CENTRE FOR INTEGRATED MOUNTAIN RESEARCH
UNIVERSITY OF THE PUNJAB QUAID-E-AZAM CAMPUS,
LAHORE –54590, PAKISTAN

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M.Sc. Mountain Conservation and Watershed Management (MCWM)
Part – I Annual Examination 2010

S_Code	Subject Name	Marks			
		Theory	**Practical**	**Project**	**Total**
I	Database Management Information System & Applications of Remote Sensing and Geographical Information System (DBMS & RS/GIS)	75	25	50	150
II	Forestry and Ecology (FE)	100	-	-	100
III	Integrated Watershed Management (IWM)	100	-	-	100
IV	Mountain Environment (ME)	100	-	-	100
V	Soil and Water Conservation (SWC)	100	-	-	100
VI	Mountain Hazards & Disaster Management (MHDM)	100	-	-	100
					Total Marks 650

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M.Sc. Programme

M.Sc. MCWM (Mountain Conservation and Watershed Management) Programme consists of two parts Part-I and Part-II. The regulations, Syllabi and Courses of Reading for the M.Sc. (MCWM) Part-I and Part-II (Regular scheme) are given below.

Regulations

The following regulations will be observed by M.Sc. (MCWM) regular students.

i. There are a total of 1200 marks for M.Sc. (MCWM) for regular students as is the Case with other M.Sc. subjects.

ii. There are six compulsory papers in Part-I. Paper 1 of Part-I carry 150 marks with marks division as 75 marks for theory paper and 75 marks for practical paper (Practical + viva 25 marks, Project report + Demo 50 marks).While all other papers of Part-I carry 100 marks.

iii. There are three compulsory papers in Part-II. Paper 1 of Part-II carry 150 marks with marks division as 75 marks for theory paper and 75 marks for practical paper (Practical + viva 25 marks, Project report + Demo 50 marks). Paper 2 of Part-II carry 100 marks with marks division as 75 marks for theory paper and 25 marks for practical paper. Where as paper III of part-II carry 100 marks.

iv. In Part-II students will also submit a Research Project of 200 marks on any topic from the provided optional course list or on any other issue after consultation and approval of the Director, CIMR.

M.Sc. Part-I

The following six papers shall be studied in M.SC Part-I:

Paper-1 **Database Management Information System & Applications of Remote Sensing and Geographical Information System (DBMS & RS/GIS)**

Section-I: Database Management Information System

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Section-II: Applications of Remote Sensing and GIS.

Paper-2 **Forestry and Ecology (FE)**

Section-I: Ecology and Biodiversity

Section-II: Forestry

Paper-3 **Integrated Watershed Management (IWM)**

Section-I: IWM

Section-II: Hydrology of Uplands

Paper-4 **Mountain Environment (ME)**

Section-I: Mountain Climate

Section-II: Mountain Environment

Paper-5 **Soil and Water Conservation (SWC)**

Section-I: Soil and Water Conservation

Section-II: Water Resources of Pakistan

Paper-6 **Mountain Hazards & Disaster Management (MHDM)**

Section-I: Geomorphology of Pakistan

Section-II: MHDM

Note: All the papers of M.Sc. Part-I given above are compulsory.

M.Sc. Part-II

The following three compulsory papers shall be studied in M.SC Part-II:

Paper-1 **Database Management Information System & Applications of Remote Sensing and Geographical Information System (DBMS & RS/GIS)**

Section-I: Database Management Information System

Section-II: Applications of Remote Sensing (RS) and Geographical Information System (GIS)

Paper-2 **Sustainable Development (SD)**

Section-I: Eco Tourism

Section-II: Sustainable Development & Natural Resources Management

Paper-3 **Environmental Impact Assessment and Research Methods and Techniques (EIA & RMT)**

Section-I: Environmental Impact Assessment (EIA)

Section-II: Research Methods and Techniques (RMT)

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Paper-4 Research Project (RP)

In addition to the above three compulsory papers, In Part-II students will also submit a Research Project of 200 marks on any topic from the following optional course list or on any other issue after consultation and approval of the Director, CIMR.

