Parvatibai Chowgule College of Arts and Science
(Autonomous)
DEPARTMENT OF GEOGRAPHY
COURSE STRUCTURE
THREE YEAR B.Sc. DEGREE COURSE IN GEOGRAPHY

SEMESTER	CORE COMPULSORY		CORE ELECTIVE			
I	GEG-I.SC1: Introduction to Geography	GEG-I.SC2: Fundamentals of Physical Geography				
	GEG-I.SC1: Measurement Systems in Geography (Practical)	GEG-I.SC-2: Practicals in Physical Geography (Practical)				
II	GEG-II.SC3: Basics of Human Geography	GEG-II.SC4: Basics of Regional Geography				
	GEG-II.SC3: Practicals in Human Geography (Practicals)	GEG-II.SC4: Practicals in Regional Geography (Practicals)				
III	GEG-III.SC5: Fundamentals of Remote Sensing and GIS		GEG-SE1: Spatial Analysis	GEG-SE2: Raster and Vector Data Models in GIS	GEG-SE3: Participatory GIS	GEG-SE4: Applied GIS
IV	GEG-IV.SC6: Fundamentals of Geomorphology		GEG-SE5: Coastal Geomorphology	GEG-SE6: Fluvial Geomorphology	GEG-SE7: Watershed Management	GEG-SE8: Biogeography
V	GEG-V.SC7: Fundamentals of Climatology		GEG-SE9: Geography of Soil Studies	GEG-SE10: Agro-Meteorology: Principles and Applications	GEG-SE-11: Field Survey in Physical Geography	GEG-SE12: Quantitative Techniques in Geography
VI	GEG-VI.SC8: Ecology and Terrestrial Environment		GEG-SE13: Remote Sensing and Forest Ecology	GEG-SE14: Advanced Coastal Geomorphology	GEG-SE15: Ecology of Estuarine Environment	GEG-SE16: Disaster Management: Urban and Coastal

SYLLABUS FOR AUTONOMOUS COURSES IN GEOGRAPHY
BACHELOR OF SCIENCE
SEMESTER I
REVISED AS ON 11TH OCTOBER 2017

Paper Title: Introduction to Geography (THEORY)
Paper Code: GEG- I.SC1
Marks: 75
Credits: 3
Duration:45 lectures of 1 hour each
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Course Objectives: This introductory paper is intended to acquaint the students with distinctiveness of Geography as a field of learning. The philosophy of the subject is to be taught in order to develop a keen interest in the subject and to pursue it for higher studies.

Learning outcomes: At the end of this course students are expected to have a holistic understanding of fundamental concepts of geography and thereby be able to analyze the interrelationships among them.

Unit No.	Course Content	Lectures	Marks
I	**Introduction of Geography** Definition, Meaning, nature and scope of geography; Major divisions of geography Major themes in Geography – location, region, process, spatial interaction and time.	15	25
II	**Introduction to Geosphere: I** **Atmosphere:** Meaning &Definitions-Composition& Structure of Atmosphere, Elements of Weather & Climate and their inter-relation. **Biosphere &Nanosphere** Major Natural regions of world	15	25
III	**Introduction to Geosphere: II** **Lithosphere:**Evolution of Earth, Geological Time scale. Orders of Relief (I, II, III), oceans and continents, classification of mountains, plateau and plains **Hydrosphere**: Hydrological Cycle Spatial distribution of water on earth.	15	25

REFERENCES

1. Dikshit R.D (2004): The Arts, Science of Geography, Integrated Readings Prentice Hall of India, New Delhi
2. Lal . D. S. (2007) : Climatology, Pushtakmahal, Allahabad
3. Goh Cheng Leong (2003): Certificate Physical and Human Geography, Oxford university press, New Delhi
4. Das Gupta and Kapoor (2013): Principles of Physical Geography, S. Chand & Company Pvt. Ltd.
5. SinghSavindra (2005) : Environmental Geography, PrayagPustakBhavan, Allahabad

Paper Title: Measurement Systems in Geography (Practical)
Paper Code: GEG- I.SC1
Marks: 25
Credits: 01
Duration: 15 sessions of 2 hours each
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Course Objectives: The course aims to develop skills of map reading and understanding. It also encourages students to understand and correlate the different measurement systems which are essential to understand the geographical concepts.

Learning outcome: After the completion of this course students are expected to be familiar with the basic cartographical skills such as basic elements of map and map reading. Besides, they will be acquainted with the cartographic techniques such as area measurements, time calculation, which will help in learning advanced techniques as they progress.

Unit	Title	Practical sessions	Marks
I	1. Scales and its types: a. Verbal Statement. b. Representative Fraction. 2. Linear scale- a. Simple and comparative- b. time and distance 3. Identification of location and extension based on latitude and longitudes. 4. Grid reference system. 5. Finding directions. 6. Calculation of time based on longitude 7. Calculation of area by square method	10	15
II	8. Preparation of map – Title, Scale, Legend, Direction, Signs and symbols, lettering and colour scheme.	05	05
III	Journal		5
		15	25

References

1. Campbell, J.(2004) Introductory Cartography, Prentice Hall, Inc Englewood
2. Misra, R.P. and Ramesh, A., (2005): Fundamentals of Cartography, Concept Pub. Co., New Delhi
3. Monkhouse, I.J. and Wilkinson, H.R., (2009): Maps and Diagram, B.I. Publication, New Delhi
4. R. P Mishra. (2014) Fundamentals of Cartography, Concept Pub. Co., New Delhi
5. Gopal Singh. (2014), : Map Work and Practical Geography, 4th Edition, Sterling Book House Mumbai

Paper Title: Fundamentals of Physical Geography (THEORY)
Paper Code: GEG- I.SC2
Marks: 75
Credits: 3
Duration:45 lectures of 1 hour each
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Course Objectives: The course aims to introduce fundamental concepts of physical geography. The course focuses of various spheres of the earth and their related concepts.
Le**arning outcome:** After the completion of this course students are expected to be familiar with the different spheres of the earth and the interrelation amongst them.

Unit No.	Course Content	Lectures	Marks
I	**Concept and Nature**: Introduction to physical geography Recent developments in physical geography. **Layers of the Earth**: Lithospheric system: Interior of the earth. Layering of the earth- Mechanical layering and chemical layering. Weathering and mass movement, Rocksand its types. Soil- definition and profile.	15	25
II	**Basic concepts of climatology**: Definition and scope of climatology .Insolation, factors affecting Insolation and Heat budget. Temperature, atmospheric pressure, wind, and humidity	15	25
III	**Dynamics of ocean water**: -Waves, Tides, and surface currents of Indian and Atlantic Ocean.	15	25
		45	75

References:

1. Bloom, Arthur L., 2008: Geomorphology – A Systematic Analysis of Late Cenozoic Landforms, Prentice Hall, Engle Wood Cliff, New Jersey.
2. Ahmed, E., 2005: Geomorphology, Kalyani Publishers, New Delhi
3. Sharma, V.K., 2006: Geomorphology, Earth Surface, Process and forms, Tata McGraw Hill, New York
4. Lal.D.S , 2004: Oceanography,PrayagPustakBhavan,Allahabad
5. Strahler, A.N., 2005: Physical Geography, 3rd Ed., Wiley Publications
6. Singh, S. 2005: Physical Geography,PrayagPustakBhawan, Allahabad
7. Thornbury, W.D., 1969: Principles of Geomorphology, 2nd Ed., Wiley International Edition, Wiley Eastern Reprint, 2004
8. Wooldridge, S.W. and Morgan, R.S., 2008: The Physical Basis of Geography, Longman (First published in 1937)
9. Worcestor, P.G., 2005: A Textbook of Geomorphology, Van Nostrand, 2nd Ed., East West Edition, New Delhi.
10. Chorley, Richard J., 2002: Spatial Analysis in Geomorphology, Harper and Row Publishers, New York, London.
11. Dayal, P. (2nd edition) 2006: A Textbook of Geomorphology, Shukla Book Depot, Patna
12. Sharma, H.S. (ed), 2002: Perspective in Geomorphology, Vol. I & IV, Concept, New Delhi.
13. Sharma, V.K., 2006: Geomorphology, Earth Surface Processes and Forms, Tata Mc. Graw Hill, New Delhi.
14. Sparks, B.W., 2000: Geomorphology, Longman, London, 2nd edition.

Paper Title: Practical in Physical Geography
Paper Code: GEG-I.SC2
Marks: 25
Credits: 1
Duration: 15 sessions of 2 hours each
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Course Objectives: The course aims to develop skills of relief representation and Toposheet reading, climate data analysis and interpretation. This exercise demands a higher order skill of converting signs and symbols into words.

Le**arning outcome:** After the completion of this course students are expected to be familiar with techniques of representing different relief features and interpretation of the characteristics and association with other relief features. Student will be able to analyze, interpret and represent climate data through graphs.

Unit	Title	Practical	Marks
I	1. Methods of Representation of Relief features a. Spot Heights, b. Bench Marks. c. Triangulation mark 2. Contours diagrams for slopes with cross sections- gentle slope, steep slope, concave and convex slope, 3. Contours diagrams for hills, plateaus, cliff, 4. Contours diagrams for V-shaped valley, waterfall, rapids, river terraces 5. Profile Drawing from contour diagram. a. Serial b. Superimposed c. composite	10	15
II	6. Calculation of mean, average, range of temperature. 7. Calculation of lapse rate and Relative Humidity.	5	05
	Journal		05

References

1. Chorley, Richard. J. (ed.), 2009: 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. 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

SYLLABUS FOR AUTONOMOUS COURSES IN GEOGRAPHY
BACHELOR OF SCIENCE
SEMESTER II
REVISED AS ON 11TH OCTOBER 2017

CORE
Course Title: Basics of Human Geography (Theory)
Course Code: GEG-II. SC3
Marks: 75
Credits: 3
Duration: 45 lectures of 1 hour each
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Course Objectives: The course provides the basic conceptual framework of Human Geography. It focuses on cultivating basic knowledge through understanding and analysis of the fundamental concepts in Human geography.

Learning outcomes: At the end of this course students are expected to have a holistic understanding of fundamental concepts of Human Geography and thereby be able to understand human related issues.

Unit	Topic	No. of hours
I	**Concept and Nature :** Meaning, Scope and Development of Human Geography. Basic principles-Principle of Activity or Change, Principle of Terrestrial Unity or whole. Approaches in human geography (humanistic, scientific, welfare and behavioral)	15
II	**Society and Culture** Evolution of man (Australopithecus, Homo Erectus, Homo sapiens. Man's spread over the earth during the Pleistocene). Culture- meaning and components. Language and religion. (Classification, distribution, issues and challenges.) Contemporary social problems: Gender disparity and related issues Ethnicity and the related issues. (Case study of India).	15
III	**Indicators of Development:** L.D.C. and M.D.C.-social, economic and demographic. (Distribution and Density. Concepts of under population, over population, age and gender composition. Fertility, mortality, migration, Ageing population.) Demographic transition.	15
		45

Note : The course should focus on basic conceptual aspects.

