For all M.Sc. / M.A. / M.P.A. / M.F.A / Programs
(Based on UGC – Learning Outcomes-Based Curriculum Framework)
Under NEP 2020

SYLLABUS

OF

5-YEAR INTEGRATED M. Sc. PROGRAMME IN APPLIED GEOLOGY
(I to IV Semesters)

Centre for Earth Ocean and Atmospheric Sciences
School of Physics
University of Hyderabad

For all M.Sc. / M.A. / M.P.A. / M.F.A / Programs
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University of Hyderabad
School of Physics

Centre for Earth Ocean and Atmospheric Sciences

Vision Statement:

To become a global centre of excellence in Earth Sciences through innovative teaching and research to produce highly quality manpower capable of addressing relevant scientific and societal challenges.

Mission Statement:

1. To provide a holistic understanding of planet Earth's dynamic processes, and linkages among the geosphere, the hydrosphere, the atmosphere and the biosphere through high quality teaching so as to enable the students to become leaders in academic and research institutions, and professional organizations.
2. To conduct innovative research in Earth Sciences, and promote national and international collaborations.
3. To build world class infrastructure for teaching and frontline research in Earth Sciences.

University of Hyderabad
School of Physics

Centre for Earth Ocean and Atmospheric Sciences

Name of the Academic Program: 5-Year Integrated M.Sc. in Applied Geology

Programme Offered:
India is facing various challenges in the context of increasing population, depleting mineral and energy resources, natural disasters, environmental hazards and climate change etc., It is very important to address these issues and find solutions for it. The discipline of Earth Sciences plays a vital role in understanding of the root causes for these global challenges and also provides issue specific solutions, which are all linked with the functioning of the Planet Earth. Therefore, there is an extensive need to understand the Earth and its interior, the processes which are operating, and any imbalance that develops in the its functioning. This essentially can be achieved by pursuing a course of Integrated MSc in Applied Geology. It is a very important and interesting course that has both fundamental as well as applied aspects of Geology.

Qualification Descriptors (QDs)

After completion of the program, the students will be able to:
QD-1. Demonstrate a fundamental understanding of dynamic processes of Planet Earth including its resources.
QD-2. Students will develop ability to address societal challenges such as depleting resources, natural hazards, global climate change, and increasing risk of environmental pollution.
QD-3. Develop analytical, logical and creative thinking and enhanced subject-specific skills with logically based innovative perception to provide solutions for the sustainable management of natural resources, preparedness and mitigation for natural hazards and climate change.
QD-4. Inculcate and promote ethics and values in applying knowledge of geosciences for sustainable development.
QD-5. Augment student skills in propagating thoughts on future Earth, with a special focus on India-specific issues, by presentations and participation in public forums to create awareness among the general public, policy makers and administrators.

Mapping Qualifications Descriptors (QDs) with Mission statements (MS)

	MS-1	MS-2	MS-3
QD-1	**3**	**3**	**-**
QD-2	**3**	**3**	**-**
QD-3	**3**	**3**	**-**
QD-4	**3**	**3**	**-**
QD-5	**3**	**3**	**3**

- **'3' for 'High-level mapping; 2 for 'Medium-level mapping; 1 for 'low-level' mapping.**

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Centre for Earth Ocean and Atmospheric Sciences

Name of the Academic Program: 5-Year Integrated M.Sc. in Applied Geology

Programme Learning Outcomes (PLOs)

After completion of this course, the students will be able to:

PLO1. Acquire a strong theoretical framework towards understanding of various component of Earth system including planetary objects, its origin, and operative processes in past and present.
PLO2. Develop a thorough understanding of geological materials such as rocks, minerals and fossils and their applications for welfare of the mankind.
PLO3. Integrate observations and theory for describing geological processes in past and present and achieve a sound understanding of the time scales of geological processes and for future predictions.
PLO4. Demonstrate various geophysical methods for the exploration of structure of the planet Earth as well as exploration of water, mineral and energy resources.
PLO5. Apply the knowledge gained through integrated study of geology, geophysics, and geochemistry to address sustainability in the context of global environmental and climate change.
PLO6. Design and construct strategies based on the knowledge of Earth dynamics to address natural hazards and their mitigation.
PLO7. Design and implement remote sensing and GIS methods in combination with field data for accurate assessment of natural resources.
PLO8. Acquire knowledge of innovative concepts, powerful data handling and modelling capabilities, refined field methods and advanced laboratory techniques will lead to quantify the interconnecting influences of various domains of planet Earth.
PLO9. Integrate the multi-disciplinary database to evaluate Earth natural processes and its resources.
PLO10. To have a holistic understanding of linkages among the different spheres of planet Earth to become leaders in professional careers, academia and industry.

Mapping of Program Learning Outcomes (PLOs) with Qualification Descriptors (QDs)

	QD-1	QD-2	QD-3	QD-4	QD-5
PLO-1	3	-	3	-	-
PLO-2	3	-	3	-	-
PLO-3	3	-	3	3	-
PLO-4	3	-	-	3	-
PLO-5	3	3	3	3	-
PLO-6	3	3	3	3	3
PLO-7	3	3	-	3	-
PLO-8	3	3	-	3	-
PLO-9	3	3	3	3	-
PLO-10	-	-	-	-	3

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5-year Integrated M. Sc in Applied Geology
(Proposed Revised Course Structure w.e.f from September 2022)

I to IV Semester (Course Nos. and Course titles)

Semester I

S. No.	Cr. No	Title of the Course	Credits
1	MM-101	Maths – I (T)	03
2	PY-101	Mechanics (T)	03
3	PY-102	Properties of Matter (T)	03
4	CY-101	Structural Chemistry and Thermodynamics- I (T)	03
5	SB-101	Introductory Biology (T)	03
6	EN-101	English – 1 (Language)	03
7		Sanskrit-Level 1/Urdu/Telugu/Hindi -1	04
		Total Credits	**22**

Semester II

S. No.	Cr. No	Title of the Course	Credits
1	**AG-151**	**Introduction to Planet Earth (T)**	**03**
2	MM-151	Maths – II (T)	03
3	PY-151	Waves and Oscillations (T)	03
4	CY-151	Basics of Analytical and Organic Chemistry (T)	03
5	CY-152	Qualitative & Quantitative Inorganic Analysis Lab (L)	1.5
6	PY-152	Physics Lab (L)	1.5
7		English II (Literature/Language)	03
8	IT-151	IT (Advanced)	02
9	**AG-152**	**Environmental Science**	**03**
		Total Credits	**23**

Semester III

S. No.	Cr. No	Title of the Course	Credits
1	**AG-201**	**Fundamentals of Remote Sensing (T)**	**03**
2	**AG-202**	**Introduction to Ocean and Atmospheric Systems**	**03**
3	MM-201	Maths 3-A: Differential Equation (T)	03
4	PY-201	Thermodynamics & Statistical Physics (T)	03

5	CY-201	Basic Inorganic Chemistry and Thermodynamics II (T)	04
6		Introduction to Public Health/ Yoga and Fitness	03
7		Study of History/ Archaeology and Heritage Studies	04
		Total Credits	**23**

Semester IV

S. No.	**Cr. No**	**Title of the Course**	**Credits**
1	**AG-251**	**Plate Tectonics and Geodynamics (T)**	**04**
2	**AG-252**	**Geomorphology & Earth Surface Processes (T)**	**03**
3	**AG-253**	**Structural Geology (T)**	**03**
4	MM-251	Maths IV B (T)	04
5	PY-251	Modern Physics(T)	03
6		Introduction to Gender Studies	03
		Total Credits	**20**

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Centre for Earth Ocean and Atmospheric Sciences

Name of the Academic Program: 5-Year Integrated M.Sc. in Applied Geology

SEMESTER II

Course Code: AG 152
Course Title: Environmental Science
L-T: Lectures, Tutorials
Credits: 03

Detailed Syllabus:

Unit 1: The multidisciplinary nature of environmental studies: Definition, Scope and importance Environmental Milestones

Unit 2: Ecosystems: Concept of an ecosystem (Abiotic and biotic environment), Structure and function of an ecosystem Producers, Consumers and decomposers. Energy flow in the ecosystem, (Nutrient cycle in the ecosystem) Ecological succession Food chain, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystems: Forest ecosystem, Grassland ecosystem, Desert ecosystem aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries).

