

Syllabus for M.A. / M.Sc. Geography

PREPARED IN 2019: EFFECTIVE FROM THE ACADEMIC SESSION 2019-2020



Department of Geography
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Division of Marks

Total marks: 1100 (Core) + 100 (Elective)

For Internal Students				Elective
Semesters	Theoretical	Practical	Total	Total
Semester- I	200	100	300	-
Semester- II	150	100	250	50
Semester- III	150	100	250	50
Semester- IV	200	100	300	-
Total	700	400	1100	100

Structure of Syllabus

Semester-I (Duration: July – December)

Types	Paper	Units	Marks			Credit	Total Class Hours	
			End-term Exam.	Internal Exam.	Unit Total			Paper Total
Theoretical	Paper-101	Unit-1:Geotectonics	20	5	25	4	60 hours	
		Unit-2 :Geomorphology	20	5	25			
	Paper-102	Unit-3: Hydrology & Water shade Management	20	5	25	50	4	60 hours
		Unit-4 : Oceanography	20	5	25			
	Paper-103	Unit-5: Soil Geography	20	5	25	50	4	60 hours
		Unit-6: Biogeography	20	5	25			
	Paper-104	Unit-7:Climatology	20	5	25	50	4	60 hours
		Unit-8: Natural Hazard &Disaster Management	20	5	25			
Practical	Paper-105	Unit-9:Basic Statistics In Geography	25	-	25	50	4	60 hours
		Unit-10:Remote sensing (Visual)	25	-	25			
	Paper-106	Unit-11:Hydrological Techniques	25	-	25	50	4	60 hours
		Unit-12:Term Paper(Issues from Physical or Human Geography – Library based assignment work)	25	-	25			

Semester-II (Duration: January – June)

Types	Paper	Unit	Marks				Credit	Total Class Hours	
			End-term Exam.	Internal Exam.	Unit Total	Paper Total			
Theoretical	Paper-201	Unit-13: Settlement Geography	20	5	25	50	4	60 hours	
		Unit-14: Urban Geography	20	5	25				
	Paper-202	Unit-15: Economic Geography & Industrial Development	20	5	25	50	4	60 hours	
		Unit-16 : Trade & Transport Geography	20	5	25				
			Special Paper						
	Paper-203	Unit-17: Special Paper			25	50	4	60 hours	
		Unit-18: Special Paper	20	5	25				
			Elective Paper(CBCS)						
	Paper-204	<u>Unit-19: Basics of Environment</u>	20	5	25	50	4	60 hours	
		<u>Unit-20 : Environmental pollution: Issues & Policies</u>	20	5	25				
Practical	Paper-205	Unit-21: Computer Application And Numerical Data Processing	25	-	25	50	4	60 hours	
		Unit-22: Environmental Mapping	25	-	25				
	Paper-206	Unit-23: Digital image processing & GIS	25	-	25	50	4	60 hours	
		Unit-24: Hydro-geomorphological Techniques	25	-	25				

Semester-III (Duration: July – December)

Types	Paper	Unit	Marks			Paper Total	Credit		
			End-term Exam.	Internal Exam.	Unit Total				
Theoretical	Paper-301	Unit-25: Unit-1: School of Geographical Thought	20	5	25	50	4	60 hours	
		Unit-26: Contemporary Discourses In Geography	20	5	25				
	Paper-302	Unit-27: Land Water Forest: Concepts, Conflict, Conservation	20	5	25	50	4	60 hours	
		Unit-28 : Food and Agricultural Geography	20	5	25				
				Special Paper					
	Paper-303	Unit-29: Special Paper: Fluvial Geomorphology	20	5	25	50	4	60 hours	
		Unit-30: Special Paper: Fluvial Geomorphology	20	5	25				
				Elective Paper(CBCS)					
	Paper-304	Unit-31: Geography of West Bengal	20	5	25	50	4	60 hours	
		Unit-32 : Geography of Tourism	20	5	25				
Practical	Paper-305	Unit-33: Advance Quantitative Techniques	25	-	25	50	4	60 hours	
		Unit-34: Physical Thematic Mapping	25	-	25				
	Paper-306	Unit-35: Field Report Preparation (special paper)	25	-	25	50	4	60 hours	
		Unit-36: Viva on Field Report (special paper)	25	-	25				