Reference

1) H.J De Blij,Alexander B.Murphy,Erin H. Fouberg.(2007) *Human Geography:people,place and culture*.John Wiley and sons. USA.
2) Panigrahi .P.K. (2011).*Human Geography-Landscape of Human Activities*. MurariLala and sons. New Delhi.
3) Sharma Y.K. (2007) *Human Geography*.Lakshmi Narain Agrawal, Agra.
4) Rubenstein J M (2010) *Contemporary Human Geography*. PHI learning pvt, New Delhi.
5) Hussain, M.(2004)*Human Geography*. Rawat Publication. New Delhi.
6) Chandna, R.C. (2006)*Geography of Population*.Kalyani Publishers. New Delhi
7) Hagget, P.(2002)*Geography: A Modern Synthesis*. Harper & Row, New York
8) De Blij, H.J., Human Geography, Culture, Society and Space, John Wiley, New York, 2006
9) Fellman, J.L. Human Geography-Landscapes of Human Activities, Brown and Bench man, Pub. U.S.A. 2007.
10) Arun Kumar Sharma, 2012: Principles of Human Geography, Rastogi Publications, Meerut

CORE
Course Title: Practicals in Human Geography
Course Code: GEG-II.SC3
Marks: 25
Credits: 1
Duration: 15 sessions of 2 hours each
==========

Course Objectives: The course provides the basic quantitative aspects of Human Geography. It focuses on cultivating quantification and diagrammatic representation of population data. This enables students to understand, quantify and precisely represent population data.

Learning outcomes: At the end of this course students are expected to have a holistic understanding of basic quantitative techniques used in Human geography. They should be able to diagrammatically represent population data and diagrams.

Unit.	Title	Practical sessions
1	Calculation and interpretation of: **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	8
2	**5. Literacy measures**: Crude Literacy Rate. Gross Enrolment Ratio. **6.** Work Participation Ratio. **7.** Per capita income **8.** GDP	7
3	Journal and viva	
		15

References:

1. Bogue, D. J., 2001: Principles in Demography, John Wiley, New York
2. Bose, Ashish et. al., 2004: Population in India's Development,Vikas Publishing House, New Delhi
3. Census of India, India : A State Profile, 2001.
4. Chandna, R.C. Geography of Population : Concept, Determinants and Patterns, Kalyani Publishers, New York 2000.
5. Crook, Nigel Principles of Population and Development. Pergmon Press, New York 2007.
6. Daugherty, Helen Gin, Kenneth C.W. Kammeryir, An Introduction to Population (Second Edition). The Guilford Press, New York, London 2008.
7. Mitra, Asok, India's Population. Aspects of quality and Control Vol. I & II. Abhinar Publication. New Delhi 2008.
8. Srinivsan, K. and M. Vlassoff. Population Development Nexus in India : Challenges for the New Millennium. Tata McGraw Hill, New Delhi 2001.
9. Srinivasan, K. Basic Demographic Techniques and Applications Sage Publications, New Delhi 2008.
10. UNDP: Human Development Report Oxford University Press, Oxford 2000.
11. United Nations, Methods for Projections of Urban and Rural Populations. No. VIII, New York 2004.
12. Woods, R. Population Analysis in Geography, Longman, London 2009.
13. Sawant & Athavale: Population Geography, Mehta Publishing House, Pune.2005

CORE
Course Title: Basics of Regional Geography
Course Code: GEG-II.SC4
Marks: 75
Credits: 3
Duration:45 lectures of 1 hour each
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Course Objectives: The course aims to develop a basic understanding of the regions and recognizing the significance of geography in shaping region. It helps students to appreciate regional unique dimensions of regions.

Learning outcome: At the end of this course, student will gain sense of spatial organization and areal variation in human activities.

Unit	Title	No. of hours
I	Concept of Region in Geography: Definition and characteristic The Regional Approach - area, region, space. ii) Methods of Regionalization- methods of delineation of region, types of regions,	15
II	i.) Foundations of Region - Ecological, Economic, Social and Cultural Dimensions ii.) Federalism-center – state relationships. iii.) Core – Periphery iv.) Hierarchy of regions, v.) Regional Consciousness and Identity. vi.) The Regional issues. (Two case studies)	15
III	Study of Regional Organization: Their evolution, functions and inter-linkages. Globalization and the New Territorial Order.	15

References

1. Singh, R.L.2001 (ed):India – A Regional Geography, National Geographical Society, India
2. Cole, J. : *A Geography of the World's Major Regions*, Routledge, London,2000
3. Israel, S. Johnson, D.I. and Wood, D.: *World Geography* Today,2005
4. Jackson, R.H. and Hudman, L.E.: *Regional Geography: Issues for Today*.,2007
5. *An Introduction to Regional Geography*, Paul Claval, Rawat Publication, Jaipur & Delhi,2003
6. Wheeler, J.H. Jr. and Kostbade, J.T., (1990): *World Regional Geography*, Holt Rinshort and Winston, Inc
7. Holier, G.P., 2008: Regional Development in Michael Pacione (ed), *The Geography of the 3rd World: Progress & Prospects*, Rutledge, London, New York.
8. Jackson, R.H. and Hudmar, L.E.: Regional Geography: Issues for Today ,2004
9. Paul Claval (2008) An Introduction to Regional Geography, Wiley-Blackwell, ISBN 155786733X.

CORE
Course Title: Practical in Regional Geography
Course Code: GEG-II.SC4
Marks: 25
Credits: 1
Duration: 15 sessions of 2 hours each

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Course objectives: The course provides the basic quantitative aspects of regional Geography. It focuses on cultivating quantification and diagrammatic representation of regional data. This enables students to understand, quantify, compare of unique characteristic of different regions.

Learning outcomes: At the end of this course students are expected to have a holistic understanding of basic quantitative techniques used in regional geography. They should be able to diagrammatically represent interpret regional data and diagrams.

Unit	Topic	Practical Sessions
I	Methods of Regional Demarcation: 1. Demarcation of agricultural regions (crop combination and diversification) 2. Gravity model, 3. Breaking point Analysis, 4. Sphere of Urban Influence 5. Population potential surfaces	**08**
II	1. Network Analysis 2. Nearest Neighbor index, 3. Centro graphic analysis	**07**
III	**Journal and viva**	
		15

References

1. Hegget Peter, Cliff A.D. et. al. (2001) Locational Methods, Locational Analysis in Human Geography, Vol.II Arnold – Heinemann Pub. (India)
2. Hegget Peter, Cliff A.D. et. al. (2000) Locational Meodels, Locational Analysis in Human Geography. Vol. I Arnold – Heinemann Pub. (India)
3. Chandna R.C. (2003): Regional Planning: A Comprehensive Text, Kalyani Publishers, Ludhiana

SYLLABUS FOR AUTONOMOUS COURSES IN GEOGRAPHY

BACHELOR OF SCIENCE

SEMESTER III

REVISED AS ON 7TH APRIL 2018

CORE

Course Title: Fundamentals of Remote Sensing and GIS (THEORY)
Course Code: GEG-III.SC5
Marks: 75
Credits: 3
Duration: 45 lectures of 1 hour each
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Course Objectives: The focus of this Course is to introduce key concepts of Remote Sensing and GIS**.**

Learning outcomes: On completion of this course students will able to appreciate the basic science of remote sensing and GIS as a tool of study and research in geography

Unit	Title	No. of hours
I	**Concepts of Remote Sensing : Introduction to remote sensing,** Electromagnetic Radiation and its components:- Characteristics of Electromagnetic Spectrum Energy Interactions with Earth's atmosphere and surface features; Spectral response of Earth's natural surface. Introduction to Sensors and platforms Aerial Photography:- Types, Error In Flying, Geometry, Scale, Relief Displacement, Stereoscopes Parallax	15
II	**Visual Interpretation of Satellite Images and Aerial Photographs :** Elements of Image interpretation, Interpretation of Multi-Spectral Imagery, Identification of Earth Surface Features **Introduction to digital analysis**	15
III	**Concepts in GIS :** Content of GIS, objectives of GIS, Elements of GIS, Hardware & Software Requirements, Point Line and Polygon, Layers and Coverage Raster and Vector Data, Components of GPS.	15
		45

REFERENCES

1. C.P.Lo and Albert K. W. Yeung,(2002) Concepts and Techniques of Geographic Information System, Prentice –Hall, India.
2. Heywood I, el. (2011) An Introduction to Geographical Information Systems , Pearson Education Pvt. Ltd., New Delhi.,
3. J.R. Jensen, (2003) Remote Sensing of Environment, An Earth Resource Perspective, , Pearson Education Pvt. Ltd., New Delhi.
4. Kang – tsung – Chang, (2002)Introduction to Geographical Information System, , McGraw Hill.
5. Lillesand T.M. and Kiefer R.W., (2002) Remote Sensing and Image Interpretation, John Wiley and Sons, New Delhi.
6. George Joseph (2005) Fundamentals of Remote Sensing, University press Private Ltd, Hyderabad.
7. P. A. Burrough and R. A. McDonnell, (2000)Principles of Geographical Information System, , Oxford University Press.
8. Paul A. Lonfley, et al.(2002), Introduction to Geographic Information Systems and Science, , John Wiley and Sons Ltd

CORE
Course Title: Fundamentals of Remote Sensing and GIS (Practical)
Course Code: GEG-III.SC5
Marks: 25
Credits: 01
Duration: 15 sessions of 2 hours each
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Course Objectives: The objective of this course is to provide hands-on training in basic Remote Sensing, GIS and GPS techniques.

Le**arning outcome:** At the end of this course, students will be able interpret and analyze remotely sensed data.

Unit	Title	Practical sessions
I	Determination of scale, coverage, area, distance and height. Determination of parallax using mirror stereoscope. Interpretation of Aerial Photographs & Satellite images Identification of physical and cultural features using elements of interpretation Aerial photographs and their verification and ground truthing	07
II	Geo-referencing of scanned maps. Digitization of point, line and polygon layers. GPS survey on field and Identification of geographic feature on image and on actual ground	08
III	Journal	
		15

References

1. C.P. Lo and Albert K. W. Yeung, Concepts and Techniques of Geographic Information System, (2002) Prentice –Hall, India.
2. George Joseph, Fundamentals of Remote Sensing, (2004), Universities Press Pvt. Ltd., Hyderabad.
3. Heywood I, (el.) An Introduction to Geographical Information Systems , Pearson (2011)
4. J.R. Jensen, Remote Sensing of Environment, An Earth Resource Perspective, (2003), Pearson Education Pvt. Ltd., New Delhi.
5. Kang – Tsung – Chang, Introduction to Geographical Information System, (2002), McGraw Hill.
6. Lillesand T.M. and Kiefer R.W., (2002), Remote Sensing and Image Interpretation, John Wiley and Sons, New Delhi.
7. P. A. Burrough and R. A. McDonnell, Principles of Geographical Information System, (2000), Oxford University Press.
8. Paul A. Lonfley, Michel F. Goodchild, D J. Maguire and D W. Rhind, Introduction to Geographic Information Systems and Science, (2002), John Wiley and Sons Ltd

ELECTIVE
Course Title: Spatial Analysis (Theory)
Course Code: GEG- SE1
Marks: 75
Credits: 3
Duration: 45 lectures of 1 hour each
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Course Objectives: The objectives of this course is to introduce the fundamentals of spatial analysis through pattern recognition, interpolation, locational and topographical analysis.

Learning outcome: At the end of this course, students will acquire the skills of spatial analysis, identification of suitable site, locational advantages and decision making.

