JIWAJI UNIVERSITY, GWALIOR

School of Studies in Earth Science

The State of Madhya Pradesh in general and Bundelkhand and Chambal regions in particular, possess varieties of rock and mineral resources. Scientific and systematic exploration of available rocks and minerals require a center of higher learning engaged in teaching and research at postgraduate and higher levels. This region falls under the semi-arid zone, where the surface water resources are depleting very fast. Hence there is an immediate need of systematic exploration of ground water for the future requirement of this essential commodity. Moreover, there is a dire need of investigation of the Chambal basin from the point of view of geological and geomorphological studies having stress on ecological and environmental aspects. These studies may also throw light on the reclamation problems of the ravine region. The result of all information, thus available, shall have a strong bearing on the socioeconomic development of Gwalior region. It is with these aims and objectives; the school of studies in earth science was established with a Master degree course in Earth Science in 1991. Apart from providing job opportunities for young and aspiring students of the region, the School has opened an avenue of effective and viable interaction with national establishments and industries related to various aspects of geology. The requirement of personnel qualified and trained in Remote Sensing and GIS application in different fields has been increasing over the past years. Keeping that in view Jiwaji University, Gwalior, has introduced a full time post graduate Course, M.Sc. in Remote Sensing & GIS from the academic year 2002. The Curriculum of the course has been designed as per the guidelines and has been introduced with the financial assistance of U.G.C. under the innovative scheme including courses in emerging areas. The School is currently engaged in active research in the fields of Petrology, Geochemistry, Mineral Exploration, Hydrogeology, Remote Sensing Geology, Geomorphology and Environmental Geology. The Major thrust areas for research are Precambrian Geology, Geoexplorations and Environmental studies in Base Metals, Coal, Chambal basin, Bundelkhand Granites, and Watershed Management and Planning.

The School is running at present the following programmes :

M.Sc. Geology
M.Sc. Remote Sensing and GIS
Ph.D.

Programme Outcomes (POs)

The curriculum of M.Sc. geology has been designed and framed in such a way that it has immense relevance in the in the construction industry, in the steel manufacturing industry, in energy resources, in environmental management, in petroleum and groundwater exploration to mention but just a few. With the current scientific and technological advances, including space missions, geology has its major role today and in the coming future. The curriculum of M.Sc. Remote Sensing and GIS has been designed in a view to cater the requirement of personnel qualified and trained in Remote Sensing and GIS application in different fields. The course aims at developing multidimensional programmes of teaching and research in the field of Remote Sensing and GIS. The faculty is committed to providing an environment that addresses the individual needs of each student and encourages them to develop their potential.

The distinguishing feature of the programme are:

PO1 Provide up-to-date knowledge solve and an understanding of major concepts in all disciplines of geology

PO2 Theoretical and practical knowledge of geological applications

PO3 Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of geological interpretations

PO4 Create an awareness of the impact of geological interpretations in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development on the environment.

PO5 Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

PO6 Communicate effectively on geological activities with the geology community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations

PO7 Providing knowledge specific data and methodologies for effective mapping and evaluation of natural resources

PO8 Apply geospatial technologies for natural resources management

Programme Specific Outcomes (PSOs)

- Geology

Curriculum of Geology is designed to prepare post graduates to attain the following program specific outcomes:

PSO1: Gain the knowledge of geology through theory and practicals. An ability to design or develop geological reports incorporating impact of economic, social and environmental sustainability

PSO2: An ability to practice or apply geological concepts, principles, in a wide range of industrial and professional employment areas

PSO3: Display critical thinking for creating new ideas and design innovative pathways.

PSO4: Explore global level research opportunities for doctoral and post-doctoral studies in geology.

PSO5: Demonstrate broad mindset with respect to knowledge penetration and accumulation in his/her professional activities**.**

PSO6: Display their true potential and get appropriate endorsement through qualifying NET/GATE/SLET/ State Civil Services and other competitive examinations.