Semester-IV (Duration: January – June)

Types	Paper	Unit	Marks				Credit	Total Class Hours
			End-term Exam.	Internal Exam.	Unit Total	Paper Total		
Theoretical	Paper-401	Unit-37: Regional Development And Planning	20	5	25	50	4	60 hours
		Unit-38: Landscape Ecology And Planning	20	5	25			
	Paper-402	Unit-39: Social & Cultural Geography	20	5	25	50	4	60 hours
		Unit-40 : Contemporary Issues In Geography	20	5	25			
	Paper-403	Unit-41: Population & Welfare Geography	20	5	25	50	4	60 hours
		Unit-42: Political Geography and globalisation	20	5	25			
	Paper-404	Unit-43: Regional Geomorphology of India	20	5	25	50	4	60 hours
		Unit-44 : Physical, Human and Regional Development of Paschimanchal, W.B.	20	5	25			
Practical	Paper-405	Unit-45: Research Methodology	25	-	25	50	4	60 hours
		Unit-46: Research Exercise in Geography [Field is optional]	25	-	25			
	Paper-406	Unit-47: Spatial Analysis in Geography	25	-	25	50	4	60 hours
		Unit-48: Socio-Cultural Thematic Mapping	25	-	25			

SPECIAL PAPERS: 1. Environmental Geography 2. Fluvial Geomorphology 3. Remote Sensing and GIS

Outcome of the academic programme on M.A. / M.Sc. in Geography

1. Fostering the ability of the students to encounter practical problems with theoretical knowledge in Geography and Environment.
2. Promotion of research aptitude and field work aptitude as well as laboratory based practical works for the students of Geography.
3. Capacity enhancement of the students in spatial mapping on digital platform for the Geographical research and studies.
4. Orientation of the students of Geography to develop competitive examinations aptitude among them including NET / SET/ and other professional jobs.
5. Preparing students for Higher Academic programmes for institutes of National and International repute.
6. On completion of the M.A./M.Sc in Geography, students are able to get absorbed in various Govt Departments (like planning and developmental commissions, forestry, environmental, and disaster management departments) travel agencies, manufacturing firms, etc. They can be cartographer (NATMO), surveyor (Survey of India), GIS and Remote Sensing experts, environmental planner, Environment Reporter, urban and regional planner, transportation manager, Teacher/Professor etc.

Semester- I (300 Marks)

THEORETICAL COURSES (200 Marks)

PAPER GEO-101: Geotectonic and Geomorphology

Unit: 1- Geotectonic

Course objectives and expected outcome:

The focus of this course is to give an in-depth concept on the fundamental physical laws towards understanding the initial phases of the early universe with special reference to the Earth and the Moon. It also focuses on the basic understanding of the genesis of the Earth's magnetic field and palaeomagnetism that will enhance the understanding about the Earth's geological history and theories about the continental drift and sea floor spreading. The course is also designed to have some advanced level of understanding of the absolute dating techniques to find the ages of geological formation. It also includes the processes and mechanisms of mountain building. All these concepts and techniques will surely enhance the ability of the students for critical analysis and thereby synthesis of the Earth's system process. The completion of this course will give impetus to the research insights for the students who would like to pursue their future carrier in geosciences.