Unit 3: Biodiversity: Conservation: Introduction, Definition: genetic, species and ecosystem diversity, Hot spots of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts. Endangered and endemic species of India, Conservation of biodiversity: In- situ and Ex-situ conservation of biodiversity.

Unit 4: Natural Resources and non-renewable resources An overview of natural resources and associated problems with references to a) Forest resources b) Water resources c) Mineral resources d) Food resources e)Energy resources f)Land resources.

Unit 5: Environmental Pollution: Definition a) Air pollution b)Water pollution c) Soil pollution d)Marine pollution e) Noise pollution f) Thermal pollution g) Nuclear pollution Solid waste management: Causes, effects and control measures of urban and industrial wastes. Environmental impact assessment.

Unit 6: Environment: Socio-Political Issues: Environmental Ethics: Science/Nature Debate) Global Environmental Issues a) Global Warming, Climate Change, Acid Rain, Ozone layer depletion, Pollution) Global Environmental Issues a) Deforestation, Loss of Bioidiversity, Desertification, Land Degradation) Global Conventation on Environment: Indian environmental Laws.

Unit 7: Human –Environment Interaction: Modes of Resource Use, Development and Environment Population growth and Environment, Environment and Human Health.

Unit 8: Project Work (Group of….) Select List of Themes: Study of simple ecosystem: pond/lake/rocks, Biodiversity Register of Campus Pollution Energy sources Water Conservation Waste Disposal and Recycling GM crops.

Course Code: AG 151
Course Title: Introduction to Planet Earth
L-T: Lectures, Tutorials
Credits: 03

Prerequisite Course / Knowledge (if any): Introductory course (no prerequisite is required)

Course Objectives:

1. To provide fundamental understanding of the Earth and other planets in the solar system.
2. To have a good understanding about the origin and early evolution of the Earth.
3. Interactions and linkages among the different components of Earth (lithosphere, hydrosphere, cryosphere, biosphere and atmosphere).
4. Introduction of evolution of life through geological time.
5. Materials and processes of planet Earth.

Course Learning Outcomes (CLOs):
After the completion of the course, the students will be able to:
CLO1: Acquire a fundamental understanding of the Earth and other planets in the solar system.
CLO2: Comprehensive knowledge of the interactions of various components - atmosphere, biosphere, cryosphere, lithosphere, hydrosphere of the Earth.
CLO3: Knowledge of functioning of planet Earth.
CLO4: A thorough understanding of materials and processes of the Earth.
CLO5: Apply the knowledge of Earth sciences to the address the societal issues.

Detailed Syllabus:

Unit 1: Introduction, Historical development in Earth Sciences, Importance of the Earth science and its relevance to society.

Unit 2: The origin and early evolution of the Planet Earth. Earth as a system of interacting components- Geosphere, Hydrosphere, Atmosphere, Cryosphere and Biosphere.

Unit 3: Materials of the planet Earth. Physiography of the Earth: Oceanic and continental domains.

Unit 4: Earth processes - Weathering and erosion. Aeolian, fluvial, glacial and marine processes and associated landforms.

Unit 5: Earth as a heat engine. Volcanoes, Earthquakes, Tsunamis, Landslides, Drifting of continents and plate tectonics. Introduction to geological time scale, dating methods, evolution of life through time.