Optional Courses

Research Project can be selected from the following list that is frequently updated according to the needs of the faculty, students and industry:

- Water logging & Salinity
- Mountain Tourism
- Glaciology Snow & Ice
- Health, Safety and Environmental Management
- Advanced Research Techniques
- Advanced Remote Sensing and GIS for Project Planning & Development
- Mountaineering
- Quality Assurance in Mountain Environment Studies
- Environmental Law and Decision Making
- Environmental Risks Assessment and managements
- Irrigation and Drainage
- Global Climate and Watershed Issues
- Water Laws and Economics

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Detailed Outline of Courses

M.Sc. Part I Papers

Paper I: Database Management Information System & Applications of Remote Sensing and Geographical Information System (DBMS & RS/GIS)

NOTE: The candidate will have to attempt FIVE questions selecting at least TWO questions from each section. Question 1 is Objective type and is compulsory.

Section-I: Database Management Information System

Introduction to the course,Database definitions, Importance of databases, Introduction to File Processing Systems,Advantages of the Database Approach,Some Additional Advantages of Database Systems, Costs involved in Database systems,Levels of data,Database users, Database Architecture, External View of the database,Conceptual view of the database, Internal Schema of the Database Architecture,Data Independence,Different aspects of the Database Management System(DBMS),Database Application Development Process,Preliminary Study of System, Tools used for Database System Designing, Data Flow Diagrams(DFDs), Different types of Data flow Diagrams(Context DFDs, Level 0 DFDs), Database Design Phase,Data Models, Types of Data Models,Entity,Different types of Entities,Attribute and its different types, Entity relationship data model (E-R data model),Concept of Key and its importance,Different types of keys,Relationships in E-R Data Model, Types of Relationships, Cardinality Types, Roles in ER Data Model, Expression of Relationship in ER Data Model, Logical Database Design, Types of Record based data model, Introduction to Relational Data Model, Basic properties of a table.

Lab Outline: Microsoft Access Introduction, Designing the application - tables, fields, data types, properties, Creating the database - primary key, creating tables, Defining Table relationships - referential integrity, primary and foreign keys, Entering data into Tables - data view, sorting and ordering,Creating data-entry forms - data validation, default values,Building simple Queries - sorting, selection criteria, working with dates,More complex Queries - multiple tables, linking, functions.

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Section-II: Applications of RS and GIS

Concept of remote sensing, Characteristics of electro-magnetic radiation, Interactions between matter and electro-magnetic radiation, Wavelength regions of electro-magnetic radiation, regions, Types, Characteristics of optical sensors, Spectroscopic filter, Spectrometer, Cameras for remote sensing, Film for remote sensing, Optical mechanical scanner, Pushbroom scanner, Imaging spectrometer, Atmospheric sensors, Sonar, radar, Principles, Attenuation of microwave, Microwave radiation, Types of Antenna, Characteristics of Antenna, Types of microwave sensor, Real aperture radar, Synthetic aperture radar, Image reconstruction of SAR, Characteristics of radar image, Radar images of terrains, Measurement of sea wind, radar, Types, Atmospheric condition and altitude, Attitude of platform, Attitude sensors, Orbital elements of satellite, Orbit of satellite, Satellite positioning systems, Definition of GIS, Why is a GIS needed, Required Functions for GIS, Computer System for GIS, GIS as a Multidisciplinary Science, Areas of GIS Applications, GIS as an Information Infrastructure, Support, Required, Required Functions of GIS Software, PC Based GIS for Education, Display, Coordinate, The Shape of the Earth, Map Projection, Coordinate Transformation, Distance, Resolution, Plan, Considerations for Installation of GIS, Keys for Successful GIS, Reasons for Unsuccessful GIS, Required Human Resource for GIS, Project, Data