1. Origin of earth's magnetic field, paleomagnetism: evidences and impact.
2. geological time scale: dating of rocks: principles and techniques
3. Mechanism of plate dynamics. Application of plate tectonic theory in explaining orogenesis, volcanism, earthquake.
4. Neotectonics and its worldwide evidences: Post Pleistocene age
5. Tsunami and its genesis

Unit: 2 –Geomorphology

Course objectives and expected outcome:

Students will learn about the mechanism and working principle of processes that lead to shape present earth-surface. Field demonstration on process-form relationship help in concretizing ideas. This understanding may help in formulating hydrological, geologic and economic planning. Learners may take part in hazard management too.

1. Fundamental concepts in geomorphology.
2. Theory of Land Form Evolution: L.C.King, Chorley Schumme
3. Slope Evolution: process-form relationship on slope elements, theories of Wood, King, and Savigear.
4. Morphogenetic regions, concepts, process& Peltiers model
5. Interruption in fluvial cycle: causes & landforms.

PAPER GEO-102: Hydrology and Water Management and Oceanography

Unit: 3 Hydrology and Water Management

Course objectives and expected outcome:

Students will learn about the working principle of earth system processes that lead to water availability and necessity for water management in the context of global climatic change. This understanding may help in water budgeting and formulating plan for water use and water management. Learners may take leading role in awareness generation among community for rain water harvesting and judicial water use.

1. Hydrological systems, estimating water potential, water budgeting at watershed level. Hydrologic frequency analysis (Gumbel's equation and log probability law).
2. Precipitation estimates: point rainfall analysis, area-depth curve, theissen network and isohyetal method for estimating rainfall volumes.
3. Infiltration and evapotranspiration: soil-vegetation complex and infiltration estimates. Methods of estimating evapotranspiration.
4. Basic concepts of water shade, introduction to watershade management,

Unit: 4- Oceanography

Course objectives and expected outcome:

The students will be able to understand the marine environment and oceanographic processes that leads to earth system processes. They can extend their ideas in understanding environmental and climatic processes too. An aptitude on the distribution of marine resources as well as their utilization and possible impact are also developed among the students.

1. Wave and tide genetic classification & mode of formation.
2. Coastal Habitats: Estuaries, lagoons, salt marshes, mangrove swamps, coral reefs- origin, circulation, sedimentation and ecology.
3. Marine Environment and Processes: Major subdivisions of the marine environment, dynamics of shoreline :coastal water movement.
4. The Ocean's Resources: Law of the sea, law of the sea treaty, exclusive economic zones, mineral resource- oil and natural gas, gas hydrates, sand and gravel, mangrove nodules, cobalt-rich oceanic crusts, phosphate deposits, living resources
5. Sealevel change: types,causes&implications

PAPER GEO-103: Soil Geography And Biogeography

Unit : 5- Soil Geography

Course objectives and expected outcome:

Learners will understand about functional integration of various process that results in formation and distribution of different types of soil and their implication of agricultural systems. They will be able to achieve integrated knowledge on soil and landscape. They will develop special aptitude on soil survey techniques to analyse patio-temporal distribution of agricultural systems.

1. Soil profile: characteristics of different soil profile
2. Bio-functions of Soil; Soil organic matter, Soil organisms and Micro-organisms and their relation with soil fertility.
3. Soil mineralogy and Soil nutrients; Role of physico-chemical properties in soil fertility and productivity.
4. Soil degradation and pollution: causes, processes and consequences; Preventive, ameliorative and conservation measures.
5. Soil taxonomic classification: USDA

Unit: 6 Biogeography

Course objectives and expected outcome:

Students will get a comprehensive understanding about the plant species, process of degradation and regeneration of plants, animal dispersal. It also provides practical knowledge about the wildlife management strategies of India.

1. Phytogeographical regions, concept of plant species, family and genera, taxonomy.
2. Concept of degradation and regeneration of plants.
3. Dispersal of animals in different geological periods
4. Wildlife management practiced in India with special reference to sanctuaries.
5. Principal of physical and human ecology ; ecosystem model

PAPER GEO-104: Climatology And Natural Hazard & Disaster Management

Unit : 7 Climatology

Course objectives and expected outcome:

The course deals with the basic understanding of the climate system. The fundamental physics of surface pressure distribution, the general circulation model and sea surface temperature (SST) variation will allow students to get insights to the space-time scale variation of weather and climate. Students will understand the weather and climatic processes working on earth and this understanding will help them to assess and predict the weather phenomena and its related hazards. Through this understanding, they can take part in hazard and disaster management programmes.

