercise 2: Scanning a Map, Saving Map in Different file formats and organizing Folders and Files, Naming Folders and Files.
		Exercise 3: Spatial Referencing–Use Sample Maps in Software to check different Coordinate Systems (Fundamentals of Spatial Referencing to discussed: Definition – Reference Surfaces for Mapping – Geoid and the Veritical Datum – the Ellipsoid – the Local Horizontal datum – the Global Horizontal Datum, Coordinate System – 2D geographic Coordinates, 3D Geographic Coordinates, 2D Cartesian Coordinates, 2D polar Coordinates)
		Exercise 4: Uploading Map to GIS platform. Assigning Coordinate values to Map or Georeferencing Map or Spatial referencing, RMS error Checking, Saving spatially referenced Map in TIFF, GIF, IMG formats.
2	Geographic Data and Thematic Visualization	**Exercise 5:** Creating Geodatabase, Vectorization of Scanned Map, Editing Vector data, (Fundamentals to be discussed: Geographic data – Raster, Vector and Attribute data, Creating and Managing Geodatabases and RDBMS)
		Exercise 6 : Creating and Editing Attribute data, Joining Tables, Adding delimited text layer,
		Exercise 7: Creating and Editing Meta-Data
		Exercise 8: Extracting Spatial data from Google Earth, Saving in KMZ/KML format, adding to GIS platform
		Exercise 9: Using a Handheld GPS to collect spatial data, Transfer and input to GIS
		Exercise 10: Using Mobile Mapping Application to Collect data, Transfer and input to GIS (Suggested Android Apps – MapPad, SW Maps, Mapit etc. Any Mobile mapping application can be used to complete the exercise)
		Exercise 11: Creating Thematic Maps – representing single data, representing multiple data;
		Exercise 12 : Map Layout Setting, Exporting / Saving map in different formats
		Exercise 13: Using ASTER / SRTM data to Prepare DEM, TIN, Slope, Aspect, Contour Maps
		Exercise 14: Extracting Spatial Elevation data from Google Earth web application, Creating DEM and Contour
		Exercise 15: Spatial Analysis - Buffer, Overlay, Union, Network (Fundamentals to be discussed – What is Spatial Analysis, Topology and its significance, Methods of Spatial analysis)
		Exercise 16 : Spatial Analysis - Area Calculation
		Exercise 17: Spatial Analysis – Interpolation (IDW, Kriging, Natural Neighbour, Spline) of Rainfall and Groundwater data
		Exercise 18: Interpolation of elevation point data to contours and DEM
5	Application of GIS	Hydrology Applications
		Exercise 18: Watershed Analysis – Delineation, Flow Direction Map, Flow Accumulation, Pour Point fixing, Slope.
		Exercise 19: Stream Ordering (Strahler Method)
		Exercise 20: Modeling in GIS – Watershed Modeling

Web References

1. https://www.coursera.org/specializations/gis
2. http://www.qgistutorials.com/en/
3. https://docs.qgis.org/2.2/en/docs/training_manual/
4. www.gpsinindia.com:
5. https://www.gislounge.com/learn-gis-for-free/
6. https://www.coursera.org/learn/gis
7. https://www.esri.com/training/
8. http://index-of.es/Programming/Pragmatic%20Programmers/Desktop%20GIS.pdf
9. http://www.geoforall.org/
10. http://opensourcegeospatial.icaci.org/
11. http://www.mdpi.com/journal/ijgi/special_issues/science-applications

Suggested Reading

#	**Book Title**	**Author**
1	Geographic Information Systems & Science	Rhind Maguire Goodchild Longley
2	Practical GIS	Gabor Farkas
3	A Practical Guide to Geostatistical Mapping	Tomislav Hengl
4	Practical GIS Analysis	David L. Verbyla
5	A Practical Guide to Geostatistical Mapping	Tomislav Hengl

GR4 P 03 QUANTITATIVE TECHNIQUES IN GEOGRAPHY (PRACTICAL)