PSO7: Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

Programme Specific Outcomes (PSOs)

- Remote Sensing and GIS

Curriculum of Remote Sensing and GIS is designed to prepare post graduates to attain the following program specific outcomes:

PSO1: Gain the knowledge of Geo information technology through theory and practicals. An ability to design or develop geospatial application reports incorporating impact of economic, social and environmental sustainability

PSO2: An ability to develop professional Remote Sensing and GIS personnel for industrial and professional employment areas

PSO3: Display critical thinking for creating new ideas and design innovative pathways for

geospatial industry.

PSO4: Explore global level research opportunities for doctoral and post-doctoral studies in Remote Sensing and GIS.

PSO5: Demonstrate broad mindset with respect to knowledge penetration and accumulation in his/her professional activities**.**

PSO6: Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

Course Outcomes (COs)
For M.Sc. Programme- Geology
Semester I
GT -101 Geomorphology

Students after studying geomorphology courses are expected:

CO1: To understand Geomorphic concepts and geomorphic processes

CO2: To understand the concept of equilibrium, cycle of erosion and various controls on Landforms.

CO3: To learn about the drainage patterns, their geological significance and morphometric analysis

CO4: To understand the various landforms and their formation

CO5: To understand the various applications of geomorphology

GT -102 Structural Geology and Tectonics

Students after studying structural geology and tectonics courses are expected:

CO1: To understand the deformation in rocks and to recognize the primary structures and joints

CO2: To learn the geometric description of fold, fault and unconformities

CO3: To understand the lineation, foliation and axial plane cleavage

CO4: To understand the concept of geodynamics and interior of the earth

CO5: To understand the plate tectonics and palaeomagnetism

GT -103 Mineralogy and Mineral optics

Students after studying Mineralogy and Mineral optics courses are expected:

CO1: To understand the concept of minerals and structure of silicates.

CO2: To understand the physical and optical properties of rock forming minerals.

CO3: To identify rock forming minerals in hand specimen and thin sections

CO4: To understand the concept of mineral optics

CO5: To understand the optical properties of uniaxial and biaxial minerals

GT -104 Crystalography, Crystal Chemistry and Geochemistry

Students after studying crystallography, crystal chemistry and geochemistry courses are expected:

CO1: To learn about crystallography, various projections and twinning

CO2: To learn about the symmetry, characteristics and forms of various classes

CO3: To understand the crystal structures and bonding in crystal structure

CO4: To understand the concept of geochemistry and applications

CO5: To describe the chemical composition of the earth's crust

CO6 : To understand the isotope geology and geochronology

Semester II

GT -201 Igneous Petrology

Students after studying Igneous Petrology course are expected:

CO1: To understand the concept of magma and its generation.

CO2: To learn about the origin of magmas

CO3: To identify rock forming minerals in hand specimen and thin sections

CO4: To understand the concept of mineral optics

CO5: To understand the optical properties of uniaxial and biaxial minerals

GT -202 Metamorphic and Sedimentary Petrology

Students after studying Metamorphic and Sedimentary petrology course are expected:

CO1: To understand the concept of metamorphism, depth zones and facies

CO2: To learn petrographic and petrogenetic study of metamorphic rocks

CO3: To understand the process of sedimentation and depositional environments.

CO4: To understand the sedimentary differentiation and provenance studies

CO5: To measure the sedimentary grain size and learn the statistical analysis of data

CO6: To learn petrographic and petrogenetic study of sedimentary rocks

GT -203 Indian Stratigraphy

Students after studying Indian Stratigraphy course are expected:

CO1: To understand geological time scale and stratigraphic correlation

CO2: To understand stratigraphic nomenclature and different types of stratigraphic units

CO3: To understand the various cratons of India

CO4: To gain knowledge about the stratigraphy various Super Groups

CO5: To understand the boundary problems in stratigraphy

GT -204 Palaeontology

Students after studying Palaeontology course are expected:

CO1: To understand the origin and evolution of life

CO2: To learn the importance of fossils in palaeoclimatic and palaeogeographic studies

CO3: To learn the morphology of classification, evolutionary trends and geological history of bivalves, cephalopods, gastropods, Echinoids, Brachiopoda and Trilobites

CO4: To understand the vertebrates and their general characteristics

CO5: To understand the microfossils and their applications

Semester III

GT -301 Oregeology and Mining Geology

Students after studying Ore geology and Mining geology course are expected:

CO1: To learn ore genesis, geothermometry, paragenesis and zoning in mineral deposits

CO2: To understand controlling factors, form, size, characteristic minerals involve in various ore formation processes

CO3: To understand the basic principles, concept and applications of ore microscopy

CO4: To learn about open cast mining and its various method.