Lab Outline: Remote, Landsat, SPOT, NOAA, IKONOS, Quick Bird, IRS etc., satellites, Digital, Geometric characteristics of image data, Radiometric characteristics of image data, Format of remote sensing image data, Auxiliary data, Calibration and validation, Ground data, Ground positioning data, Map data, Digital terrain data, Media for data recording, storage and distribution, Satellite data transmission and reception, Retrieval of remote sensing data, Geometry and Topology of Vector Data, Topological Data Structure, Topological Relationships between Spatial Objects, Geometry and Topology of Raster Data , Topological Features of Raster Data, Thematic Data Modeling, Model, Required, Digitizers for Vector Data Input, Scanner for Raster Data Input, Digital Mapping by Aerial Photogrammetry, Remote Sensing with Satellite Imagery, Rasterization, Vectorization, Advanced Technologies for Primary Data Acquisition

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Paper II: Forestry and Ecology (FE)

NOTE: The candidate will have to attempt FIVE questions selecting at least TWO questions from each section. Question 1 is Objective type and is compulsory.

Section I: Ecology and Biodiversity

What is Ecology and Biodiversity; Defining ecology and biodiversity, General concepts and basic terms, Subdivision of Ecology, Understanding Ecosystems: (Definition, Ecosystem ecology, Biotic components, Abiotic components, How an ecosystem works, Biomes). Ecological systems are models for sustainability, Principles of Ecology;Levels of Organization, Nutrition and Energy Flow, Trophic levels, Food chain and food web, Application of Ecological Principles in Mountain Conservation and Management,Ecological Succession;Primary and Secondary Succession / changes in Ecosystems, Importance of Ecological succession in Ecosystem Management and Conservation, Population ecology; Population characteristics, populations Growth: Exponential and logistic growth, Population density: Density-dependent and density-independent effects/factors on populations, Population Dispersal, stability and regulation, Managing population, How can Pakistan feed its growing population,Agro ecology; Definition, Application of concepts and principles of Agro-ecology to design and manage sustainable farming systems, Sustainable Agriculture, How Sustainable Forming helps in Mountain Conservation and Management,Wetland Ecology; Ramsar Definition of Wetlands, Importance of Wetlands, Problems to Wetland conservation and management in Pakistan, Thermal Stratifications and overturn in lakes), Problems in Ecology, Nutrient cycling models, Mountain Ecology and Biodiversity,Biodiversity; Introduction to biodiversity, (Genetic-diversity, species-diversity and ecosystem-diversity), The significance of biodiversity for Human well-being(Economic Values,Medicinal Values, Food and fiber Values),Importance roles of Biodiversity, Root Causes of Biodiversity Loss in Pakistan, Major threats to Bio diversity/HIPPO Dilemma(Habitat Degradation, Introduced Species, Population Growth, Pollution & Over-consumption), Reduction of biodiversity (the ultimate disaster?), Conservation and Managing Biodiversity for Sustainable Future inPakistan, Biodiversity Conservation, National and international initiatives, GlobalNetwork, Ways of reducing biodiversity losses.

Lab Outline: Study of some properties of ecological and biodiversity modules and field trips to analyze mountain biodiversity and ecology, Herbarium sheet will be prepared by students.

Section II: Forestry

Defining /Introducing Forests, General introduction to forestry, Types of Forests in Pakistan, Functional Morphology (Tree Morphology), Structure and Dynamics of Mountain Forests; Forest disturbances: their role in forest dynamics, Dendroecology: using tree rings to analyze present and past forest disturbances and dynamics. Management and Treatment in Mountain Forest; Classification of forest stands within the right forest typology, Choice and description of the different possible silvicultural systems that can be applied and their consequences on stand structure dynamics, Ecological and structural risks in case of wrong forest treatments in subalpine environments. Forest economics related to mountain areas; Economics of mountain forestry: fundamentals (long rotation periods, concepts related to the multi-functionality role of forests in mountain areas), Environmental economics. Environmental policies in mountain areas; Main goals, specific objectives and instruments of forest policies in mountain areas, with a focus on the involved actors (both private and public) and coalitions, as well as on their interconnections with the resources and related territories, Mountain forest policies: the international framework. Forest Hydrology. Mountain fluvial morphology and stream restoration; basics of fluvial morphology and ecology, Effective management of mountain streams. Wood Defects and Their treatments, Key issues in forestry at the local, national and international levels, Mountainous Forest Succession, Harvesting Systems for Mountainous Regions, Pakistan Forest Policy.