References:

1. Skinner, B.J., Porter, S.C. and Park, J., 2003. The Dynamic Earth: An Introduction to Physical Geology, John Wiley & Sons, 631 p.
2. Skinner, B.J., 2010. The Blue Planet: An Introduction to Earth System Science, John Wiley & Sons, 592 p.
3. Press, F., Siever, R., Grotzinger, J. and Jordan, T.H., 2004. Understanding Earth, 4th Edn., W.H. Freeman, 567 p.
4. Tarbuck, E.J. and Lutgens, F.K., 2006, Earth Science, 11th Edn., Pearson Prentice Hall, New Jersey, 726 p.

Course Code: AG 152
Course Title: Environmental Sciences
L-T: Lectures, Tutorials
Credits: 03

SEMESTER III

Code No: AG 201
Course title: Fundamentals of Remote Sensing
Credits: 03
L-T-P: Lectures, Tutorials

Prerequisite Course / Knowledge (if any): Basic knowledge of the physics

Course Objectives:

1. To learn about the principles of remote sensing and the technical characteristics and constraints or Earth Science;
2. To design, implement and critically evaluate methods of digital image processing ranging from pre-processing to image classification, field data collection and accuracy assessment.
3. To generate geographical information by processing digital remotely sensed data and critically evaluate its use for integrated natural resource management /or environmental applications; and
4. To critically evaluate the opportunities and available methods for integrating remote sensing and GIS for Earth Science.

Course Learning Outcomes:

After the completion of the course, the student will be able to:
CLO1. To explore ways in which remote sensing and GIS systems will be able to provide geospatial information that is relevant, accurate, timely, accessible, available in an appropriate format, and cost-effective for Earth Science:
CLO2. Develop understanding on fundamental of remote sensing, geographic information system and recent developments in Earth observation such as optical, imaging radar and hyperspectral sensors.
CLO3. Ability to develop remote contemporary image processing, advanced remotely sensed data sources on local, regional and global scales.
CLO4. To engage and explore the ideas, opinion, and analysis that describe efforts to interrogate the Earth science;

CLO5. Internalize and apply the concepts and theory learned from the course in furthering Earth science research and improve understanding,

Detailed Syllabus:

Unit 1: Basic principles of remote sensing; Electromagnetic spectrum; Planck's Law and Wien's Displacement Law; insolation, passive and active remote sensing; Interaction of electromagnetic radiation with matter, selective and non-selective scattering; Impact of scattering on remotely sensed data; atmospheric windows and absorption bands. Multispectral, hyperspectral, thermal remote sensing, thermal infra-red signatures of various rocks and minerals; influence of water and vegetation on thermal inertia and atmospheric interference; Position systems: principles, platforms, accuracies and data integration for location applications.

Unit 2: Spectral reflectance properties and sensors: Reflectance, Spectral reflectance curves, Spectral reflectance properties of gases, water, snow, clouds, vegetation, soils, rocks and minerals; Factors controlling spectral reflectance properties of the above land cover classes. Sensors: non-imaging and imaging sensors; radiometers, spectrometers, spectro-radiometers; Scanner dependent systems: line scan systems; array scanning systems; multispectral scanning systems – push broom and whisk broom imaging systems; circular, conical, side scanning systems. Sensor characteristics: spatial, spectral, radiometric and temporal resolutions.

Unit 3: Aerial Photography: Various types of aerial cameras and black and white films including digital; Scale, brightness and contrast of photographs; resolution of photographs; resolving power of film and camera lens; vertical and oblique aerial photographs; methods of aerial photographic surveys; parallax/relief displacement; Slope, relief and height measurements from stereo photography; Datum and Projection systems;
Drone platforms: specifications, mounted sensor systems and planning data acquisition for studying land cover features in different spectral regions; the geometric correction and information processing and real-time dissemination.