Unit	Topic	No. of hours
I	**Introduction to Spatial Analysis**: concepts, functions of spatial analysis Characteristics, importance of geo-data base Topology and types Concept and sources of Spatial and Non-Spatial Data	**15**
II	Concept and methods of spatial Interpolation. Raster analysis. Overlay analysis.	**20**
III	**Topographic Analysis**: Digital Elevation Model, Slope, Aspect, Flow Accumulation, Flow Direction etc.	**10**
		45

Reference Books:

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. M Goodrich (2000). Data Structures and Algorithms in Java, 2nd Edition Wiley.
4. Malczewski, J. (1999). GIS and Multicriteria Decision Analysis. New York: John Wiley and Sons
5. Ott, T. and Swiaczny, F. (2001). Time-integrative GIS. Management and analysis of spatio-temporal data. Berlin / Heidelberg / New York: Springer.
6. 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.

ELECTIVE
Course Title: Spatial Analysis (Practical)
Course Code: GEG-SE1
Marks: 25
Credits: 1
Duration: 15 sessions of 2 hour each
==========

Course Objectives: The objectives of this course is to introduce the fundamentals of spatial analysis through pattern recognition, interpolation, locational and topographical analysis.

Learning outcome: At the end of this course, students will acquire the skills of spatial analysis, identification of suitable site, locational advantages and decision making.

Unit	Topic	Practical Sessions
I	**Vector Operations** (Single Layer): Dissolve, Buffer, Multi Ring Buffer. Vector Operations (Multi Layer): Clip, Erase, Merge, Intersect. **Raster Operations**: clip and mosaic (Extract By Mask). Spatial Queries and Non-Spatial Queries based on locations	**10**
II	**Interpolation**: Inverse Distance Weighted method Topo to Raster. **Overlay Operations** (Point in Polygon, Line in Polygon, Polygon in polygon).	**05**
III	Journal	**-**
		15

Reference Books:

1. Alias A. Rahman and Morakot Pilouk (2008): Spatial Data Modeling for 3D GIS, Springer New York.
2. Goodrich, M (2000). Data Structures and Algorithms in Java, 2nd Edition Wiley Longley, P.A.,
3. Goodchild, M.F., Maguire, D.J. and Rhind, D.W. (2005). Geographic Information Systems and Science. Chichester: Wiley. 2nd edition.
4. Malczewski, J. (1999). GIS and Multicriteria Decision Analysis. New York: John Wiley and Sons
5. Ott, T. and Swiaczny, F. (2001). Time-integrative GIS. Management and analysis of spatio-temporal data. Berlin / Heidelberg / New York: Springer.
6. 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.

ELECTIVE
Course Title: Raster and Vector Data Models in GIS (THEORY)
Course Code: GEG-SE2
Marks: 75
Credits: 3
Duration: 45 lectures of 1 hour each
==========

Course Objectives: This course introduces basic concepts and principles of GIS and emphases on the role of raster and vector data models. The students will introduced data processing, transformation and visualization of data using various models.

Learning outcomes: The students will be able to differentiate raster and vector data models and also appreciate the role of these models in visualizing graphical outputs through GIS.

Unit	Title	No. of hours
I	GIS Concepts, Principles, Geospatial Data Models, Organization of GIS Data and System Functionality, Map Projections, Coordinate Systems and Transformations.	15
II	Fundamentals of Raster data models, metadata and data exchange 2D and 3D raster data models Fundamentals of raster maps, Raster data transformation	15
III	Vector data Basics of vector data and Generation of vector data, fundamentals of Vector map queries and statistics, Basics of Point analysis Basics of Network analysis	15
		45

Reference :

1. Markus Neteler and Helena Mitasova (2008) OPEN SOURCE GIS, A GRASS GIS Approach (Third Edition) Springer, USA
2. McCartney Taylor, Nik Freeman (2014) Getting Started With GIS Using QGIS (Kindle Edition) McCartney Taylor.

Sample Data source

1. https://grass.osgeo.org/download/sample-data/
2. http://grassbook.org/datasets/datasets-3rd-edition/
3. http://www.qgis.org/en/site/

ELECTIVE
Course Title: Raster and Vector Data Models in GIS (Practical)
Course Code: GEG-SE2
Marks: 25
Credits: 1
Duration: 15 Sessions of 2 hour each
==========

Course Objectives:
This course introduces basic concepts and principles of GIS and emphasis on the role of raster and vector data models. The students will be also be introduced data processing, transformation and visualization of data using various models.

Learning outcomes: The students will be able to differentiate raster and vector data modes and also appreciate the role of these models in visualizing and graphical outputs through GIS.

Unit	Title	Practical sessions
I	Import of raster data, Coordinate transformation, Raster map algebra Raster data transformation and interpolation Spatial analysis with raster data	8
II	Vector Datageneration Network Analysis Cluster analysis Transformations to Raster(vectorization - rasterization) Spatial Interpolation.	7
III	Journal	-

Reference :

1. Markus Neteler and Helena Mitasova (2008) OPEN SOURCE GIS, A GRASS GIS Approach (Third Edition) Springer, USA
2. McCartney Taylor, Nik Freeman (2014) Getting Started With GIS Using QGIS (Kindle Edition) McCartney Taylor.

Sample Data source

1. https://grass.osgeo.org/download/sample-data/
2. http://grassbook.org/datasets/datasets-3rd-edition/
3. http://www.qgis.org/en/site/

ELECTIVE
Course Title: Participatory GIS (Theory)
Course Code: GEG-SE3
Marks: 75
Credits: 3
Duration: 45 lectures of 1 hour each
==========

Course Objectives: This is an introductory Course of Participatory GIS that aims to expose student to applications of GIS in the context of community and people's participation. This helps to enhance Geographical Information through shared knowledge and information.

Learning outcomes: At the end of this course, students will be able to understand and acknowledge the applications of GIS for benefit of society.

Unit	Title	No. of hours
I	Participatory Geographic Information Systems Concepts and Methods, History (PRA, P-GIS pGIS Pgis) Ethics, Partnership, role and responsibility of the scientist. Methodology for Pgis., implementation and limitations of the participation Methods, Techniques, advantages of community mapping. Data management. Features of interest for socio-economic analysis and social development skills and training requirements. P-GIS and the livelihoods approach.	15
II	Contribution of P-GIS through Community Mapping in Water Resource Inventory. Urban and Peri-Urban Partnership and Community Empowerment Community Resource Mapping in Forest, Agriculture and Water Resources Management: Bridging the Divide between Community and Government Voluntary Information and PGIS (VI & PGIS)	15
III	Neo-geography and GIS/2 : value addition to P-GIS Needs of Participatory GIS. Perspectives on Participatory mapping and PGIS	15
		45

References

1. Abbot, J., Chambers, R., Dunn, C., Harris, T., Merode, E. d., Porter, G., Townsend, J.,Weiner, D., de Merode, E., (1998). 'Participatory GIS: opportunity or oxymoron?' PLA Notes33. IIED: Londo
2. Elwood, Sarah (2006) Participatory GIS and Community Planning: Restructuring Technologies, Social Processes, and Future Research in PPGIS Collaborative Geographic Information Systems edited by Shivanand Balram and Suzana Dragicevic, Idea Group Inc. University of Arizona, USA
3. Elwood, Sarah (2006), Critical Issues in Participatory GIS: Deconstructions, Reconstructions, and New Research Directions Transactions in GIS, 10(5): 693–708
4. McCall, Michael K. (2004) Can Participatory-GIS Strengthen Local-level Spatial Planning? Suggestions for Better Practice. Dept. of Urban & Regional Planning and GeoInformation Management ITC. Course prepared for: GISDECO 2004 Skudai, Johor, Malaysia, 10-12 May (2004)
5. Quan, Julian, Oudwater, Nicoliene, Pender, Judith and Martin, Adrienne (2001)*GIS And Participatory Approaches In Natural Resources Research*. SOCIO-ECONOMIC METHODOLOGIES FOR NATURAL RESOURCES RESEARCH BEST PRACTICE GUIDELINES. Published by Natural Resources Institute, The University of Greenwich 2001
6. Minang, Peter A. and McCall, Michael K. (2006) Participatory GIS and local knowledge enhancement for community carbon forestry planning: an example from Cameroon. Participatory Learning And Action.

ELECTIVE
Course Title: Participatory GIS (Practical)
Course Code: GEG-SE3
Marks: 25
Credits: 1
Duration: 15 Sessions of 2 hour each
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Course Objectives: The basic objective of this practical course is to equip students with skills to calculate various indices and practically apply it in case studies.

Learning outcome: This practical course helps in developing skills by which students will practically carry on field studies.

Unit	Title	Practical Sessions
1	Data processing and computing indices Linear Model & Linear Combination Method (LCM) Assessment Index (AI) Employment index (M) Education index (E) Health index (S) Housing index (H) Infrastructure index The Principal Component Analysis Method (PCAM) Marginality Index (MI) Human Development Index	5
2	Case study of any one of the following (mini project) Water Resource Inventory Urban and Peri-Urban Agriculture Forest and Water Resources Management Using software like GRASS (Geographic Resources Analysis Support System) and ILWIS (Integrated Land and Water Information System)	10
3	Project report	-

References:

1. Françoise Orban-Ferauge V.Aguilar, E. Alarcon, A. Carmona, N. Daix, B. Denil, A. Ignacio, J. Martinez, M. McCall, G.Miscione, E. Olivarez, M. Pandan. G. Rambaldi, R. Teruel, J. Verplanke participatory geographic information systems and land planning life experiences for people empowerment and community transformation , Technical Centre for Agricultural and Rural Cooperation ACP-EU (CTA) Wageningen, The Netherlands

ELECTIVE
Course Title: Applied GIS (Theory)
Course Code: GEG-SE4
Marks: 75
Credits: 3
Duration: 45 lectures of 1 hour each
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Course Objectives: This Course introduces various recent application of GIS in business, society, transportation and spatial planning.

Learning outcomes: At the end of this course students will be able to correlate acknowledge of GIS in the day to days life problems.

Unit	Title	No. of hours
I	**Geobusiness** Retail Application of Spatial Modelling to Solve: Retail Location Problems, Location Based Services for Mobile Applications Mass Appraisal Model, Lifestyle Segmentation Profiles, Neighbourhood Model, Housing Price Mass Appraisal Model.	15
II	**Social Application**: Assessing Clusters of Deprivation in City Regions, GIS for Joined up Government Spatial Statistical Methods to the Detection of Geographical Patterns of Crime **Transport and Location**: Demand Responsive Passenger Transport Services, Strategic Land Use / Transportation Model, Relocation of Facilities. Probability Based GIS Model.	15
III	**Spatial Planning** Modelling Migration, Modeling Regional Economic Growth, Carrying Capacity, Planning Network of Site, Assessing Service Provision,	15
		45

References

1. Abbot, J., Chambers, R., Dunn, C., Harris, T., Merode, E. d., Porter, G., Townsend, J.,Weiner, D., de Merode, E., (1998). 'Participatory GIS: opportunity or oxymoron?' PLA Notes33. IIED: Londo
2. Elwood, Sarah (2006) Participatory GIS and Community Planning: Restructuring Technologies, Social Processes, and Future Research in PPGIS Collaborative Geographic Information Systems edited by Shivanand Balram and Suzana Dragicevic, Idea Group Inc. University of Arizona, USA
3. Elwood, Sarah (2006), Critical Issues in Participatory GIS: Deconstructions, Reconstructions, and New Research Directions Transactions in GIS, 10(5): 693–708
4. McCall, Michael K. (2004) Can Participatory-GIS Strengthen Local-level Spatial Planning? Suggestions for Better Practice. Dept. of Urban & Regional Planning and GeoInformation Management ITC. Course prepared for: GISDECO 2004 Skudai, Johor, Malaysia, 10-12 May (2004)
5. Quan, Julian, Oudwater, Nicoliene, Pender, Judith and Martin, Adrienne (2001)*GIS And Participatory Approaches In Natural Resources Research*. SOCIO-ECONOMIC METHODOLOGIES FOR NATURAL RESOURCES RESEARCH BEST PRACTICE GUIDELINES. Published by Natural Resources Institute, The University of Greenwich 2001
6. Minang, Peter A. and McCall, Michael K. (2006) Participatory GIS and local knowledge enhancement for community carbon forestry planning: an example from Cameroon. Participatory Learning And Action.
7. Stillwell, John and Clarke, Graham (2004) Applied GIS and Spatial Analysis (Ed). John Willy and Sons LTD England

ELECTIVE
Course Title: Applied GIS (practical)
Course Code: GEG-SE4
Marks: 25
Credits: 1
Duration: 15 Sessions of 2 hour each
==========

Course Objectives: The basic objective of this practical course is to equip students with skills to apply GIS skills various issues through spatial modeling and analytical tools.