Lab Outline: In this course students will learn about many basic and advanced concepts and models. The development or refinement of critical thinking, problem-solving, interactive (social) skills, and written and oral communication skills will be practiced. Also, Students will learn about various computerized forest growth and yield models, economic models,

linear programming models of forest management and harvesting scheduling, and forest resource management simulation modeling. Hands-on experience in forest menstruation

and assessment will be gained through one weekend-long field trip to a forest-monitoring project.

Paper III: Integrated Watershed Management(IWM)

NOTE: **The candidate will have to attempt FIVE questions selecting at least TWO questions from each section. Question 1 is Objective type and is compulsory.**

Section I: IWM

Introduction to Watershed Management What is a watershed? Why manage on a watershed basis, Watershed delineation, Introduction to Watershed Assessments & Tools Reading Contour Maps and Their Applications for Watershed Management Watershed Hydrology or Watershed Systems, The Hydrologic Cycle, Water Balance, Climate and precipitation, Soils and infiltration, Interception and evapotranspiration , Groundwater, Stream flow and runoff, Water chemistry, Key Problems in Watershed Management, Spatial Linkages and Externalities, Socioeconomic issues in watershed management, Biophysical issues in watershed management, Issues in Water Resources, Point source pollution , Agricultural no point source pollution , Erosion, Urban no point source pollution, Water scarcity , Flooding, Drinking water protection, Wastewater treatment and septic systems, Legal and Institutional Tools, Clean Water Act , Land use planning and zoning, Watershed organizations, Watershed planning & Management Plans EPA's Top Lessons Learned in Watershed Management, Restoration techniques, Stakeholders, Outreach and education,. Watershed Issues of Pakistan, Identifying Systems of Best Management Practices (BMPs) Needed, Principles of Rangeland Management, Rangeland Ecosystem Assessment & Monitoring, Rangeland Vegetation Management Techniques, Predicting Hydrologic, Hydraulic, Water quality, & Sediment Transport Response Using a Modeling Approach, Introduction to the fundamental ecological and logical framework of integrated Watershed systems, overview of integrated Watershed systems in various countries of Asia, assessment of their performance and potential with respect to environmental, economic and socio cultural considerations, contribution of integrated land use systems to watershed protection and biodiversity conservation, exploration of ways to promote, improve or conserve integrated Watershed management systems, stakeholder analysis, methods of monitoring and evaluation, bio-physical and socio-economic environs, status and management of natural resources, institutional

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arrangements, public participation, gender role, support services and facilities, participatory problem analysis, potential assessment.

Lab Outline: Managing Watershed with Information Technology/ GIS/ Modeling Techniques

Section II: Hydrology of Upland

Physical Hydrology & Processes, Drainage basins, hydrologic cycle, water budgets, Precipitation/Interception, Frequency analysis, Energy Balance, Snow Hydrology, Snow & Vegetation, Evapotranspiration, Soil water, Infiltration, Runoff Processes (Hydrographs), Runoff Processes (Hillslope hydrology), Streamflow Measurements & Empirical Estimates, Groundwater, Groundwater/Surface water Interactions, Hydrologic Modeling, Geomorphology & Fluvial Processes, Erosion, Sedimentation, & Mass Movement, Water Quality – Physical, Water Quality – Chemical and Watershed Budgets, Floods, Vegetation and Water Yield/Lowflows/Peakflows, Land-use and Water Quality, Channel Hydrology, Hydrology of unsaturated zone, Groundwater recharge, Theory of groundwater flow and aquifer characteristics, Flow system analysis, Estimation of hydraulic parameters using geological information, Pumping test analysis, Groundwater monitoring and exploration strategies, Introduction to the use of hydro chemical and isotope data, The Hydrological System, Surface and Groundwater Hydrology of Pakistan. Hydrological Basins of Pakistan, River System, River Meandering, Erosion Terraces. Hill torrents and Piedmont Plains, Irrigation Canals, Barrages, Dams, Harvesting of Groundwater, Loss of Water by Evaporation, Seepage and Run off to Sea, Water Logging and Salinity, Weather Fluctuations and Climatic Changes, Loss of Moisture and Desertification, Surface Water Pollution, Groundwater Pollution, Flooding of Urban Areas, Water Supplies to Cities.