CO5: To understand basic concepts and types of underground mining.

GT - 302 Indian Mineral Deposits and Mineral Economics

Students after studying Indian Mineral Deposits and Mineral Economics course are expected:

CO1: To develop specific knowledge about the mineral sector of the country along with mineral deposits of India

CO2: To learn about geological environment, mode of occurrence genesis and distribution of various metaliferrous deposits in India.

CO3: To understand specification, grades and industrial uses of the minerals used in various industries

CO4: To develop understanding about the coal deposits and oilfields of India

CO5: To understand concept of mineral economics, mineral legislation and mineral policies of India

GT - 303 Mineral Exploration and Mineral Beneficiation

Students after studying Mineral Exploration and Mineral Beneficiation course are expected:

CO1: To learn basic principles, concepts and methods of geological exploration.

CO2: To understand Geophysical exploration methods

CO3: To develop understanding about geochemical exploration methods and techniques

CO4: To learn about mineral dressing, commutation and classifiers.

CO5: To understand various mineral beneficiation methods and flow sheets of important ore and minerals.

GT – 304 Advanced Environmental Geoscience – Part I

Students after studying Advanced Environmental Geoscience – Part I course are expected:

CO1: To develop basic understating of environmental geoscience.

CO2: To learn risk assessment and mitigation measures of natural hazards

CO3: To understand various aspects of pollutions

CO4: To develop understanding about impacts, controls, disposal and management of waste

CO5: To introduce various legalization and policies related to environment

GT – 305 Remote Sensing in Geoenvironmental Science

Students after studying Remote Sensing in Geoenvironmental Science course are expected:

CO1: To develop basic understating of Principle of Remote Sensing and nature of EMR

CO2: To learn about basics of Aerial Photography and the elements of interpretation

CO3: To learn about various satellites, Sensors and their characteristics

CO4: To develop understanding about digital image processing

CO5: To understand the fundamentals of GIS and GPS

CO6 : To learn various applications of remote sensing in geo-environmental science

Semester IV

GT -401 Hydrogeology

Students after studying Hydrogeology course are expected:

CO1: To learn basic concepts of hydrology and meteorology.

CO2: To learn field and laboratory methods of permeability determination

CO3: To prepare water table maps and interpretation of ground water movement

CO4: To understand various ground water exploration techniques

CO5: To enrich knowledge about hydro geochemistry, ground water recharge and ground water management

GT – 402 Advanced Environmental Geoscience – Part II

Students after studying Advanced Environmental Geoscience – Part I course are expected:

CO1: To understand concept of land use planning and environmental impacts of land use.

CO2: To learn the environmental impacts associated with surface and ground water

CO3: To understand the mineral resources and environment

CO4: To learn the environmental impacts associated with energy resources

CO5: To introduce various legalization and policies related to environment

GT – 403 Engineering Geology and Environmental Geology

Students after studying Engineering Geology and Environmental Geology course are expected:

CO1: To learn basic engineering properties of rocks and their applicability in civil engineering.

CO2: To develop understanding about geotechnical problems of large infrastructures like dams, tunnels

CO3: To develop awareness about the environmental impacts associated with natural hazards

CO4: To learn the environmental impacts associated with energy resources

CO5: To learn the environmental impact of mineral development conservation and utilization

Course Outcomes (COs)
For M.Sc. Programme- Remote Sensing and GIS
Semester I

RT – 101 Fundamentals of Remote Sensing

Students after studying Fundamentals of Remote Sensing course are expected:

CO1: To Understand the principle of Remote Sensing and Laws of radiations

CO2: To **a**nalyze the energy interactions in the atmosphere and earth surface features.