Learning outcome: This practical course helps in developing skills by which students will be able to under undertake various local problems and suggest realistic spatial solution to it.

Unit	Title	Practical Sessions
1	Spatial Modelling: Land Use transformation model and Transportation Model, Neighboring Model (NNI)	8
2	Spatial Statistic: Cluster Analysis, Crime Pattern Analysis, Mass Appraisal	7
3	Journal	-

References :

1. John Stillwell and Graham Clarke (2004) Applied GIS and Spatial Analysis (Ed). John Willy and Sons Ltd. England
2. Markus Neteler and Helena Mitasova (2008) OPEN SOURCE GIS, A GRASS GIS Approach (Third Edition) Springer, USA
3. McCartney Taylor, Nik Freeman (2014) Getting Started With GIS Using QGIS (Kindle Edition) McCartney Taylor.

Sample Data source

1. https://grass.osgeo.org/download/sample-data/
2. http://grassbook.org/datasets/datasets-3rd-edition/
3. http://www.qgis.org/en/site/

SYLLABUS FOR AUTONOMOUS COURSES IN GEOGRAPHY
BACHELOR OF SCIENCE
SEMESTER IV
REVISED AS ON 7TH APRIL 2018

CORE
Course Title: Fundamentals of Geomorphology (Theory)
Course Code: GEG-IV.SC6
Marks: 75
Credits: 3
Duration: 45 lectures of 1 hour each

Course Objectives: The Course provides the fundamentals of geomorphology. It also focuses on application of geomorphological knowledge to resolve the challenging issues of man environment relationships.

Learning Outcomes: At the end of this course, students will be familiar with fundamentals of geomorphology and learn the techniques of application of geomorphological knowledge to solve the challenging issues of man environmental relationships.

Unit	Title	No. of hours
I.	Geomorphic concept : major geomorphic concept	18
II.	Slope development theory. Davis and Penck. Aeolian landforms: Erosional & Depositional. Glacial Landforms: Erosional and Depositions	12
III.	Application of Geomorphology: • Mining • Hazard management • Agriculture • Environmental management	15
		45

References:

1. Ahmed, E., 2005 : Geomorphology , Kalyan Publishers, New Delhi
2. Bloom, Arthur L., 2004: Geomorphology – A systematic Analysis of Late Cenozoic Landforms, Prentice Hall, engle Wood Cliff, N.J
3. Chorley, Richard J., 2002: Spatial Analysis in Geomorphology, Harper and Row Publishers, New York, London.
4. Cooke R. U. and Doornkamp J.C. (1989): Geomorphology in Environmental Management, 2nd Edition, Oxford : Clarendon Press
5. Dayal, P. (2nd edition) 2006 A Textbook of Geomorphology, Shukla Book Depot, Patna
6. Sharma, H.S. (ed), 2002: Perspective in Geomorphology, Vol. I & Vol. IV, Concept, New Delhi.
7. Sharma, V.K., 2006 : Geomorphology, Earth Surface Processes and Forms, Tata Mc. Graw Hill, New Delhi
8. Sharma, V.K., 2006 : Geomorphology, Earth Surface, Process and forms, Tata McGraw Hill, New York
9. Singh, S: Physical Geography, Pustak BHawan, Allahabad, 2005
10. Sparks, B.W., 2000: Geomorphology, Longman, London, 2nd edition.
11. Strahler, A.N .: Physical Geography, 3rd Ed., Wiley, 2006
12. Thornbury W.D, 2001: Principles of Geomorphology , 2nd Ed., Wiley International edition, Wiley Eastern Reprint, 2001
13. Wooldridge, S.W. and Morgan, R.S., 2000: The Physical Basis of Geography, Longman.
14. Worcestor, P.G., 2005: A textbook of Geomorphology, Van Nostrand, 2nd Ed., East west Edition, New Delhi

CORE
Course Title: Fundamentals of Geomorphology (Practical)
Course Code: GEG-IV.SC6
Marks: 25
Credits: 1
Duration: 15 sessions of 2 hour each

Course Objectives: The Course provides the skills in rock identification and their uses. strategies to the challenging issues of man environment relationships.

Learning Outcomes: At the end of this course, students will be familiar with the skills of identification and application of geomorphology and the techniques of application of geomorphological knowledge to solve the challenging issues of man environmental relationships.

Unit	Title	Practical sessions
I.	Identification of rocks and their properties Soil profile, Soil analysis and their application	9
II.	Interpretation of geological map, identifications of faults, lineaments, dykes and sills, rock types Identification of Aeolian and Glacial Landforms	6
III.	Journal and viva voce	
		15

References:

1. Ahmed, E., 2005 : Geomorphology , Kalyan Publishers, New Delhi
2. Bloom, Arthur L., 2004: Geomorphology – A systematic Analysis of Late Cenozoic Landforms, Prentice Hall, engle Wood Cliff, N.J
3. Chorley, Richard J., 2002: Spatial Analysis in Geomorphology, Harper and Row Publishers, New York, London.
4. Dayal, P. (2nd edition) 2006 A Textbook of Geomorphology, Shukla Book Depot, Patna
5. Sharma, V.K., 2006 : Geomorphology, Earth Surface, Process and forms, Tata McGraw Hill, New York
6. Singh, S: Physical Geography, Pustak BHawan, Allahabad, 2005
7. Strahler, A.N .: Physical Geography, 3rd Ed., wiley, 2006
8. Thornbury W.D, 2001: Principles of Geomorphology , 2nd Ed., Wiley International edition, Wiley Eastern Reprint, 2001
9. Sharma, H.S. (ed), 2002: Perspective in Geomorphology, Vol. I & Vol. IV, Concept, New Delhi.
10. Sharma, V.K., 2006 : Geomorphology, Earth Surface Processes and Forms, Tata Mc. Graw Hill, New Delhi
11. Sparks, B.W., 2000: Geomorphology, Longman, London, 2nd edition.
12. Wooldridge, S.W. and Morgan, R.S., 2000: The Physical Basis of Geography, Longman.
13. Worcestor, P.G., 2005: A textbook of Geomorphology, Van Nostrand, 2nd Ed., East west Edition, New Delhi

ELECTIVE
Course Title: Coastal Geomorphology (Theory)
Course Code: GEG-SE5
Marks: 75
Credits: 3
Duration: 45 lectures of 1 hour each

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Course Objectives: The basic objective of this course is to familiarize students about the mechanism of landform development resulting from coastal processes.

Learning outcomes: At the end of this course, students are expected to have an understanding of the various processes and associated landforms in coastal regions. Besides learn the methods of coastal hazard management

Unit	Title	No. of hours
I	Introduction to coastal Processes Waves: Formation, Drifts and Tides. Types of coastlines, Coastal erosion and deposition. Costal landforms.	15
II	Beach Geomorphology: Types and Configuration of beaches Coastal wetlands. Coral reefs and marine environment.	15
III	Coastal Ecosystem Management. Coastal Hazard Management.	15
		45

References

1. Cooke R. U. and Doornkamp J.C. (1989): Geomorphology in Environmental Management, 2nd Edition, Oxford : Clarendon Press
2. Eric Bird: Coastal Geomorphology: An Introduction, John Wiley & Sons; 1 edition (November 7, 2000),
3. Gerhard Masselink , Michael Hughes :An Introduction to Coastal Processes and Geomorphology (Hodder Arnold Publication), ISBN-10: 0340764112 , ISBN-13: 978-0340764114
4. Kale, V. S. and Gupta, A. (Rep.2011): Introduction to Geomorphology, Orient Longman, Calcutta.
5. Karlekar, S. (2009): Coastal Processes and Landforms: Diamond Publications, Pune
6. Richard Davis Jr. , Duncan Fitzgerald : Beaches and Coasts, Wiley-Blackwell; 1st edition (July 15, 2004), ISBN-10: 0632043083 , ISBN-13: 978-0632043088
7. Timothy Beatley , Anna K. Schwab , David Brower (2002):An Introduction to Coastal Zone Management, Island Press; REV edition

ELECTIVE
Course Title: Practicals in Coastal Geomorphology
Course Code: GEG-SE5
Marks: 25
Credits: 1
Duration: 15 sessions of 2 hours each

Course Objectives: To develop the skills of identification and interpretation of coastal landforms and processes.

Learning outcome: At the end of the course students are expected to independently prepare geographic map and interpret coastal landscape. Besides they should be able to carry out beach profiling using instruments**.**

Unit	Title	Practical sessions
1	Identification of coastal features and processes on SOI toposheet.	05
2	Beach profiling & identification of major and minor coastal features on beach. Profile of various types of coast. Geomorphic mapping of Coastal Areas.	10
3	Journal and Viva	
		15

References

a. Bygot, J.: An Introduction to Map Work and Practical Geography, 2001
b. Campbell, J., 2004: Introductory Cartography, Printice Hall, Inc Englewood
4. Jackson, R.H. and Hudmar, L.E.: Regional Geography: Issues for today ,2001
5. Misra, R.P. and Ramesh, A., 2005: Fundamentals of Cartography, Concept Pub. Co., New Delhi
6. Monkhouse, I.J. and Wilkinson, H.R., 2001: Maps and Diagram, B.I. Publication, New Delhi
7. Raisz, E.: General Cartography, McGraw Hills Co., London ,2005
8. Robinson, A.H., et al,: Elements of Cartography, John Wiley and Sons, New York,2003
9. Singh, R.L.: Elements of Practical Geography, Kalyani Publishers, New Delhi ,2000
10. Singh, R ; Singh L.R., Mapworks in Practical Geography,Central book Depot, Allahabad,2001

ELECTIVE
Course Title: Fluvial Geomorphology (Theory)
Course Code: GEG-SE6
Marks: 75
Credits: 3
Duration: 45 lectures of 1 hour each

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Course Objectives: The Rivers being a major agent of erosion, the course assumes significance as it mainly deals with fluvial forms and processes.

Learning outcomes: At the end of this course, students are expected to have an understanding of the fundamental concepts of river and its processes.