Unit 4: Satellite remote sensing: Various platforms used for remote sensing data acquisition; Orbits of satellites: geosynchronous and sun synchronous orbits; Optical remote sensing satellites – Environmental meteorological satellites like GOES, METEOSAT, GRACE, INSAT, GMS, NOAA etc. Earth resources observation satellites including commercial and small satellites (Past, present and future) and their sensors; Nimbus/CZCS; Landsat, Spot, MOS, Indian Remote Sensing activity; IRS series of satellites, Oceansat satellites, Resourcesat, Cartosat and RISAT series satellite systems etc., Future remote sensing missions of ISRO, NASA and ESA for Earth observation. Open satellite data sources and web-based data processing

References:

1. Floyd F. Sabins Jr., Remote Sensing: Principles and interpretation, W.H. Freeman & Co., San Fransico, 426p
2. Charles Elachi, Introduction to the physics and techniques of remote sensing, John Wiley & Sons, 413 p.
3. John R. Jensen, Introductory Digital Image Processing: A Remote Sensing Perspective, Prentice Hall, 1996

4. Campbell, J.B., 2011. Introduction to Remote Sensing, 5th edition. New York, Guilford Press.Fundamentals of Satellite Remote Sensing: An Environmental Approach, Second Edition Mar 3, 2016, by Emilio Chuvieco, ISBN-13: 978-1498728058, ISBN-10: 1498728057
5. Paul Bolstad, GIS Fundamentals: A First Text on Geographic Information Systems, 5th Edition ISBN-13: 978-1506695877, ISBN-10: 1506695876.
6. Peter A. Burrough, Rachael A. McDonnell,Principles of Geographical Information Systems (Spatial Information Systems), 2nd Edition, ISBN-13: 978-0198233657, ISBN-10: 9780198233657.
7. Bakker, Win H., et al 2001. Principles of Remote Sensing – An Introductory Textbook. ITC, Enschede, Netherlands publication.
8. Averey, T. F. 1985. Interpretation of Aerial Photographs. Minneapllis, Minnnesota: Burges Publishing Company.
9. Paine, D. P. 1981. Aerial Photography and Image Interpretation for Resources Management, John Wiley & Sons.
10. Lillesand, T. M., Kiefer, R. W. and Chipman, J. W. 2004. Remote Sensing and Image Interpretation. John Wiley Students Edition

Code No: ES 202
Course Title: Introduction to Ocean and Atmospheric systems
Credits: 03
L-T: Lectures, Tutorials

Prerequisite Course / Knowledge (if any): Knowledge of physics and Introductory aspects of the Planet Earth.

Course Objectives:

1. To study the fundamental concepts of atmospheric and ocean sciences.
2. To learn about the different ocean systems.
3. To learn about the ocean circulation and basic concepts of fluid motion.

Course Learning Outcomes:
After the completion of the course, the student will be able:
CLO1: Acquires knowledge on the ocean and atmosphere and their role on weather.
CLO2: Understanding of land-ocean-atmospheric interactions and their linkages to extreme events.
CLO3: Acquire knowledge about different ocean systems - Atlantic, Pacific and Indian Oceans.
CLO4: Acquire knowledge about ocean tides and waves and apply to coastal management.
CLO5: Understanding about cyclones in Arabian Sea and Bay of Bengal.

Detailed Syllabus:

Unit 1: Fundamental concepts of atmospheric sciences; vertical thermal structure and composition of the Earth's atmosphere; hydrostatic equation, atmospheric moisture variables, static stability.

Unit 2: Fundamental concepts of ocean sciences; dimension of the ocean and geographical features; physical properties of seawater, distribution of temperature, salinity, and density in space and time, ocean carbon cycle.

Unit 3: General introduction of ocean systems, water type, water masses and their formation mechanisms, temperature-salinity diagrams, water masses of the Atlantic, Pacific, and Indian Oceans. Basics of Ocean circulation; wind-driven circulation, Coriolis force; subtropical and polar gyres; major currents of the world oceans; thermohaline circulation, ocean conveyor belt. Tropical coupled climate phenomena: ENSO, and IOD

Unit 4: Indian monsoon and its variability, Tropical cyclones and their origin, morphology, development and dissipation: The Indian context.

Unit 5: Introduction of Earth's radiation budget, geographical and seasonal distribution of incoming solar radiation, outgoing terrestrial radiation. Wind and global general circulation of winds, climatological variation of temperature, pressure, wind and rainfall. Introduction to equations of motion, recent climate change, Ocean-Atmosphere-Land feedbacks.