Lab Outline: Hydrologists use a variety of techniques that require skills in statistics, mathematics, remote sensing, cartography, computers, drafting and surveying. We won't go into great depth in developing skills in all of these areas, but the lab portion of this course is to give a basic understanding of these skills and show how to apply them to specific hydrologic problems. Basic statistics, introduction to computers & more statistics, precipitation measurements, aerial estimation, frequency analysis, energy balance in snowmelt runoff , infiltration measurements, developing a simple model of

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infiltration, approaches for estimating evapotranspiration, groundwater flow in channels, unit hydrographs, flood frequency analysis, watershed and regional hydrologic analyses

Paper IV: Mountain Environment (ME)

NOTE: The candidate will have to attempt FIVE questions selecting at least TWO questions from each section. Question 1 is Objective type and is compulsory.

Section I: Mountain Climate

Introduction to Climatology, Climate elements and factors, Atmosphere and its heating and cooling. Heat flow and temperature distribution. Atmospheric pressure and wind circulation. Insolation and temperature distribution over the face the earth. Air masses, fronts, Hydrosphere and Precipitation, Climate and the Physical /Biological Environments of mountains, climate change Climate and aquatic environment, hydrological processes, Impact of climate change on hydrological resources, Impact of climate change on water resources, climate and glaciers, Glacier Types, zone and climate controls, conversion of snow to glacier ice and role of climate, Glacier mass balance and climate controls. Climate and geomorphology, climate and geomorphologic processes, climate change and landforms Climate and soil geography, soil and greenhouse gases, Effect of climate change on soil, Climate and Vegetation, Climate and life, bio-climatic zones, Climate and the cultural environments, hot, humid climates, hot-arid climates, cold climates-polar regions, climate factors regulating crop and animal production, crop production and climate change, general classification of the climate. Mountain climates, Temperature variation, laps rate, Energy Balance, Diurnal temperature Range, Wind Pattern, Mountain wind, Adiabatic processes and Katabatic wind, Valley wind, Climate on windward and lee ward side of mountain Rainfall pattern in Mountains Climate-leisure interactions, Weather and climate information for the tourist, tourism and recreation, Past and potential future changes in mountain Environments, Climate risk concern in an alpine, Community, Applied Climatology, Meteorological Instruments, Meteorological elements and its units, time series analysis, spatial analysis, Global Climate model, climate impact models, Climate Change and Mountain Ecosystems, Latitudinal Variation in the Potential Response of Mountain Ecosystems to Climatic

Change, Climate Change and Natural Hazards, Comparing the Behavior of Mountainous Forest Succession Models in a Changing Climate, Impact of Atmospheric Changes on High Mountain Vegetation, Environmental perception, climate change, and tourism, Mountain environments and climate change in the Hindu Kush-Himalayas, Global Climate and Watershed Issues, Climate Scenario for mountain Regions.

Section II: Mountain Environment

The Study of Mountain, Mountains in geographical enquiry, Components of Mountain environment and livelihoods, The physical environment of mountains, The cultural framework, The production environment: The significance of the physical environment for livelihood, Mountains in Transition, Environmental Change, Demographic transformation, Geomorphic Hazards in mountain environments, Economic and political development, Human aspects of Mountain Environmental Change, Past and Potential Future Changes in Mountain Environments, The Mountains under Local, Regional and Global Pressure, Long-Ter

m Vegetation Change in Mountain Environments: Paleo-ecological, Insights into Modern Vegetation Dynamics, Environment, Natural Hazards and Sustainable Development, Climate risk concern in an alpine mountain, Environmental perception, climate change, and tourism, Localizing the threats of climate change in mountain environments, Mountain environments and climate change in the Hindu Kush-Himalayas-Karakorum.

Paper V: Soil and Water Conservation (SWC)

NOTE: The candidate will have to attempt FIVE questions selecting at least TWO questions from each section. Question 1 is Objective type and is compulsory.