Unit	Title	No. of hours
I	River basin and Drainage Network: River and Stream, Drainage basin and network characteristics, River Dynamics, Classification, Phases of development, Patterns.	15
II	Fluvial processes: Erosion, Transportation and Deposition. Fluvial cycle and Fluvial landforms.	15
III	Applied fluvial geomorphology: Environmental changes and river metamorphosis. Flood and its impact(case studies)	15
		45

Reference Books:

1. Chorley, R. J., Schumm, S. A. and Sugden, D. E. (1984): Geomorphology, Methuen, London.
2. Fairbridge, R. W. (1968): Encyclopedia of Geomorphology, Reinholdts, New York.
3. Goudie, Andrew, S. (2004), Encyclopedia of Geomorphology, 1& 2, Routledge, Taylor & Francis, New York
4. Kale, V. S. and Gupta, A. (Rep.2011): Introduction to Geomorphology, Orient Longman, Calcutta.
5. Luna Bergere Leopold, Markley Gordon Wolman, John P. Miller (1995): Fluvial Processes in Geomorphology. Dover Publications Inc., New York
6. R.J. Small (1989)Geomorphology and Hydrology (Longman modular geography series), Longman Publication, Harlow, Essex, England
7. Singh, Savindra (Rep. 2011): Geomorphology, Prayag Pustak Bhawan, Allahabad
8. Strahler A. H and Strahler, A. N. (1992) : Modern Physical Geography, John Wiley, New York
9. Thomas, S.G. David, (2016) The Dictionary of Physical Geography, 4th Edition, Wiley-Blackwell, New Jersey, USA
10. Thornbury, W. D. (Rep.2011): Principles of Geomorphology, John Wiley and Sons, New York.

ELECTIVE
Course Title: Practicals in Fluvial Geomorphology
Course Code: GEG-SE6
Marks: 25
Credits: 1
Duration: 15 sessions of 2 hours each
==========

Course Objectives: To develop the skills of river morphometry analysis, river profiling, fluvial processes.

Learning outcome: At the end of the course student are expected to independently prepare drainage map and interpret fluvial landscape. Besides they should be able to carry out river profiling using instruments**.**

Unit	Title	Practical sessions
1	Preparation of drainage map. Identification and Interpretation of fluvial landforms, Patterns and processes from SOI toposheet. Slope analysis.	05
2	Drainage basin morphometry: Morphometric analysis of drainage basin. Field visit : river Profiling and to observe fluvial processes	10
3	Journal and Viva	
		15

References

a. Bygot, J.: An Introduction to Map Work and Practical Geography,2001
b. Campbell, J., 2004: Introductory Cartography, Printice Hall, Inc Englewood
c. Misra, R.P. and Ramesh, A., 2005: Fundamentals of Cartography, Concept Pub. Co., New Delhi
d. Monkhouse, I.J. and Wilkinson, H.R., 2001: Maps and Diagram, B.I. Publication, New Delhi
e. Raisz, E.: General Cartography, McGraw Hills Co., London ,2005
f. Robinson, A.H., et al,: Elements of Cartography, John Wiley and Sons, New York,2003
g. Singh, R.L.: Elements of Practical Geography, Kalyani Publishers, New Delhi ,2000
h. Singh, R ; Singh L.R., Mapworks in Practical Geography,Central book Depot, Allahabad,2001

ELECTIVE
Course title: Watershed Management (Theory)
Course Code: GEG-SE7
Marks: 75
Credits: 3
Duration: 45 lectures of 1 hour each

Course Objective: The objective of this course is to acquaint students with basic concepts and importance of Watershed Management. This course will also help students in understanding various processes that take place and that are involved in a watershed.

Learning outcomes: At the end of this course, students are expected to have a holistic understanding of Watershed Management. It will help them to develop a process-based understanding of how land surface characteristics will affect fluxes of mass and energy within a watershed.

Unit	Title	No. of hours
I	Introduction to Watershed Management : Definition, Principles, objectives, Need of Watershed Management, Identification of problems in Watershed Management	15
II	Characteristics of watershed Runoff, River discharge Sediment load	15
III	Hydrological Process in Watershed : Ecological Characteristics of the river Soil management techniques in watershed Watershed Conservation methods.	15
		45

REFERENCES:

- Manual of water and soil conservation: Government of India, ICAR
- Manuals of the USDA

1. DeBarry. A. Paul, 2004, Watersheds : Processes, Assessment, and Management, Hoboken, N.J. : John Wiley & Sons, New Jersey
2. Heathcote. W. Isobel , 2009, Integrated Watershed Management : Principles and Practice, 2nd Edition, Hoboken, N.J. : John Wiley & Sons, New Jersey
3. National Watershed Program Manual, The U.S. Department of Agriculture (USDA), Washington, D.C, December, 2009
4. Narayana, V.V. Dhruva, 2002, Soil and water conservation research in India, Published by ICAR, New Delhi
5. Singh Rajvir, 2003, Watershed Planning and Management, 2nd Edition, Yash Publishing House, Bikaner, India

ELECTIVE
Course title: Practicals in Watershed Management
Course Code: GEG-SE7
Marks: 25
Credits: 1
Duration: 15 sessions of 2 hours each

Course Objective: The objective of this practical is to acquaint students with basic concepts and importance of Watershed Management. This practical will also help students in understanding various processes that take place and that are involved in a watershed.

Learning outcomes: At the end of this practical, students are expected to have a holistic understanding of Watershed Management as it will help them to develop a process-based understanding of how land surface characteristics will affect fluxes of mass and energy within a watershed, so that science-based management principles may be effectively applied to watershed systems.

Unit	Title	Practical Sessions
I	Sediment load analysis	5
II	Measurement and Estimation of Soil Erosion – Revised Universal Soil Loss Equation (RUSLE). Field Visit and Report: visit to watershed (Identification of problems of watershed, soil and water management) Survey, Database Generation.	10
III	Journal and Viva-voce	
		15

REFERENCES:

1. DeBarry. A. Paul, 2004, Watersheds : Processes, Assessment, and Management, Hoboken, N.J. : John Wiley & Sons, New Jersey
2. Heathcote. W. Isobel , 2009, Integrated Watershed Management : Principles and Practice, 2nd Edition, Hoboken, N.J. : John Wiley & Sons, New Jersey
3. National Watershed Program Manual, The U.S. Department of Agriculture (USDA), Washington, D.C, December, 2009
4. Narayana, V.V. Dhruva, 2002, Soil and water conservation research in India, Published by ICAR, New Delhi
5. Singh Rajvir, 2003, Watershed Planning and Management, 2nd Edition, Yash Publishing House, Bikaner, India

ELECTIVE
Course title: Biogeography (Theory)
Course Code: GEG-SE8
Marks: 75
Credits: 3
Duration: 45 lectures of 1 hour each

Course Objectives: Biogeography deals with spatial and temporal patterns of biological diversity and the factors that govern the distribution and abundance .

Learning Outcomes: At the end of this course, students will be familiar with fundamentals of biogeography.

Unit	Title	No. of hours
I.	Concept of Biogeography. Historical evolution of Biogeography. Global patterns of Biodiversity.	18
II.	Niche. Speciation and extinction. Accident and invasion. Endemism, vicariance and conservation. Island biogeography. Zoogeography and its Environmental Relationship. Palaeo botanical and Palaeo Climatological records of environmental change.	10
III.	Biodiversity hotspots. Forest communities and their distribution. Conservation- laws and practices. Social Movements of conservation.	17
		45

References:

1. Bhattacharyya, N.N.: Biogeography, Rajesh Publications, New Delhi.
2. Husain, M. (ed)., 1994: Biogeography(Part I & II), Anmol Publications, Pvt. Ltd., New Delhi.
3. Newbigin, M.I., 1939: Plants and Animal Geography.
4. Singh, Savindra, 2010: Biogeography, Prayag Pustak Bhawan, Allahabad.
5. Tiby, 1982: Biogeography, Longman, London.
6. Walts, D., 1971: The Principles of Biogeography, Mc. Graw Hill, London.

ELECTIVE
Course title: Practicals in Biogeography
Course Code: GEG-SE8
Marks: 25
Credits: 1
Duration: 15 Sessions of 2 hrs each

Course Objectives: Biogeography deals with spatial and temporal patterns of biological diversity and the factors that govern the distribution and abundance .

Learning Outcomes: At the end of this course, students will be familiar with fundamentals of biogeography .

Unit	Title	Practical Sessions
I.	Vegetation Map interpretation Biodiversity indexing Biomass analysis Canopy structure Stock analysis	07
II.	NDVI Density of tree Plant tress analysis Disturbance analysis	08
III.	Journal and viva voce	
		15

References:

1. Bhattacharya, N.N.: Biogeography, Rajesh Publications, New Delhi Husain, M. (ed)., 1994: Biogeography(Part I & II), Anmol Publications, Pvt. Ltd., New Delhi.
2. Newbigin, M.I., 1939: Plants and Animal Geography.
3. Singh, Savindra, 2010: Biogeography, Prayag Pustak Bhawan, Allahabad.
4. Tiby, 1982: Biogeography, Longman, London.
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SYLLABUS FOR AUTONOMOUS COURSES IN GEOGRAPHY
BACHELOR OF SCIENCE
SEMESTER V

CORE
Course Title: Fundamentals of Climatology (THEORY)
Course Code: GEG-V. SC-7
Marks: 75
Credits: 3
Duration: 45 lectures of 1 hour each
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Course Objectives: The focus of this Course is to introduce key concepts of climatology in general and Indian monsoon in details.

Learning outcomes: On completion of this course students will able to understand and apply the concepts in analyzing and applying climatological concepts.

Unit	Title	No. of hours
I	**Fundamental of Atmospheric circulation** Basics of water cycle, Atmospheric Stability. Air Masses and its types. Fronts and types. El-Nino and La-Nina. **Atmospheric disturbances:** Thermodynamics Koppens Classification CAPE and CINE- cloud development and stability, thunderstorm Cyclogenesis – T number (basics of cyclones)	15
II	**Indian Climatology: Monsoons** **Pre monsoon:** Cyclone genesis, Cyclonic storms, frequency, intensity, landfall and associated weather. **South West monsoon :** Onset and advance of southwest monsoon, Semi-permanent features of monsoon, active and break in monsoon **Post monsoon:** withdrawal of southwest monsoon, Northeast monsoon, cyclonic storms in the Indian seas, trends in cyclonic disturbances, Easterly waves. **Winter:** western disturbances, fog, cold waves	15
III	**The Earth's Changing Climate** **Climate change and sea level rise:** Ocean in relation to long changes in Monsoon, tropical cyclones and climate, Land use change and climate. Cloud burst, clouds seeding and artificial rain. **Climate services:** Climate and application in agriculture, water, health and disaster risk reduction and urban planning.	15
		45

REFERENCES

1. Barry R.G. and Chorley, R. J., 2009: Atmosphere, Weather and Climate, Routledge
2. Bunnett R.B. , 1993: Physical geography in Diagrams, Longman
3. Critchfield, H.J, 1998 : General Climatology, Prentice-Hall
4. Lal, D.S., 2011: Climatology, Sharda Pustak Bhavan
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9. Stringer, E.T., 1972: Foundation of Climatology: An Introduction to Physical, Dynamic, Synoptic, and Geographical Climatology, W.H. Freeman & Co. Ltd.
10. Tikka - R.N., 1998 - Physical Geography. Kedar Nath Ram Nath, Meerut
11. Trewartha, G.T., 1968: Introduction to Climate, McGraw-Hill

CORE
Course Title: Fundamentals of Climatology (Practical)
Course Code: GEG-V. SC-7
Marks: 25
Credits: 01
Duration: 15 sessions of 2 hours each
==========

Course Objectives: The objective of this course is to provide basic practical tools in understanding weather and climate.
Learning outcome: At the end of this course, students will be able interpret and analyze weather and climatic phenomena.