1. Classification Sources, origin, modification of air mass
2. The General Circulation: GCM, Tropical circulation- mechanism of Indian monsoon, Walker circulation and ENSO phenomena, Temperate Circulation.
3. Climatic changes through geological periods- evidences and possible causes; Global Warming- Natural and anthropogenic causes and probable consequences.
4. Meteorological and climatic hazards and disasters : Cyclones, Thunderstorms, Tornadoes, Cloud Burst.
5. Approaches and techniques of weather forecasting with reference to the tropics: short, medium, and long range

Unit : 8 Natural Hazard & Disaster Management

Students will foster their skill in managing various types of natural hazards by analysing their risk and vulnerability. They will be trained in the procedures of hazard management through proactive approach by increasing the resilience of the community in tune with national policy of hazard management and international laws.

1. Hazard, Risk, Disaster, Vulnerability and Resilience Capacity: concept and Paradigm shift.
2. Hydro-Metrological Hazard ,cyclone and Storm surges, Drought and Desertification: impact and management.
3. Earthquake Hazard and Tsunami Disasters: Consequences and Management.
4. Natural Hazard and Disaster Management in India.
5. A Social Perspective on Natural Disaster Management and Planning; Other Disaster (Disease as Disasters)

PRACTICAL COURSES (100 marks)

PAPER GEO-105: Basic Statics In Geography And Remote Sensing (Visual)

Unit: 9 Basic Statics in Geography

Course objectives and expected outcome:

The course, split into two units, corresponds to the basic and advance statistics, is a starting point of escalating the statistical analytical skills. It includes the founding concepts of probability distribution including the advanced linear modelling with matrix solution to the multivariate linear and non-linear model. These concepts are essential for augmenting the analytical skills of any beginner in Geography that includes both physical and social aspects of academic discipline. Upon completion of this course, the students get the benefit of having a strong mathematical and statistical analytical skills.

1. Measurement in Geography: Nominal, ordinal, interval and ratio measurement. Scaling Techniques: Rank Score, Weighted Score, Likert's Opinionnaire
2. Concept of covariance, correlation and regression: Bi-variate analysis - linear, exponential, Product moment correlation, Spearman's Rank correlation, correlation matrix, partial correlation, residuals - mapping of residuals.
3. Probability distribution: addition and Law of multiplication, concept of probability distributions (binomial distributions, normal probability distribution), properties of normal curve.
4. Hypothesis testing: Formulation, Rejection rule, one and two tailed tests, significance level, degrees of freedom type I and type II errors, Standard Error. Different types of significance test for various purposes. Chi- square test, shortest path analysis, student's t- test, Z test
5. Sampling techniques for geographical analysis.

Unit: 10 Remote Sensing (Visual)

Course goal and expected outcome:

The course content is focused on basic understanding of satellite remote sensing. Basic principles of satellite motion and sensor parameters help the students to formalize with the modern space based analytical techniques. Upon completion of this course, the students will get benefit from rigorous practice and comprehensive theories.

1. Physics of Remote Sensing: Electro Magnetic Radiation (EMR), Radiation laws (wavelength-frequency-energy relationship of EMR numerical problems).
2. Satellite Sensors: Concept of IFOV, resolution and determination of pixel size, referencing scheme of satellite system (path/row calculation).
3. visual interpretation of satellite images

PAPER GEO-106: Hydrological Techniques and Term Paper

Unit:11 Hydrological Techniques

Course objectives and expected outcome:

Students will develop skills in application of theoretical knowledge of hydrology. They will learn on field as well as laboratory techniques for estimating different hydrological attributes as for example rainfall, run off, infiltration etc. in order to construct water budget. Students are enabled to analyse magnitude frequency of different hydrological hazards like flood and droughts and their social and economic applications. This knowledge will help them in formulating various hydrological projects and their successful management.