CO3: Identify the earth surface features from satellite images.

CO4: To learn the process of data acquisition of satellite images and their characteristics

CO5: To Read ancillary information of remotely sensed data.

CO6: To select the type of remote sensing technique / data for as per required project demands.

RT – 102 Aerial Photography and Photogrammetry

Students after studying Aerial Photography and Photogrammetry course are expected:

CO1: To determine geometrical elements of aerial photograph.

CO2: To analyze the aerial photographs for physical measurements utilizing photogrammetry techniques used in Aerial Photographs**.**

CO3: To Demonstrate interior and exterior orientation on two overlapping aerial photographs**.**

CO4: To Measure parallax and compute elevations from parallax measurements.

CO5: To Prepare mosaics, orthophotos and photomaps for mapping of resources.

RT – 103 Cartography and Global Positioning System

Students after studying Cartography and Global Positing System course are expected:

CO1: To understand classification the maps, coordinate systems and projections.

CO2: To determine the scale, ground coordinates and the aerial extent of aerial photographs.

CO3: To Prepare base maps and thematic Maps**.**

CO4: To identify GPS components and their functions**.**

CO5: To identify error sources in GPS observations, and apply the corrections for accurate positioning

RT – 104 Digital Image Processing

Students after studying Digital Image Processing course are expected

CO1: To understand the fundamentals of satellite image and their digital processing.

CO2: To classify the types and understand formats of digital satellite data.

CO3: To process digital satellite images for retrieving features.

CO4: To classify the processed remote sensing data.

CO5: To evaluate the accuracy of image classification.

Semester II

RT – 201 Thermal and Microwave Remote Sensing

Students after studying Thermal and Microwave Remote Sensing course are expected

CO1: To understand thermal radiation principles and their thermal characteristics in IR images.

CO2: To interpret features in thermal images and prepare thermal map.

CO3: To identify the working mechanism and applications of active and passive microwave systems..

CO4: To learn about the interpretation of microwave images

CO5: To use microwave imageries for mapping the geospatial features

RT – 202 Geographical Information System

Students after studying Geographical Information System course are expected

CO1: To understand the basic concept and applications of GIS

CO2: To understand the data structure, formats and database design in GIS

CO3: To prepare and analyze the different geospatial layers.

CO4: To learn about the data quality and probable source of errors

CO5: To learn how to use Digital Elevation Model and Network analysis in GIS environment

RT – 203 Remote Sensing in Geosciences

Students after studying Remote Sensing in Geosciences course are expected

CO1: To understand the spectral characteristics of rocks and minerals

CO2: To learn identify and interpret various landforms from the satellite images

CO3: To learn geomorphological mapping and terrain evaluation

CO4: To understand the lithological interpretation of various rock types

CO5: To identify the structural features and learn lineament mapping

RT – 204 Remote Sensing in Mineral Exploration and Geotechnical Engineering

Students after studying Remote Sensing in Mineral Exploration and Geotechnical Engineering course are expected

CO1: To understand the role of Remote sensing in mineral exploration.

CO2: To understand the mineral resources management using GIS**.**

CO3: To understand the concept of geotechnical engineering and

CO4: To learn the engineering geological terrain evaluation using remote sensing data**.**

CO5: To learn about digital Terrain Modelling

Semester III

RT – 301 Remote Sensing in Water Resources

Students after studying Remote Sensing in Water Resources course are expected

CO1: To analyse the spectral characteristics of water

CO2: To learn how to identify ground water potential zones Using Remote sensing and GIS

CO3: To learn about the water harvesting structures and optimum site section studies

CO4: To understand Watershed planning and Management through Remote Sensing and GIS.

CO5: To prepare snow and flood plain mapping using remote sensing and GIS .

RT – 302 Remote Sensing in Agriculture, Soil and Land Evaluation Studies

Students after studying Remote Sensing in Agriculture, Soil and Land Evaluation Studies course are expected

CO1: To analyze the spectral properties of crop and learn crop acreage estimation

CO2: To learn the assessment of crop condition and diseases.