Unit	Title	Practical sessions
I	Representation of weather phenomena using isolines Isohyets map Isotherm map Isobars Representation of wind data Evapotranspiration Determining atmospheric stability (Tephigram) Preparation of weather Station Model. Upper air chart, isotach (wind)	05
II	• Study of weather symbols and IMD weather charts. Interpretation of IMD weather charts (at least 1 map of three seasons) • Visit to IMD for hands- on- training: handling of weather instruments, taking readings, temperature, pressure, sunshine chart interpretation and forecasting. (seven Days Training in IMD)	10
III	Journal	
		15

References

1. Campbell, J. (2004), Introductory Cartography, Prentice Hall, Inc Englewood
2. Chorley, Richard. J. (ed.), 2001: Water, Earth and Man, Methuen & Co., London
3. Khullar.D.R. (2007), Essentials of Practical Geography, New Academic Publishing Co.,Jalandher
4. Misra, R.P. and Ramesh, A., 2009: Fundamentals of Cartography, Concept Publishing Co., New Delhi
5. Monkhouse, F.J. and Wilkinson, H.R., 2009: Maps and Diagrams, B.I. Publications Pvt. Ltd., New Delhi
6. Sarkar, Ashis (2000), Practical Geography: A Systematic Approach, Orient Longman Pvt. Ltd., Kolkata
7. Singh, R.L. and Singh Rana P.B., 2008, Elements of Practical Geography, Kalyani Publishers, New Delhi
8. Singh, R.L. and Singh Rana P.B.(2008), Elements of Practical Geography, Kalyani Publishers, New Delhi
9. Strahler, A.N., 2000: Physical Geography, 3rd Ed., Wiley.

ELECTIVE
Course Title: Geography of Soil Studies (THEORY)
Course Code: GEG-V.SE-9
Marks: 75
Credits: 3
Duration: 45 lectures of 1 hour each
==========

Course Objectives: This is a basic course that focuses on understanding of soil formation, development and distribution. They will also be equipped with basics of soil structure, composition, content and conservation practices.

Learning outcomes: On completion of this course, the students will be able to identify and differentiate between various soils profiles and types

This will develop understanding amongst students how different types of soil formations, characteristics and importance in agricultural practices.

Unit	Topic	No. of hours
I	**Introduction to soil:** Concept , soil formation Soil water dynamic, Factors affecting soil formation. **Soil structure, composition and classification:** Soil profile, Soil taxonomy, Sub-orders, groups, families, series, Texture	15
II	**Soil and organisms** - Organic matter of soil, Sources of organic matter – Biomass, Termites, worms, ants, algae, fungi, bacteria..., Carbon cycle – simple decomposition, Agricultural importance of soils - Nitrogen fixation	15
III	**Soil Conservation and management** Soil erosion, degradation and pollution, its sources and impacts : industrial, agricultural, e-waste, nuclear, urban waste, mining, deforestation, irrigation projects. Soil conservation and management practices traditional and modern Case studies- global# and local examples.	15

#-different examples every year

References:

1. Brady Nyle. (2002). The nature and properties of soil. MacMillan Publishing company, USA
2. Foth Henry. (1984). Fundamentals of soil science. John Wiley & Sons, Inc. USA
3. Munns Donald and Singer Michael. (1996). Soils – An introduction. Prentice-Hall Inc, New Jersey, USA
4. Lal R and Stewart B.A. (1990). Advances in soil sciences. Springer-Verlag New York.
5. White Robert. (2005). Principles and Practice of Soil Science: The Soil as a Natural Resource, 4th Edition. Wiley & Sons, Inc – Blackwell. USA

ELECTIVE
Course Title: Geography of Soil Studies (PRACTICAL)
Course Code: GEG-V.SE-9
Marks: 25
Credits: 1
Duration: 15 Sessions of 2 hours each
==========

Course Objectives: This is a basic practical course in soil studies that give emphasis on lab analysis of soil sample to understand the various properties of soil sample.

Learning outcomes: On completion of this course, the students will be able test the soil properties and quality of collected soil samples using various instruments and prepare lab reports.

Unit	Topic	No. of hours
I	Field visit component Sample preparation Moisture content Particle size analysis (density, porosity) Soil pH levels NPK level testing Carbonate testing	07
II	Spectro-photometric analysis of soil Quality control (trace element assessment) Permeability and erodibility tests Nutrient availability of soil Soil humus fraction	08
III	Journal	
		15

Reference:

1. Brady Nyle. (2002). The nature and properties of soil. MacMillan Publishing company, USA
2. Foth Henry. (1984). Fundamentals of soil science. John Wiley & Sons, Inc. USA
3. George Estefanm, Rolf Sommer, and John Ryan. (2013) Methods of Soil, Plant, and Water Analysis: A manual for the West Asia and North Africa region. Beirut, Lebanon
4. Head K.H. (1994). Manual of soil laboratory testing. John Wiley & Sons, Inc. USA
5. Munns Donald and Singer Michael. (1996). Soils – An introduction. Prentice-Hall Inc, New Jersey, USA

ELECTIVE
Course Title: Agrometeorology: Principles and Applications (THEORY)
Course Code: GEG-V.SE-10
Marks: 75
Credits: 3
Duration: 45 lectures of 1 hour each
==========

Course Objectives: This is a basic course that focuses on agrometeorology and its application in agriculture. This will help students to develop understanding of the physical and human interventions that affect agricultural systems and management practices.

Learning outcomes: On completion of this course, the students will be able to understand the role of climate in agricultural productivity. They will be exposed to use of geospatial technology in monitoring agricultural systems especially in the context of climate change.

Unit	Title	No. of hours
I	**Agrometeorology:** Perspectives and Applications: Definition and scope and development. **Solar Radiation and Its Role in Plant Growth:** The Source of Energy, Laws of Radiation, Earth's Annual Global Mean Radiative Energy Budget, Solar Radiation and Crop Plants, Solar Radiation Interception by Plants, Photosynthetically Active Radiation (PAR), Solar Radiation Use Efficiency **Environmental Temperature and Crop Production:** Soil and Air Temperature, Plant Injury Due to Sudden Changes in Temperature, Frost: Damage and Control, Thermoperiodism, Temperature As a Measure of Plant Growth and Development.	15
II	**Climatological Methods for Managing Farm Water Resources**- Water for Crop Production, Making Effective Use of Rainfall, Evaporation and Evapotranspiration, Water Use and Loss in Irrigation. Climatological Information in Improving Water-Use Efficiency (WUE), Reducing Water Losses from Reservoirs, **Drought Monitoring and Planning for Mitigation:** water budgeting, irrigation scheduling, Drought Monitoring and Planning for Mitigation. **Climate, Crop Pests:** Role of Weather and Climate, Some Important Insect Pests of Crop Plant.	15
III	Remote-Sensing Applications in Agrometeorology**.** Computer Models in Managing Agricultural Systems, Agro-climatological Services, Using Climate Information to Improve Agricultural Systems, Climate Change and Its Impact on Agriculture.	15
		45

REFERENCES

1. Grigg, David (2005) An Introduction to Agricultural Geography (2nd Ed), Routeledge, London and New York
2. G. Kathiresan (2015) Agrometeorology: A Simplified Textbook. New India Publishing Agency
3. G.S. Mahi & P.K. Kingra (2014): Fundamentals of Agrometeorology. Kalyani Publishers
4. Harpal S. Mavi and Graeme J.,Tupper (2004), Agrometeorology Principles and Applications of Climate Studies in Agriculture. The Haworth Press, Inc., Binghamton, NY.
5. Mavi H S (2003): Introduction To Agrometeorology. Oxford & Ibh
6. Rao and Prasada (2008) Agricultural Meteorology. PHI Learning PVT. LTD., New Delhi
7. Seemann, Jochen, Chirkov, Y. I., Lomas, J., Primault, B. (2012): Agrometeorology. Springer-Verlag Berlin and Heidelberg GmbH & Co. KG
8. SR Reddy & D.S. Reddy (2014) Agrometeorology. Kalyani Publishers
9. S. Venkatraman (2015): Principles and Practice of Agricultural Meterology. BS Publications.
10. WMO (2011), Agricultural Meteorology Guide to Climatological Practices World Meteorological Organization, Geneva.

ELECTIVE
Course Title: Agrometeorology Principles and Applications (Practical)
Course Code: GEG-V.SE-10
Marks: 25
Credits: 01
Duration: 15 sessions of 2 hours each
==========

Course Objectives: This course enables student to understand the role of insolation, rainfall, evapotranspiration in crop growth and development. The students will learn techniques of measurement in agrometrology.

Learning outcomes: On completion of this course, the students will able to independently analyze the interaction of solar radiation, temperature, rainfall, evapotranspiration using metrological and remotely sensed data.

Unit	Title	Practical sessions
I	Green leaf response to Electro Magnetic Radiation Photosynthetically Active Radiation (PAR) Solar radiation use efficiency Temperature and crop growth	07
II	Measurement of effective rainfall(using Huggins and Kassam water balance approach) Water balance, Measurement of evaporation and calculation of evapotranspiration irrigation scheduling for crops Analyzing the water deficiency (drought) , drought index Use of thermal data in drought monitoring	08
III	Journal	
		15

References

1. Don Ankerman; Richard Large (2013) Agronomy Handbook. Midwest Laboratories Inc., OMAHA, NE
2. Harpal S. Mavi and Graeme J. Tupper (2004), Agrometeorology Principles and Applications of Climate Studies in Agriculture, The Haworth Press, Inc., Binghamton, NY.
3. Indian Council of Agricultural Research (2011) Handbook of Agriculture, Indian Council of Agricultural Research
4. Rao and Prasada (2008) Agricultural Meteorology. PHI Learning PVT. LTD., New Delhi
5. WMO (2011), Agricultural Meteorology Guide to Climatological Practices World Meteorological Organization, Geneva.

ELECTIVE
Course Title: Field Survey in Physical Geography (THEORY)
Course Code: GEG-V.SE-11
Marks: 75
Credits: 3
Duration: 45 lectures of 1 hour each
==========

Course Objectives: The primary aim of this Course to introduce various surveying instrument used in Physical Geography. Students will learn the operation and the application of the instruments and methods of surveying.

Learning outcomes: At the end of this course students will be able to understand functions and applications of dumpy level, Plane table and Global Positioning Systems (GPS) in field based studies.