Instructional hours/ week: 4 **Credit: 4**

Module	Theme	Contents	
1.	Introduction	Meaning, development and significance of quantitative techniques in geography	
		Models: Problem solving techniques (problems of scale, field work, outline of the method, constructing the hypothesis, collecting and portraying information and analysis of information).	
2.	Statistics	Measures of central tendency-	
		Measures of variation- mathematical methods and graphical methods	
		Lorenz curve	
		Semi log graph	
		Triangular graph	
		Centro graphic analysis	
		Mean centre & median centre and standard distance	
		Normal curve and properties of normal curve	
		Measures of Skewness and Kurtosis- Residual mapping.	
3.	Sampling	Characteristics of samples, Methods of sampling,	
		Statistical Difference between large and small samples	
		Significance test in large samples	
		Hypothesis testing – student t-test & chi-square test	
		Measures of spatial distribution	
		Point and line distribution,	
		Gravity potential models	
4.	Spatial Analysis And Quantization In Major Fields Of Geography	Geomorphology	The drainage basin and its system, Morphometric analysis
		Climatology and Meteorology	Collecting climatic data- an example: identifying trends in climate, micro climates
		Agricultural Geography	Agricultural regionalization methods- Crop combination methods- Weaver and Rafiullah, Crop concentration method- Location quotient and crop diversification method- R.L Bhatia, Agricultural productivity, Land capability classification, etc
		Settlement Geography	Urban morphology, Nearest neighbor analysis, Demongeons co-efficient of dispersion, Simple index dispersion, Bernard's index of concentration, Kant's index of concentration, density of housing
		Population Geography	Surveys, Crude birth rate, death rate, fertility ration , Growth- Malthusian theory, Population pyramid, spatial diffusion- diffusion study of local area)
		Transport Geography	Transport network analysis- measures of accessibility, connectivity and efficiency of transport network- degree of development of network. Diameter, density and route shape of network).-
		Industrial and Economic Geography	Industrial location , correlation, Regression
5.	Sources of Statistics And Statistical Organisations	Pre and post independence period- Central statistical organization (CSO)-National sample survey organization (NSSO)	
		Population statistics	
		Agricultural statistics- Livestock and poultry statistics	
		Trade statistics-	
		Labour statistics-National income statistics- Financial statistics.	

Web References

1. https://www.wikiwand.com/en/Quantitative_revolution
2. http://ludwig.missouri.edu/405/quantitative.pdf
3. https://www.inflibnet.ac.in/ojs/index.php/JARG/article/view/223

Suggested Reading

#	Book Title	Author
1	Statistical methods and the geographer	MGSU, Bikaner Gregory S
2	Applied General Statistics	Growzon & Cowden
3	Locational Analysis in Human Geographical Studies	Hagget, P
4	Statistical Concepts in Geography	John Silk
5	Multivariate Statistical Analysis in Geography	Johnston, R J
6	Statistical Analysis in Geography	King, T J:
7	Statistical Methods in Geographical Studies	Mahmood A
8	Statistics for Geosciences Techniques and Applications	Saroj K Pal
9	Quantitative methods in geographical research	Najma Khan
10	Quantitative Geography	R.G.Woodcock and M.J.Bailey

GR 4 P 04 REMOTE SENSING AND CARTOGRAPHY (PRACTICAL)

Instructional Hours/Week: 4 **Credit: 4**

Part I REMOTE SENSING			
Module	**Theme**	**Title**	
1	**Optical Remote Sensing and Photogrammetry**	Exercise. 1. Development of Photogrammetry.	
		Exercise. 2. Basic principles and Elements of photographic system.	
		Exercise. 3. Types of photographic systems.	
		Exercise. 4. Scales and ground coverage of aerial photographs.	
		Exercise. 5. Resolution, radiometric characteristics, films, filters and aerial cameras.	
		Exercise. 6. Marginal information of aerial photographs	
		Exercise. 7. Methods of stereoscopic viewing	
		Exercise. 8. Orientation of aerial photographs	
		Exercise. 9. Stereographic test	
		Exercise. 10. Interpretation of stereo-pairs for mapping terrain forms	
		Exercise. 11. Land use / Land cover mapping from aerial photographs	
		Exercise.12. Determination of photo scale	
		Exercise. 13. Measurement of parallax from aerial photographs	
		Exercise.14. Determination of height from aerial photographs	
		Exercise. 15. Measurement of area from aerial photographs	
2	**Visual Interpretation of Satellite imagery and Digital Image Processing**	Exercise. 16. Marginal information of satellite imagery	
		Exercise. 17. Interpretation keys for visual interpretation	
		Exercise. 18. Steps in ground truth validation	
		Exercise. 19. Generating False Colour Composite	
		Exercise. 20. Extracting area of Interest	
		Exercise. 21. Generating Histogram of various bands	
		Exercise. 22. Geometric correction of satellite image	
		Exercise. 23. Enhancement using Band ratio and NDVI	
		Exercise. 24. Enhancement using Filtering techniques	
		Exercise. 25. Enhancement using Image Fusion	
		Exercise. 26. Principal Component Analysis (PCA)	
		Exercise. 27. Fourier analysis	
		Exercise. 28. Supervised classification of images	
		Exercise. 29. Classification using Neural Network and Fuzzy Logic	
		Exercise. 30. Accuracy Assessment	
		Exercise. 31. Change detection	
3	**Appraisal of Topographic Maps**	Exercise. 32. Comparative study of maps of different scales prepared by survey of India	
		Exercise.33. Study of relationship between physical and cultural features represented on the map	
		Exercise. 34.Comparison of Topographic maps and Aerial Photographs	
Part II CARTOGRAPHY			
4	**Map projections**	Exercise. 01. Significance of map projections in map making	
		Exercise. 02. Classification of map projections	
		Construction of maps using map	**I. Zenithal map projections**
			Exercise. 03. Equatorial case of Gnomonic projection
			Exercise. 04. Equatorial case of Stereographic projection
			Exercise. 05. Equatorial case of Orthographic projection
			II. Conical map Projections
			Exercise. 06. Polyconic map projection
			Exercise. 07. International projection
			III. Cylindrical map projections