1. Point rainfall analysis, area-depth curves, Thiessen network and Isohyetal methods to determine rainfall volumes.
2. Estimating infiltration using infiltrometre and other field techniques. Drawing infiltration curve.
3. Evaporation estimation: Use of evaporation pan and empirical equations using climatic data.
4. Runoff and discharge estimation: Curve Number methods for estimating runoff: area-velocity method for discharge estimate & Estimation of Evapotranspiration
5. Construction of unit-hydrograph and rating curves.

Unit-12: Term Paper

Course objectives and expected outcome:

The aim of the course is to develop the ability to discuss, describe and explain an issue related to different geographical topics and also build up their writing skill.

Issues from Physical or Human Geography: Library Based Assignment Work

Semester- II (300 Marks)
THEORETICAL COURSES (200 Marks)

PAPER 201: Settlement & Urban Geography

Unit – 13: Settlement Geography

Course objectives and expected outcome:

The primary aim of studying settlement geography is to acquaint with the spatial and structural characteristics of human settlements under varied environmental conditions. The paper deals with multi disciplinary perspectives on the formation, evolution of human settlement. The paper will help the students to make an understanding on the reasons people settle in certain locations and the geographical features lead to the development of civilizations. The Nature and Scope of Settlement Geography, Characteristics of Rural and Urban Settlements according to Indian Census and nature, scope, evolution and several study methods. The settlement types, pattern and nature and process of urban settlement ,different cultural landscapes

1. Evolution of the concept of shelter; Settlement types: on the basis of census category ,shape and locations.
2. Traditional rural house types: Origin, evolution & characteristics, roof and building materials
3. Architectural design of houses and dependence on climate and its recent trends
4. Site, situation and spacing of settlements – dependence on terrain characteristics and water availability
5. Transformation and planning of Indian villages: models and plans

Unit – 14: Urban Geography

Course objectives and expected outcome:

This paper will provide knowledge on spatial analysis of functions of urban areas. Social and economic characteristics of cities and suburbs will be discussed under this paper. Urban land use and its impact on environment and ecology will be addressed. This paper will introduce students to the basics of urban geography, such as definition of cities, central place theory, National urban systems, and traditional models of urban spatial structure. More importantly, students will be exposed to contemporary urban topics such as global cities, urban sprawling, urban green space, urban ecology and footprints etc. Emphasis will be placed on the urban experience of developing countries, especially India. The students will be able to assemble knowledge of urbanism and urbanization as historic, geographic, social, and cultural processes, historical development, contemporary condition, and environmental impact of cities and urban related issues growing from exposure to the disciplines of Geography and Planning

1. Recent trends in urban geography; concepts of urban place, urbanisation, urbanism and urban ecology
2. Characteristics of Pre industrial ,industrial and modern cities; Functions and functional classification of towns
3. Urban landuse and functional morphology: Burges, Hoyt, Harris & Ullman
4. Size and spacing of cities: Rank-size rule; Law of the primate city; urban hierarchies; Central Place Theory (Christaller & Losch)
5. Challenges and issues of Indian urbanisation: urban sprawling, slum, pollution ;India's Urban Policy(1986).

PAPER 202: Economic Geography & Industrial Development and Trade & Transport Geography

Unit – 15: Economic Geography & Industrial Development

Course objectives and expected outcome:

Students will be aware about the different global economic policies, scenario etc. They will also learn about the industrial policies of India and different economic zones of India.