References:

1. Wallace, J. M., and P. V. Hobbs, Atmospheric Science: An Introductory Survey, 2nd edition, Elsevier Academic Press, 2006.
2. Marshall J., and R. A. Plumb, Atmosphere Ocean and Climate Dynamics: An Introductory Text, Elsevier Academic Press, 2008.
3. Houghton, J. T., Physics of the Atmosphere, Cambridge University Press, 2002.
4. Stewart, R. L., Introduction to Physical Oceanography
5. Williams, F. J., and S. Elder, Fluid Physics for Oceanographers and Physics: An Introduction to Incompressible, US Naval Academy, Paragon Press.
6. Talley, L. D., G. L. Pickard, W. J. Emery and J. H. Swift, Descriptive Physical Oceanography, 6th edition, Elsevier, 2011.

SEMESTER IV

Code No: AG 251
Course title: Plate Tectonics and Geodynamics
Credits: 04
L-T: Lectures, Tutorials

Prerequisite Course / Knowledge (if any): Preliminary knowledge on Physics and introductory aspects of planet Earth.

Course Objectives:

1. Introducing the planet Earth's exterior and interior structures.
2. To understand the potential fields associated with the Earth.
3. To understand the mantle convections and their role in changing the geology of the Planet Earth.

Course Learning Outcomes:
After completion of the course, the students will be able to:
CLO1: Have a sound knowledge about the physical features on land and in oceans, and about the internal layers of the Earth from physical and chemical characteristics.
CLO2: Have a sound knowledge on the outer rigid layer of the Earth, the lithospheric plates and their evolution through the geological time.
CLO3: Have a good understanding on the geomorphology of the continental landmasses and oceans, its implications on continental drift theory and limitations.
CLO4: Explain processes like mantle convection, accretion of ocean floor and Earth's past magnetic fields, continental rift initiations, evolutions, ocean floor expansions, etc.
CLO5: Understand how the excess thermal regimes at deeper depths, core-mantle boundary led to initiate the upwelling of lower mantle rocks to the surface of the Earth and form the linear volcanic ridges.

Detailed Syllabus:

Unit 1: Size and shape of the planet Earth, Geoid, Oblate spheroid; morphology of the Earth's surface, Physical features of the planet Earth, Passive and Active continental margins, ridges, basins, fracture zones, cratons, tectonic zones/ mobile belts
The spheres of the Earth System, Earth's layering from physical and chemical properties, and their thickness variations in oceanic and continental domains; Density and velocity in the interior of the Earth and their variations as a function of depth

Unit 2: Gravity and magnetic fields of the Earth, and their variations across the Earth's surface and within the Earth; Paleomagnetism, Polar wandering. Super-continents in geological past; Continental rifting and break-ups; Geological, biological and environmental evidences for formulation of continental drift theory, drawbacks of the theory; Configuration of continental masses through geological ages.

Unit 3: Lithosphere, Structure and formation of the lithosphere, Lithospheric plates of the Earth, Thermal regime of the continental and oceanic lithosphere; Principal types of the plate boundaries – mid-ocean ridge, subduction zone and transform fault; Mechanism of Plate Tectonics – mantle convection models; Global distribution of seismicity and Heat flow values; Seafloor spreading process, Records of the Earth's magnetic field, magnetic reversals of the Earth recorded in rocks and sediments, use of spreading anomalies for dating the ocean floor; Age distribution of the Planet Earth

Unit 4: Theory of stress and strain, Poisons relation, Elastic Plate Thickness (Te), Isostacy, compensation models; Flexural bending of Elastic lithospheric plates and its effect on surface topography; Forces acting on the lithospheric plates; Continental collision, Mountain building process in collisional tectonics; Theory of buckling in layered rocks, faulting and folding; Plate subduction models, Volcanism, Island arcs