Section I: Soil and Water Conservation

Conservation and the Environment, Precipitation, Infiltration, Evaporation and Transpiration, Runoff, Water Erosion and Control Practices, Wind erosion and control practices, Vegetated Waterways, Terracing, Soil and Water as Natural Resources, World History & Geography of Soil Erosion, Global Food Issues and Land Use, Geologic Erosion and Acceptable Soil Loss, Types of Water Erosion and Damage, Controlling Factors of Water Erosion, Types of Wind Erosion and Damage, Controlling Factors of Wind Erosion, Predicting Soil Loss With USLE, Erosion Control: Soil Survey & land

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use, Economics of Conservation, Desertification Soil Quality, Hydrologic Cycle, Water Quantity, Water Quality, Water Requirements Soil Water Management, Irrigation, Drainage, Stalinizations, Soil and Water Policy (Pak), Soil and Water Policy (International).

Lab Outline: Presentation of the problems caused by poor management and subsequent soil erosion, Presentation of the process of soil erosion, Analysis of soil erosion problems, Applications of soil management & conservation methods to solve land-use problems.

Section II:Water Resources of Pakistan

Water in global perspective, Global distribution of fresh water, Global water balance, Hydrological cycle and available water, Challenges of water scarcity, Water channels, Basic introduction to the fundamental concepts of integrated water resources management, techniques and knowledge required to understand and manage water resources, Hydrologic cycle, processes and measurements, the factors affecting movement and behavior in different environments, surface and groundwater environments, the watershed concept and, the impacts of weather and climate Fundamental ecological concepts, the role of the natural environment in the hydrologic cycle, the effects of changes in land use on water processes, the impacts of water on land, tools of watershed analysis, aspects of land use planning, control and conservation. Governance and community based approaches, the concepts and practices of community based water resources management, domestic and international governance, community involvement and gender issues, Surface water resources of Pakistan, Major rivers of Pakistan, Water available from different sources, River water quality, Evaporation from large exposure of fresh water surface, General characteristics of groundwater and its movement, Utilization and management of surface water resources, Construction of dams, barrages, and canals, Historical irrigation distribution system, drainage, Seepage from irrigation system, Environmental impact of irrigation & drainage, Ground water resources of Pakistan, Occurrences of groundwater, Sources of ground water, Groundwater issues, Groundwater quality, Groundwater contamination, Water quality guidelines/standards, Apportionment of the waters of the Indus River system among Provinces, Water Resources Conflicts: Indus River case experiences, National Water

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policy, Applying Integrated Water Resources Management, Customized case studies, practical illustrations of the concepts and procedures of IWRM, and investigative techniques for students to assess their own IWRM needs, conducted in tutorial format Water requirement and wastage in water usage, water management, Techniques in the plains, Techniques for the irrigated areas, Techniques for barani areas, Techniques for deserted areas, Technologies for mountains, Rainwater harvesting, Groundwater investigation techniques, Protection and rehabilitation of rivers, Technical methods and procedures, management options for Protection of river water quality, Excursion

Paper VI: Mountain Hazards and Disaster Management (MHDM)

NOTE: The candidate will have to attempt FIVE questions selecting at least TWO questions from each section. Question 1 is Objective type and is compulsory.

Section I: Geomorphology of Pakistan

The Earth as a Planet, The Universe, The Solar system, The earth as a member of Solar System, Geometrical form of the Earth, Longitudes and Latitude, Location and direction on Earth, Maps and Map Reading, Geographical grid, Shields and Platforms, Continents and Oceans, Mountains and Plains, Island Arcs, Earth Material and Geo Chemistry, Geological time and Geochronology, Geomagnetism, Cosmic Radiations, Climate and Weather, Climatic regions of Pakistan, Earth Processes, Internal Structure of the Earth, Core, Mantle, Crust, Internal Processes, Metamorphism, Plutonic Intrusions, Volcanism, Crustal Plates and Plate Tectonics, Mountain Building and Mountain Ranges, External Processes, Weathering and Erosion, Land and Rock Slides Wind Erosion, Sedimentation and Alluvial Plains, Deserts, Desertification, Desert Regions, High land-Low land transitional zone, Geomorphology of Pakistan, Geographical Location of Pakistan, Evolution of Pakistan's Crust, Geomorphological Provinces (Regions), Northern Mountain Ranges, Western Border Ranges, Balochistan and Potwar Plateau, Salt Range & Trans-Indus Ranges, Makran Coastal Ranges, Suleiman Kirthar Ranges, Shield Elements and Buried Ranges, Indus Alluvial Plain, Indus Delta, GeoEnvironmental impact of landforms, Natural Resources of Pakistan, The concept of resources, the resources of Pakistan, Water Resources, Mineral Resources, Energy Resources, (Coal, Oil, Natural and Gas), Soils, and Soil Resources, Natural Vegetation and Forests, Grasslands and upland pastures, Agriculture and Produce, Urban Vegetation and