1. Scope and content of economic geography; Economic geography in the era of globalisation: changes and recent trends
2. World economic order: Economic boom and crisis (Kuznetz's model)
3. Classification of industries, Theories of industrial location (A. Losch, D.M. Smith & A. Pred)
4. Industrial policy of India; Role of liberalisation, privatisation and globalisation
5. Industrial regions of India: Special Economic Zone (SEZ), Exclusive Economic Zone (EEZ), Industrial complex and Industrial hubs ,MSME and craft development.

Unit – 16: Trade & Transport Geography

Course objectives and expected outcome:

Students will learn about the role of transport in entire economic and social processes. This course aims to make students understand the locational advantage of different economic and social institutes based on transport principle. They are made aware of the role of public transport in addressing the problems of congestion and air pollution. This understanding may help them in formulating plan for regional development and economic regeneration by proper transport planning.

1. Concept of distance, Transportation and space, space-time relation through transportation, Models of Transportation: Railways, Roads, Airways and waterways.
2. Transport network analysis: Centrality, Accessibility, Connectivity; **Transportation Models**, Traffic congestion Model
3. Transport cost, Principles of transport cost fixation, comparative cost advantage by different modes.
4. National transport policy and development in India: National Highways and Golden Quadrilateral, State and District Roads, Pradhan Mantri Gram Sadak Yojana, National Freight corridor, Green corridor.
5. Regional blocks in international trade: SAARC, OPEC, EU

PAPER 203: Fluvial Geomorphology (Special Paper)

Unit – 17: Fluvial Geomorphology –

Course objectives and expected outcome:

Students will learn about the mechanism and working principle of geomorphic processes in details that lead to shape present earth-surface. This understanding may help in formulating engineering plan for management of land, water and soil, three basic resources on earth surface.

1. Fluvial Geomorphology: Concept and evolution of fluvial geomorphology, Contribution of Indian geomorphology
2. Open channel flow: mechanism, hydraulic relations, types and factors
3. Concept of channel equilibrium, Graded stream, Re-graded stream; Base level of erosion – types, change and consequences
4. Channel migration: evidences, causes and consequence; Concept of palaeo channel
5. Empirical and genetic model of drainage pattern

Unit – 18: Fluvial Landforms

Course objectives and expected outcome:

Students will learn about origin and process of formation of different geomorphological landforms of India and they also come to know their importance.

1. Morphological characteristics of Alluvial terraces with special reference to Tista River Basin.
2. Morphological characteristics of Alluvial Fan with special reference to Kosi River basin.
3. Morphological characteristics of Flood plain with special reference to Brahmaputra River Basin.
4. Morphological characteristics of Delta Plain with special reference to Lower Ganga Basin.
5. Badland Morphogenesis: Components, factors, processes and evolution.

PAPER- 204 Basic of Environment and Environmental pollution: Issues and Policies

Unit- 19: Basic of Environment

Course objectives and expected outcome:

The living things interact with each other in various ways and with the non-living components that make up the environment in which we live. These non-living components include rocks, soils and water, as well as the atmosphere. All these interactions produce a complicated set of interrelationships and these interrelationships can take many forms. Thus, this paper on basics of environment and ecology prepares students for careers as leaders in understanding and addressing complex environmental issues from a problem-oriented, interdisciplinary perspective. Ecology is a scientific way of thinking about the world. This means that it involves a certain way of investigating, studying and writing about the systems. Student can learn the core concepts and methods from ecological and environmental perspectives and their application in environmental problem solving.

1. Approaches to study of environment and its recent trends, Type of environment.
2. Concept of ecosystem and its classification.
3. Function of Ecosystem: Trophic level, Energy flow, Bio-chemical cycle (Carbon, Nitrogen, and Geochemical), Food chain, Food web and Ecological pyramid.
4. Concepts of biome and biomass, Classification of biomes, Geographical distribution and characteristics of equatorial rainforest and temperate grass land.
5. Environmental ethics and its significance.