Unit 5: Origination of mantle plumes; Plume heads and tails, Large Igneous Provinces (LIPs); Role of mantle plumes on continental breakups, aseismic ridge formations, how plume traces can be used for determining the plate motions and plate reorganizations, plume interactions with the mid-ocean ridge segments

References:

1. Fundamentals of Geophysics, William Lowrie
2. Philip Kearey, Keith A. Klepeis and Frederick J. Vine Global Tectonics,
3. Mantle Convection in the Earth and Planets, Gerald Schubert, Donald L. Turcotte & Peter Olson.
4. Plate Tectonics, Unraveling the Mysteries of the Earth, Jon Erickson
5. The Ocean Basins: Their Structure and Evolution, Open University Course Team
6. Mantle Convection and Plumes, Peter Olson
7. Solid Earth Geophysics, C.M.R. Fowler
8. Marine Geophysics, E.J.W. Jones
9. Understanding the Earth, John Grotzinger, Thomas H. Jordon, Frank Press, Raymond Siever
10. Looking into the Earth, Alan E. Mussett, M. Aftab Khan
11. Dynamic Earth, Geoffrey F. Davies
12. Geodynamics, Donald L. Turcotte and Gerald Schubert

Code No: ES 252
Course Title: Geomorphology and Earth Surface Processes
Credits: 03
L-T: Lectures, Tutorials

Prerequisite Course / Knowledge (if any): Introductory aspects of Geology and planet Earth topography.

Course Objectives:

1. Study of the fundamentals of Geomorphology and Earth surface processes
2. learn interactions between exogenic and endogenic interactions, and
3. Learn about the various landforms by river, wind, glacial, etc.

Course Learning Outcomes:
After the completion of the course, a student will learn about
CLO1: Knowledge of the formation of various landforms and drainage system.
CLO2: Comprehensive Knowledge on understanding the weathering and soil formation.
CLO3: Knowledge on interplay of climate, tectonics and denudation on the landscapes.
CLO4: Knowledge about the interaction between exogenic and endogenic processes.
CLO5: Understanding and applying the knowledge of geomorphology to land use and land cover planning.

Detailed Syllabus:

Unit 1: Introduction to geomorphology; concepts, cause-effect relationships, landforms in relation to climate, rock type, structure and tectonics.

Unit 2: Geoid, topography, hypsometry, major morphological features of the Earth surface. Large scale topography - plate tectonics overview, orogeny and large scale mountain building with emphasis on Himalayas.

Unit 3: Earth's Surface processes and geomorphology; weathering and associated landforms. Landforms produced by glacial, periglacial processes, fluvial processes, aeolian processes, coastal and karst processes. Landforms associated with igneous activities. Endogenic-exogenic interactions; rates of uplift and denudation; tectonics and drainage development; sea-level change; long-term landscape development. Landform dating techniques.

Unit 4: Tides and waves: Surface waves, ocean tides, tides in shallow waters and their role and influence in coastal landforms. Cryosphere - Polar ice sheets and Himalayan glaciers. River drainage patterns, water balance, overland flow, floodplain processes. Anthropogenic influences on the landforms.

Unit 5: Ocean floor morphology: Submarine canyons, turbidite channel-levee systems, coral reefs and banks, seamounts and guyouts, abyssal plains, trenches.

References:

1. Philip A. Allen, 2009. Earth surface processes, Wiley.
2. W.D. Thornbury (1969) Principles of Geomorphology. Wiley Eastern Ltd. New Delhi.
3. H.S. Sharma (1990) Indian Geomorphology. Concept Pub. Co., New Delhi.
4. Bloom, A.L. 1998. Geomorphology: A systematic Analysis of Late Cenozoic Landforms (3rd Edition), Pearson Education, Inc.
5. Singh, S. 1998. Geomorphology. Prayag Pustak Bhavan, Allahabad.
6. Kale, V.S. and Gupta, A. 2001. Introduction to Geomorphology. Orient Longman Ltd.
7. Easterbrook, D.J. 1992. Surface processes and landforms. McMillan Publ.