Unit.	Topic	No. of hours
I	Significance and Methods of Survey; Classification of Surveying; Fundamentals of Plane Table Survey: a) Radiation Method b) Intersection Method Pre survey work: Safety Measures, Field Book Preparation, Literature Survey, Sharing Responsibilities and Plan of Action Post field survey work: Data Processing Methods, Analysis, Mapping and Report Writing.	15
II	Dumpy level surveying : meaning, functioning elements, applications and Methods(Rise-fall and Collimation method) Profile drawing: Beach and River. Beach and River Morphology. Observation of slope, river and coastal morphology on toposheet. Pre survey and Post survey tasks.	15
III	GPS survey: Meaning, Space Segment, Ground Segment and GPS Receivers, Applications.	15
		45

REFERENCES

6. Campbell, J. (2004), Introductory Cartography, Prentice Hall, Inc Englewood
7. Khullar.D.R. (2007), Essentials of Practical Geography, New Academic Publishing Co.,Jalandher
8. Misra, R.P. and Ramesh, A. (2005), Fundamentals of Cartography, Concept Pub. Co., New Delhi
9. Monkhouse, I.J. and Wilkinson, H.R. (2009), Maps and Diagram, B.I. Publication, New Delhi
10. Sarkar, Ashis (2000), Practical Geography: A Systematic Approach, Orient Longman Pvt. Ltd., Kolkata
11. Singh, R.L. and Singh Rana P.B.(2008), Elements of Practical Geography, Kalyani Publishers, New Delhi

ELECTIVE
Course Title: Field Survey in Physical Geography (PRACTICAL)
Course Code: GEG-V.SE-11
Marks: 25
Credits:1
Duration: 15 Sessions of 2 hours each
==========

Course Objectives: The main objective of this course is to provide hands-on training in Plane Table, Dumpy Level and GPS survey.
Learning outcome: At the end of this course, students will be able to independently handle survey instruments and prepare maps and field reports.

Unit	Topic	Practical sessions
I	Plane table survey: a) Radiation Method :2 Exercises B) Intersection Method: 2 Exercises	07
II	Dumpy Level Survey: Rise-Fall and Collimation Method GPS Survey: Use of GPS in Mapping And Location Observation Of Slope, River and Coastal Morphology on Field	08
III	Journal /Field report	
		15

References

1. Campbell J. (2004), Introductory Cartography, Printice Hall, Inc Englewood
2. Khullar.D.R (2007), Essentials of Practical Geography, New Academic Publishing Co. Jalandher
3. Misra, R.P. and Ramesh, A. (2005), Fundamentals of Cartography, Concept Pub. Co., New Delhi
4. Monkhouse, I.J. and Wilkinson, H.R.(2009), Maps and Diagram, B.I. Publication, New Delhi
5. Singh, R.L. and Singh Rana P.B.(2008), Elements of Practical Geography, Kalyani Publishers, New Delhi
6. Sarkar, Ashis (2000), Practical Geography: A Systematic Approach, Orient Longman Pvt. Ltd., Kolkata.

ELECTIVE
Course Title: Quantitative Techniques in Geography (THEORY)
Course Code: GEG-V.SE-12
Marks: 75
Credits: 3
Duration: 45 lectures of 1 hour each
==========

Course Objectives: The focus of this course is to expose students to basic and advance statistical methods in geography in general**.**

Learning outcomes: On completion of this course students will able to test various statistical tools applied in earth science. Further they will be able to understand various stochastic models and forecasting methods in the discipline of earth science.

Unit	Title	No. of hours
I	Statistical Methods in Geography Basics of Sampling, Data Collection and Sample Design, Hypothesis Quantification and Prediction / projection, The Concept of Variable, Probability, Frequency Function.	15
II	Frequency Analysis and Simulation, Measure of Central tendency, Dispersion, Skewness and Kurtosis, Correlation and Regression, Chi Square(X^2)	15
III	Stochastic Modelling (Time Series Analysis) and Forecasting Processes, Autocorrelation, Moving Average. Spectral Analysis (Frequency Domain) Spectrum, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Maximum Entropy Method, Spectral Density and Entropy.	15
		45

REFERENCES

1. Pal S. K., 1998: Statistics for Geoscientists: Techniques and Application, Concept, New Delhi.
2. Sharma, D.D. (2008): Geostatistics with Application in Earth Sciences, Springer, with Capital Publishing Company, New Delhi, India.
3. Rogerson., P. A.(2001) : Statistical Methods for Geography. SAGE Pub. New Delhi
4. Spence, N. & Owens, A. (2011) :Methods of Geographical Analysis. University of London
5. Tomislav Hengl (2009): A Practical Guide to Geostatistical Mapping. The European Communities, Luxembourg

ELECTIVE
Course Title: Quantitative Techniques in Geography (Practical)
Course Code: GEG-V.SE-12
Marks: 25
Credits: 01
Duration: 15 sessions of 2 hours each
==========

Course Objectives: The focus of this course is to enable students to learn and apply basic and advance statistical methods in geography**.**

Learning outcomes: On completion of this course students will able to test and analyze various statistical tools applied in geography. Further they will be able to formulate hypothesis and prove it applying various stochastic models and forecasting methods in the discipline of geography.

Unit	Title	Practical sessions
I	Measure of Central tendency and Dispersion Mean (Z) Estimates for the Mean, Confidence Limits for the Mean Skewness and Kurtosis Correlation and Regression, Correlation Coefficient Hypothesis testing :The Chi-square (X^2) Test, Time Series Analysis and Forecasting	07
II	Spectral Analysis (Frequency Domain) Spectrum, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT) Maximum Entropy Method, Spectral Density and Entropy Stationarity and Intrinsic Hypothesis Variogram and Estimation Variance	08
III	Journal	
		15

Note : Only physical geography data should be used.

References

1. A. Stewart Fotheringham, Chris Brunsdon and Martin Charlton. (2000): Quantitative Geography Perspectives on Spatial Data Analysis. SAGE Publications Ltd
2. Rogerson, Peter A. (2015) Statistical Methods for Geography. (4th Ed) SAGE Publications Ltd
3. Sharma, D.D. (2008): Geostatistics with Application in Earth Sciences, Springer, with Capital Publishing Company, New Delhi, India.
4. Spence, N. & Owens, A. (2011) Methods of Geographical Analysis. University of London
5. Robert Hammond, Patrick McCullagh; (1974): Quantitative techniques in geography: an introduction. Clarendon Press,

SYLLABUS FOR AUTONOMOUS COURSES IN GEOGRAPHY
BACHELOR OF SCIENCE
SEMESTER VI

CORE
Course Code: GEG-VI.SC-8
Course Title: Ecology and Terrestrial Environment (THEORY)
Marks: 75
Credits: 3
Duration: 45 lectures of 1 hour each
==========

Course Objectives: The basic objective of this course is to introduce the concepts of terrestrial ecology which will help in sustainable management of the same.

Learning outcomes: At the end of this course, students are expected to have an understanding of Biomes, ecological factors and applications. They will be familiar with sustainable strategies for conservation of terrestrial ecology.

Unit	Title	No. of hours
I	**Biomes of the world:** • Biogeography: Species distribution, Historic effect of plate tectonics-past and present pattern of Biogeography • Meaning and Types of Biomes • Terrestrial Biomes : Tropical Rain Forest, Temperate Deciduous Forest, Savannah, Tundra, Desert •	15
II	**Factors controlling terrestrial ecosystem** • Soil : soil as an ecological factor, formation, profile, texture, • Water: Classification, properties of water as ecological factors: properties, composition, effect of rainfall and moisture on growth and distribution of plants and animals. • Temperature: ecological factor, range of temperature tolerance, effects on plants and animals, morphological and physiological adaptation in organism to change in temperature	15
III	**Threats to terrestrial environment and ecosystem** Population growth, Urbanization, Industrial growth, Military conflicts and Nuclear war, Natural hazard Mining, dams, land use changes	15
		45

References:

1. Dhaliwal GS, Sangha GS, Ralhan PK, 1996: Fundamentals of Environment Science, Kalyani Publishers New Delhi,
2. J.L Chapman and MJ Reiss, 1999: Ecology: Principles and Application, Second Edition, Cambridge University Press, UK
3. Kotpal RL, Bali NP, 1998: Concepts Of Ecology, Vishal Publication, Jalendhar
4. Purphit SS, Ranjan R, 2003: Ecology, Environment and Pollution, Agrobios (India) Publication, Jodhpur

CORE
Course Code: GEG-VI.SC-8
Course Title: Ecology and Terrestrial Environment (PRACTICAL)
Marks: 25
Credits: 1
Duration: 15 sessions of 2 hours each
==========

Course Objectives: The course aims to develop skills of field sampling, testing and analysis of water and soil and interpretation .

Le**arning outcome:** After the completion of this course, students will learn water and soil testing

Unit	Title	Practical sessions
1	• Soil sampling (Field work) • Soil Testing o Grain size analysis o Soil chemistry – pH **Organic matter and organic carbon:** Methods(Titration and Loss & ignition)	07
2	• Soil chemistry • pH testing • **organic matter and organic carbon:** Methods(Titration and Loss & ignition)	08
3	Journal and Viva	
		15

References :

1. Handbook of Applied Hydrology, Ven Te Chow, Ed., Section 4-II, McGraw-Hill Book Company, New York
2. King, C. A. M. (1966): Techniques in Geomorphology, Edward Arnold Ltd., London
3. Miller, A. A. (1953): The Skin of the Earth, Methuen and Co. Ltd., London
4. Monkhouse, F. J. and Wilkinson, H. R. (1971): Maps and Diagrams, Methuen and Co., London
5. Strahler, A. N. (1964): Quantitative Geomorphology of Drainage Basins and Channel Networks,

ELECTIVE
Course Code: GEG-VI .SE-13
Course Title: Remote Sensing of Forest Ecology
Marks: 75
Credits: 3
Duration: 45 sessions of 1 hours each
==========

Course Objectives: The objective of this course is to introduce the fundamental application of remote sensing in the forest ecology.

Learning outcome: Student will be able to appreciate the use of remotely sensed data in forest applications.

Unit	Title	No. of hours
1	**Remote Sensing of Forest Environments** Spectral Response of Vegetation. Measuring and monitoring: General Methods of Measuring Vegetation. Selecting a Measurement Method: Indirect Measurement of Forest Canopy Structure.	15
2	Measurement of Vegetation: Biophysical Measure, Timing of Measurements, Forest Structure and Composition, Species richness and composition	15
3	Modeling Forest Productivity Using Data Acquired Through Remote Sensing, Forest Information Extraction from coarse and medium Resolution Satellite Data. Selection of Remotely Sensed Data, Understanding Forest Dynamics	15
	Total	45

References

1. Adrian Newton (2007) Forest Ecology and Conservation, A Handbook of Techniques Techniques in Ecology & Conservation. Oxford New York
2. Hamlyn G Jones and Robin A Vaughan (2010) Remote Sensing of Vegetation Principles, Techniques, and Applications. Oxford University Press, Oxford.
3. Michael Wulder and Steven E. Franklin (2003) Remote Sensing of Forest. Environments, Concepts and Case Studies. (Ed) Springer, US.
4. Ned Horning, Julie A. Robinson, Eleanor J. Sterling, Woody Turner, and Sacha Spector (2010)
5. Remote Sensing for Ecology and Conservation, A Handbook of Techniques. Oxford University Press, Oxford.
6. Roger M. McCoy (2005) Field Methods in Remote Sensing. The Guilford Press, New York London.
7. Van Der Valk, Arnold (2009) Forest Ecology Recent Advances in Plant Ecology. Springer.

ELECTIVE
Course Code: GEG-VI .SE-13
Course Title: Practical in Remote Sensing of Forest Ecology (PRACTICAL)
Marks: 25
Credits: 1
Duration: 15 sessions of 2 hours each
==========

Course Objectives: To develop the skills of assessing forests using remotely sensed data products.

Learning outcome: At the end of the course student are expected to independently prepare forest map and interpret the forest dynamics.