Unit- 20: Environmental pollution: Issues and Policies

Course objectives and expected outcome:

Students will learn about the necessity and mechanism of waste water treatment and understand the procedures to manage land, air and noise pollution. This course aims to enable the learners to participate in making of pollution free environment. This fundamental understanding and knowledge help them to get engaged in various non-government and government initiatives in this regard.

1. Fundamental concepts: Pollution, pollutants, Pollution sink, Ecological foot print.
2. Environmental pollution, causes and consequence: Air, Water and Land.
3. Measurement of environmental contaminants based on WHO, BIS: Drinking water, Ground water, Air.
4. Biodiversity: Issues, vulnerability and conservation (IUCN)
5. National policies on environmental conservation.

PAPER- 205 Computer application and Numerical data processing and Environmental mapping

Unit- 21: Computer application and Numerical data processing

Course objectives and expected outcome:

The course is designed to get a comprehensive knowledge of fundamentals of computer application. It also includes the exercise from Microsoft excel and SPSS regarding the basic statistical computation. The course, therefore, lay the foundation for software-based computing skills. Upon completion, the students get adequate level of skills to do statistical analysis.

1. Computer components: Hardware and software: CPU, Input and Output devices; Common computer languages, System Software, Application Software and Operating Systems.
2. Representation of data; Numbering Systems; Binary Arithmetic; Basic Logic Gates; Boolean Logic.
3. Computation, Storing and Formatting Spreadsheets: Computation of Rank, Mean, Median, Mode, Standard Deviation, Sample Variation, Correlation, Covariance, Selection of technique and interpretation using MS-Excel.
4. Fitting the trend line: Bivariate regression (Scatter diagram), Time series analysis (Moving average).
5. Preparation of power point presentation through data mining from internet.

Unit-22: Environmental mapping

Course objectives and expected outcome:

Students will develop cartographic skills for constructing various thematic maps and foster their abilities in showing the spatial distribution of various environmental elements and their proper interpretation. This ability will help them to formulate environmental plans and to manage and conserve vegetation, soil, water etc.

1. Concept of environmental mapping and its significance.
2. Sampling technique, data preparation, and mapping technique of environmental parameters.
3. Surface and ground water quality mapping and interpretation.
4. Air quality mapping and interpretation.
5. Soil mapping and interpretation.

PAPER- 206 Digital image processing and GIS and Hydro-morphological techniques

Unit-23: Digital image processing and GIS

Course objectives and expected outcome:

The course is designed for the general ideas of GIS and image-based information. Upon completion of this course, students get benefit from these baseline concepts to further increase their knowledge.

1. Digital Image Processing: Pre-processing, Image Registration, Image geometric operations, Enhancement, Spatial filtering, Transformation, classification, data compression, spectral pattern recognition, output generation.
2. Digital image classification technique-supervised, unsupervised and interpretation.
3. Basic Concepts and components in GIS: An overview of the development of the GIS fields, Data Sources; Data acquisition methods.
4. Data structure: Vector and Raster data structures, data storage.
5. Creation of Vector layer: Point, Line and Polygon features.

Unit -24: Hydro-Morphological Technique

Students will be skilled to identify basin morphological characters in the field and come to know about the importance of drainage network analysis and its practical applications. They will also become skill-full in determining of pebble and sediment analysis and handling of different field instruments.

1. Basin morphometry: Form factor, Circularity ratio, Compactness co-efficient, Elongation ratio, Relief ratio.
2. Drainage network analysis: Stream ordering (after Horton 1945, A.N. Strahler,1964, R.L. Shreve 1967), Bifurcation ratio, Law of stream length, sinuosity Index (Schumm's model, Muller's Model), drainage texture analysis, Length of overlay flow, Constant of channel maintenance.
3. Analysis of pebble and Sediment: Shape Indices and textural analysis by Seiving.
4. Determination of discharge by using equipments: Total Station, Fish-finder, Flow meter, Calculation of velocity and discharge using Manning equation.
- 5.** Preparation of River bank erosion map and vulnerable zone with the aid of GPS and GIS techniques.