		projection techniques	Exercise. 08. Mercator's projection
			Exercise.09. Gall's projection **IV. Conventional projections**
			Exercise. 10. Sinusoidal projections
			Exercise. 11. Molleweide's projections
			Exercise. 12. Interrupted case of sinusoidal projection
			Exercise. 13. Interrupted case of Molleweide's projection
			Exercise. 14. Choice of map projections
5	**Surveying**	Exercise. 15. Prismatic compass – Open and closed traverse	
		Exercise. 16. Plane table – Intersection and Resection	
		Exercise. 17. Dumpy level – Preparation of contours	
		Exercise.18. Theodolite – Finding heights of accessible and in accessible points	

Web Resources

1. http://www.iirs.gov.in/
2. http://srtm.csi.cgiar.org/
3. https://asterweb.jpl.nasa.gov/gdem.asp
4. https://earthexplorer.usgs.gov/
5. https://www.wikiwand.com/en/Indian_Remote_Sensing
6. http://bhuvan.nrsc.gov.in/bhuvan_links.php
7. https://nrsc.gov.in/IRS_Data_Products
8. http://www.geo-informatie.nl/courses/grs10306/Materials/Practical/1%20Manual/000%20Practical%20manual%202010.pdf

Suggested Reading

#	Book Title	Author
1	Elements of Cartography	Arthur H. Robinson
2	Statistical Methods in Geographical Studie	Aslam Mahmood
3	Cartographic Methods	G R P Lawernce
4	Cartography – Visualization of Geospatial Data	Menno-Jan Kraak & Ferjan Ormeling
5	Quantitative techniques in Geography	R. Hammond & P Mccullagh
6	Fundamentals of Cartography	R P Misra

ANNEXURE- I

Guidelines for the Preparation of PROJECT REPORT

i) Arrangement of contents

The project should be arranged as follows-

a. Cover page and Title page
b. Bona fide certificate/s from guide/supervisor &Centre Coordinator
c. Declaration by the student
d. Acknowledgement
e. Table of contents
f. List of tables
g. List of figures
h. List of symbols, Abbreviations and Nomenclature
i. Chapters
j. Bibliography
k. Appendices

ii) Pages and Formatting of Report

a. The Project report should be printed with font 'Time New Roman" and font size 12 on A4 size bond paper.
b. The general text of the report should be typed with 1.5 line spacing.
c. Paragraphs should be arranged in justified alignment with margin 1.0'' each at the top, bottom, left and right of the page.
d. The content of the report shall be around 40 pages excluding bibliography and appendix.
e. The report should be bound using flexible cover of the thick white art paper or spiral binding.

iii) A typical specimen of Bonafide Certificate

UNIVERSITY OF CALICUT
<Font Style Times New Roman-size 18>

BONAFIDE CERTIFICATE
<Font Style Times New Roman-size 16>
<Font Style Times New Roman-size 14>

Certified that this project report "…… (**TITLE OF THE PROJECT)**……." is the bonafide work of "…….**NAME OF THE CANDIDATE**……..." who carried out the project work under my supervision.

<< Signature of HoD>>

<< Name>>
<<Academic Designation>>
<< Department>>

<< Signature of Supervisor/co-supervisor>>

<< Name>>
<< Academic Designation>>
<<Department>>

SIGNATURE
HEAD OF THE CENTRE SUPERVISOR
<<Name>>

<<Seal with full address of the Centre>>

<< Seal with full address>>

iv) Declaration by the student

DECLARATION

I,……, hereby declare that the Project Report entitled…….(Title of the project), ……has been prepared by me and submitted to the University of Calicut in partial fulfillment of Requirements for the award of the Master of ……is a record of original work done by me under the supervision of Dr./Prof……..of the Department of ……, ... College / (Name of institute).

I also declare that this Project work has not been submitted by me fully or partly for the award of any Degree, Diploma, Title or recognition before any authority.

Place: Name and Signature of the student
Date: (Reg. No.)