Unit	Title	Practical sessions
1	**Measurement of Forest Canopy** Accuracy Assessment of forest map Per-Pixel Analysis of Forest Structure Extracting Individual Tree Information Tree Canopy structure Fragmentation metrics, Fragmentation Analysis	10
2	**Vegetation indices** • NDVI • Principal Component Analysis (method specify) • Mapping forest disturbances	5
		15

References

1. Adrian Newton (2007) Forest Ecology and Conservation, A Handbook of Techniques Techniques in Ecology & Conservation. Oxford New York
2. Hamlyn G Jones and Robin A Vaughan (2010) Remote Sensing of Vegetation Principles, Techniques, and Applications. Oxford University Press, Oxford.
3. Michael Wulder and Steven E. Franklin (2003) Remote Sensing of Forest. Environments, Concepts and Case Studies. (Ed) Springer, US.
4. Ned Horning, Julie A. Robinson, Eleanor J. Sterling, Woody Turner, and Sacha Spector (2010)
5. Remote Sensing for Ecology and Conservation, A Handbook of Techniques. Oxford University Press, Oxford.
6. Roger M. McCoy (2005) Field Methods in Remote Sensing. The Guilford Press, New York London.
7. Van Der Valk, Arnold (2009) Forest Ecology Recent Advances in Plant Ecology. Springer.

ELECTIVE
Course Code: GEG-VI.SE-14
Course Title: Advanced Coastal Geomorphology (THEORY)
Marks: 75
Credits: 3
Duration: 45 lectures of 1 hour each
==========

Course Objectives: The basic objective of this course is to introduce the process of coastal foration and coastal geomorphology of India. It's also introduces application of geo-spatial data which will help in understanding coastal processes.

Learning outcomes: At the end of this course, students are expected to develop the skill of understanding coastal processes by using GIS tools and methods.

Unit	Title	No. of hours
I	**Tectonic and coast** • Structural factors -Tectonic Coasts, Orientation of coastal tectonic movement, rates of coastal tectonic movement • Formation of coast • Structurally controlled coasts- Bold and Low coast • Coastal Process and sea-level fluctuations • Climatic factors	15
II	**Coastal Geomorphology of India:** • Indian coast- Extent & Topography Geology & structure of coastal zone, Evidence of emergence and submergence, • Shore features-Beach, Bar, Lagoons-lake, Delta, Estuaries, Coral reefs and islands • Classification of Indian coast	15
III	**Application of R.S in Coastal Studies:** Interpretation of coastal area: • Using SOI toposheet • Satellite images • Study of coastal problems: A case study	15
		45

References

1. Bloom. L. Arthur (2012):Geomorphology, Rawat Publication Delhi.
2. Ahamad.E (1972) Coastal geomorphology of India, Orient Longman Delhi.
3. Cooke R. U. and Doornkamp J.C. (1989): Geomorphology in Environmental Management, 2nd Edition, Oxford : Clarendon Press
4. Eric Bird (2000): Coastal Geomorphology: An Introduction, 1 edition, John Wiley & Sons
5. Gerhard Masselink , Michael Hughes :An Introduction to Coastal Processes and Geomorphology (Hodder Arnold Publication), ISBN-10: 0340764112 , ISBN-13: 978-0340764114
6. Kale, V. S. and Gupta, A. (Rep.2011): Introduction to Geomorphology, Orient Longman, Calcutta.
7. Karlekar, S. (2009): Coastal Processes and Landforms: Diamond Publications, Pune
8. Pethick J. (1995): Introduction to Coastal Geomorphology, John Wiley & Sons Inc.
9. Richard Davis Jr. , Duncan Fitzgerald : Beaches and Coasts, Wiley-Blackwell; 1st edition (July 15, 2004), ISBN-10: 0632043083 , ISBN-13: 978-0632043088
10. Timothy Beatley , Anna K. Schwab , David Brower (2002):An Introduction to Coastal Zone Management, Island Press; REV edition

ELECTIVE
Course Code: GEG-VI.SE-14
Course Title: Advanced Coastal Geomorphology (PRACTICAL)
Marks: 25
Credits: 1
Duration: 15 sessions of 2 hours each
==========

Course Objectives: The basic objective of this course is to introduce the GIS techniques which will help in understanding and evaluating coastal processes.

Learning outcomes: At the end of this course, students are expected to develop the skill of understanding coastal processes by using GIS tools and methods.

Unit	Title	Practical sessions
1	Demarcation of shoreline and tide level and coastal features using GIS software from satellite and SOI toposheet.	05
2	Case study of any coastal problems: Field work and use of GIS software	10
3	Journal and Viva	
		15

References:

1. Ahamad. E (1972) Coastal Geomorphology of India, Orient Longman Delhi.
2. Bloom. L. Arthur (2012):Geomorphology,Rawat Publication Delhi.
3. Cooke R. U. and Doornkamp J.C. (1989): Geomorphology in Environmental Management, 2nd Edition, Oxford : Clarendon Press
4. Eric Bird (2000): Coastal Geomorphology: An Introduction, John Wiley & Sons; 1 edition

ELECTIVE
Course Code: GEG-VI.SE-15
Course Title: Ecology of Estuarine Environment (THEORY)
Marks: 75
Credit: 03
Duration: 45 lectures of 1 hour each

Course objectives: This Course enables the study of estuaries and their unique ecosystems. It explores the features of estuarine ecosystem and analyzes the effects of anthropogenic activities on estuaries.

Learning outcomes: After the completion of this course, students will be able to understand the estuarine processes. They will be aware about anthropogenic effects on estuaries.

Unit No	Contents	No. of hours
1	**Physical attributes of Estuaries** • Concept and Significance. • Physical characteristics of estuaries • Classification of estuaries. • Environment in estuaries: mudflats, salt marsh, mangroves, salt pans • Sediment source, transportation and deposition in estuaries.	15
2	**Estuarine dynamics** • Tides and tidal currents in estuaries • Estuarine circulation and mixing. • Estuaries as sources of food for marine organisms and nurseries for marine organisms.	15
3	**Anthropogenic Effects on estuaries and mitigation** • Agricultural runoff. • Fishing • Urban development and Reclamation of land for development. • Recreational activities. • Ports and harbors	15
		45

References:

1. Dronker J and Leussen W.V (1988) Physical Processes In Estuaries, Springer Verlag Publishers. London
2. Dyer. K.R (1997) Estuaries- Physical Introduction, 2nd edition John Wiley and Sons, New York
3. Gade, Edward and Svendson(1982) Coastal Oceanography, Plenum Press London.
4. Nair N. B. and Thampy, D.M.: (1989), Textbook of Marine Ecology. Macmillan Publishers
5. Tait, R.V- (1982), Elements of Marine Ecology: An Introductory Course, 3rd Edition, Butterworth-Heinemann

ELECTIVE
Course Code: GEG-VI.SE-15
Course Title: : Ecology of Estuarine Environment (PRACTICAL)
Marks: 25
Credit: 01
Duration: 15 sessions of 2 hours each

Course objectives: this Course helps in developing the practical skills of studying estuarine ecology.

Learning outcomes: after the completion of this course, students will be able to independently test and analyze various parameters associated with estuarine ecology and suggest remedial measures for the protection f the same.

Unit No	Contents	Practical sessions
1	Mapping of estuaries from Indian coasts using SOI toposheets(any 3)	6
2	**Mapping of estuaries in Goa:** • LULC • Drivers for change	9
3	Journal and Viva	

References:

1. Dronker J and Leussen W.V (1988) Physical Processes In Estuaries, Springer Verlag Publishers. London
2. Dyer. K.R (1997) Estuaries- Physical Introduction, 2nd edition John Wiley and Sons, New York
3. Gade, Edward and Svendson(1982) Coastal Oceanography, Plenum Press London.
4. Nair N. B. and Thampy, D.M.: (1989), Textbook of Marine Ecology. Macmillan Publishers
5. Tait, R.V- (1982), Elements of Marine Ecology: An Introductory Course, 3rd Edition, Butterworth-Heinemann

ELECTIVE
Course Code: GEG-VI.SE-16
Course Title: Disaster Management: Urban and Coastal (THEORY)
Marks: 75
Credits: 3
Duration: 45 lectures of 1 hour each
==========

Course Objectives: The course aims give insights of basics and applications of landscape and disaster management.

Learning outcomes: This course will enable the students to understand the role of landscape in Urban and Coastal disaster management.

Prerequisite:
Students must have completed the course of Basics of remote sensing and GIS in SEM III.

Unit	Title	No. of hours
I	**Introduction to Disaster Management:** • Definition, Types, Concepts of Disaster Management • Importance of Disaster Management • Introduction to mitigation methods • Disaster Management Cycle • Indian Scenario **Natural Hazards & Landscapes:** • Types of landscapes & natural hazards • Distribution Pattern • Consequences • Mitigation measures	15
II	**Urban Landscape & Disaster Management:** • Understanding Risk of Urban hazard • Case study	15
III	**Coastal Landscape & Disaster Management:** • Understanding Risk of coastal hazards • Coastal risk, mitigation and planning. • Case study	15
		45

References:

1. Asian Development Bank, (2016), Reducing Disaster Risk by managing Urban Landuse-Guidance notes for planners, Metro Manila, Philippines
2. Ban Wisner, (2005), At Risk: Natural Hazards, People's Vulnerability and Disasters, Routledge
3. Chowdhury Emdadul. Haque, (2005), Mitigation of Natural Hazards And Disasters: International Perspectives, Springer
4. FitzGerald. M. Duncan, (2003), Beaches and Coasts, Blackwell Publishing
5. Natural Hazards and Disaster Management, (2006), A Supplementary Textbook in Geography for Class XI on Unit 11: Natural Hazards and Disasters, Published by: The Secretary, Central Board of Secondary Education, 2, Community Centre, Preet Vihar, Delhi-110092
6. Vernberg. F. John, Vernberg. Winona B, (2001), The Coastal Zone: Past, Present, and Future, University of South Carolina Press

ELECTIVE
Course Code: GEG-VI.SE-16
Course Title: Practical in Disaster Management: Urban and Coastal (PRACTICAL)
Marks: 25
Credits: 1
Duration: 15 sessions of 2 hours each
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Course Objectives: This practical course aims to equip student with the techniques of vulnerable hazard zone delineation in local and regional landscape.

Learning outcomes: Student will be able to demarcate the risk prone sites and potential disasters in local and regional landscape.

Prerequisite:
Students must have completed the course of Basics of remote sensing and GIS in SEM III.

Unit	Title	Practical sessions
I	1. Mapping Flood risk area 2. Mapping Landslide and Erosion prone sites 3. Mapping Rock fall prone sites	07
II	4. Mapping the urban land surface temperature (Urban Heat Islands) 5. Risk sensitive land use map 6. Calculating permissible density of hazards.	8
	Journal	
		15

References

1. Asian Development Bank, (2016), Reducing Disaster Risk by managing Urban Landuse-Guidance notes for planners, Metro Manila, Philippines
2. Ban Wisner, (2005), At Risk: Natural Hazards, People's Vulnerability and Disasters, Routledge
3. Chowdhury Emdadul. Haque, (2005), Mitigation of Natural Hazards And Disasters: International Perspectives, Springer
4. FitzGerald. M. Duncan, (2003), Beaches and Coasts, Blackwell Publishing
5. Natural Hazards and Disaster Management, (2006), A Supplementary Textbook in Geography for Class XI on Unit 11: Natural Hazards and Disasters, Published by: The Secretary, Central Board of Secondary Education, 2, Community Centre, Preet Vihar, Delhi-110092
6. Vernberg. F. John, Vernberg. Winona B, (2001), The Coastal Zone: Past, Present, and Future, University of South Carolina Press