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Agriculture, Fisheries, Livestock, Wildlife and Natural Parks, Minerals Sector and GeoEnvironmental Issues of Pakistan, Energy Sector and Geo-Environmental Issues of Pakistan.

Section II: MHDM

Introduction, Natural hazards in perspective, Broad Identification of Natural hazard types and characteristics, Types of Natural Hazards, Basics of disasters: Overview about different disasters in the world and the trends of disasters, Geomorphology: Hill-slope processes and torrent-and river-processes and methods for quantification including run-out distances of shallow landslides, particle rock-fall, debris flow and snow avalanches Erosion and sediment-transport dependent on forests and vegetation and methods of quantification, Geologic Hazards, Debris avalanches, Expansive soils, Landslides, Rock falls, Submarine slides, Subsidence, Volcanic Tephra (ash, cinders, lapilli), Gases, Lava flows, Mudflows, Projectiles and lateral blasts, Pyroclastic flows, Hydrologic Features of catastrophic rainstorms and snowfall and the development of disaster runoff and snow avalanche Coastal flooding, Desertification, Stalinization, Drought, Erosion and sedimentation, River flooding, Storm surges, Atmospheric Hailstorms, Hurricanes, Lightning, Tornadoes, Tropical storms, Seismic Fault ruptures, Ground shaking, Lateral spreading, Liquefaction, Tsunamis, Seiches, Wildfire Brush, Forest, Grass, Savannah Overview Natural Hazard Assessment and Zonation (magnitude, frequency and location relations versus type of hazard), Element at risk mapping (mountain towns and villages rural)- Vulnerability Assessment (depth - damage curves), Damage assessment, loss analysis, Risk Assessment Techniques (incl. Cost/Benefit Analysis), Hazard Mitigation Strategies & Selection Natural Hazards and Development Issues, Resource Evaluation and the Role of Ecosystems in Mitigating Natural Hazards, Land use Evaluations, Limitations of Land use Evaluation , Remote Sensing in Natural Hazard Assessments Applications of Remote Sensing and GIS Technology to Natural Hazard Assessments and Management, Education and Training Activities, Incorporating Mitigation Measures into the Stages of an Integrated Development Planning Study, Mountain risks and infrastructure in the Hindu Kush Himalayas, Building and construction improvement for mountain areas, Floods and landslide hazards in the Hindu Kush Himalayas, Capacity building for hazard mitigation and disaster management, Management of water for the

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prevention of environmental hazards, Geographic information systems in natural hazard assessments and integrated development planning, Mini Workshop Risk Assessment, Hazards and Disaster in Mountain Environments Problems in the Geography of Risk Excursion. Natural Hazard & Disaster Management in Northern Pakistan and NWFP focusing on Earthquake hazard management, Visit to Terbela: High water prediction in the Indus river catchments, use of GIS, overview of tasks, Visit Province of NWFP, Water management of the province such as High Water Information System, Flood scenario's, Use of internet techniques for disaster management, GIS applications for disaster management. Cooperation with WAPDA on the Indus River.

Lab Outline: During and after lectures pending topics will be discussed, as well as assignments and projects. All students are responsible for every phase of topic discussion. Students Participation based on readings and any experience or ideas will be involved. Several labs/demos will be given on ecological modeling and analytical techniques.