CO3: To learn estimation of soil moisture, erosion and prepare soil map**.**

CO4: To identify the soil type using remote sensing data.

CO5: To identify degraded land and understand implementation of optimum land use planning.

RT – 303 Remote Sensing in Forestry

Students after studying Remote Sensing in Forestry are expected

CO1: To understand the role of Remote Sensing and GIS in Forestry

CO2: To learn about the spectral and temporal characteristics of vegetation

CO3: To identify and mapping vegetation type and their stress conditions.

CO4: To learn the processing microwave data for thick forest cover area, forest fire and damage assessment.

CO5: To understand biodiversity characterization and **to learn e**stimation of biomass, and suitable habitat mapping

RT – 304 Remote Sensing in Marine Sciences

Students after studying Remote Sensing in Marine Sciences course are expected

CO1: To learn the interaction of EMR with water

CO2: To learn about marine bio-resources mapping

CO3: To map sea surface temperature and suspended sediments concentration.

CO4: To understand coastal land forms and map shoreline changes

CO5: To learn about potential fishing zone mapping using NDVI

RT – 305 Remote Sensing Basic and Applications

Students after studying Remote Sensing Basic and Applications course are expected

CO1: To understand fundamentals of remote Sensing and nature of EM spectrum

CO2: To understand the geometry of Aerial photographs and elements of photo interpretation

CO3: To understand the concept of resolution

CO4: To understand the basics of thermal microwave and hyperspectral sensing

CO5: To know the various applications of Remote Sensing Techniques

Semester IV

RT – 401 Remote Sensing in Human Settlement Analysis

Students after studying Remote Sensing in Human Settlement Analysis course are expected

CO1: To understand the urban land use planning and mapping through remote sensing

CO2: To recognize .various settlement pattern through satellite images

CO3: To carryout urban sprawl and change detection studies

CO4: To analyze transportation and their networks using remote sensing and GIS.

CO5: To understand the urban hazard and risk mapping using remote sensing data.

RT – 402 Remote Sensing in Environmental Science

Students after studying Remote Sensing in Environmental Science course are expected

CO1: To learn the change detection through multi temporal data

CO2: To learn water quality monitoring and mapping using GIS

CO3: To identify landslide hazard zones and prepare landslide hazard maps

CO4: To learn about the use of geospatial tools and techniques for hazard mitigation and resource planning

CO5: To understand the environmental monitoring for sustainable development through Remote Sensing and GIS

RT – 403 Basics of DIP, GIS and GPS

Students after studying Basics of DIP, GIS and GPS course are expected

CO1: To understand the concept of Digital Image Processing

CO2: To learn how to classify digital satellite images and also perform accuracy assessment of the result.

CO3: To understand concept of GIS , Data structure and formats.

CO4: To learn how to handle spatial data and their analysis

CO5: To understand the concept of GPS and know the GPS system elements and signals

PhD. Course Work Programme

Research Methodology

Students those are pursuing doctoral degree, after successfully finishing the course, will be capable

CO1: To develop innovative ideas related to various fields of Earth science such as Hydrogeology, Economic Geology, Remote sensing geology, Petrology and many more**.**

CO2: To having hands-on/operational experience of different sophisticated instruments**.**

CO3: To cultivate technologies, those are more effective and easy to use for society

Review of Literature

Upon successfully completion of review of literature the student will be able:

CO1: To identification of key questions about a topic that need further research and determination of methodologies used in past studies of the same or similar topics.

CO2: To develop solid foundation of knowledge in the area and a good feel for the direction any new research should take.

Computer Applications

After successfully finishing the course, the student will be able:

CO1: To develop specialized computational skills

CO2: To gain proficiency in working with different software, beneficial for their research studies

Advacnced Studies in Earth Science (Geology/Remote Sensing)

After successfully finishing the course, the student will be able:

CO1: To acquire useful information and to make the most informed decisions possible.

CO2: To develop theoretical and practical knowledge of different instrumental techniques.

CO3: To apply the knowledge of interpretation skills in their research problems**.**