Code No: AG 253
Course title: Structural Geology
Credits: 03
L-T-P: Lectures, Tutorials

Prerequisite Course / Knowledge (If any): Basic concepts of Geology, Physics and Mathematics.

Course Objectives:

1. To have an understanding of the structural elements and steps in structural analysis.
2. To provide comprehensive knowledge on the stress-strain relationships, deformation patterns, and strain distribution in the crust.
3. To understand the strain ellipsoid and measurement of strain gradient in the crust.
4. To gain knowledge about the geometric, kinematic and dynamic analysis of the rocks and regions.
5. To have a basic understanding on the deformation and structures in different tectonic settings.

Course Learning Outcomes:
After completion of the course the student will be able to develop:

CLO1: Understanding of the geometry, kinematics and dynamics of deformation in Earth crust.
CLO2: Understanding the instability of the lithosphere produced by complex plate tectonic movements, continuous and discontinuous deformation at different scales and at different depths.
CLO3: Understanding of the deformation patterns and structures developed during deformation.
CLO4: Understanding of basic techniques of measurement of different parameters in deformed rocks.
CLO5: Understanding the link between the structures in exploration for minerals, energy and water.

Detailed Syllabus:

Unit 1: Introduction to structural geology. Rock deformation: Stress and strain; Relationship between stress and strain. normal stress, shear stress, principal axes of stress, Types of Strain ellipsoid and their geological significance; Mohr circle of stress and their use; concept of stress-strain compatibility.

Unit 2: Factors controlling deformation behaviour of rocks, brittle, plastic transition, seismic behaviour of the upper crust. Continental deformation: transpressional and transtensional tectonics in Indian and global context.

Unit 3: Fundamental structures: Planar and linear fabrics, foliation, cleavage, joints, shear zones. Faults: Geometry and types of faults - Normal and Reverse, strike-slip faults, thrusts. Folds: Geometry and classification of folds. Mechanism of folding and distribution of strain in folds. unconformities. Shear zones: Brittle and ductile shear zones, geometry and kinematics of shear zones. Mylonites and cataclastites. Tectonite fabrics.

Unit 4: Extensional tectonics and basin development, Vertical tectonics, dome-basin patterns, large scale thrusts.

Unit 5: Structures of the orogenic belts, Types of orogens, orogenic events in the geological record with special reference to India.

References:

1. Jain, A.K., (2014) An introduction to structural geology. Text Book series in Geological Sciences for Graduate Students. Geological Society of India, Bangalore.
2. Davis, GH. and Reynolds, S.J., 1996. Structural Geology of rocks and regions, John Wiley. and Sons.
3. Pollard, D.D. & Fletcher, R.C. 2005, Fundamentals of Structural Geology, Cambridge University Press.
4. Ghosh, S.K., 1993. Structural Geology: Fundamentals, and modern developments, Pergamon Press.
5. Ramsay, J.G and Huber, M.I., 1983. Techniques of Modern Structural Geology: Vol. I & 11. Academic Press
6. Ramsay, J. G, 1967. Folding and Fracturing of Rocks, McGraw-Hill Book Company, New York.

University of Hyderabad
Centre for Earth Ocean and Atmospheric Sciences

5-year Integrated M.Sc in Applied Geology

Mapping of Program Learning Outcomes (PLOs) with Core Courses (CCs)
(Semester I to IV)

	CC-1 AG151	CC-2 AG152	CC-3 AG201	CC-4 AG202	CC-5 AG251	CC-6 AG252	CC-7 AG253
PLO-1	3	3	3	3	3	3	3
PLO-2	3	3	3	-	-	-	3
PLO-3	2	2	2	3	3	-	3
PLO-4	-	-	-	-	-	-	3
PLO-5	2	2	2	-	-	3	-
PLO-6	-	-	-	3	3	3	-
PLO-7	-	-	-	-	-	-	-
PLO-8	-	-	-	3	3	3	-
PLO-9	-	-	-	-	-	-	3
PLO-10	-	-	-	-	-	3	-