DEPARTMENT OF GEOLOGY

SYLLABUS FOR FOUR YEAR UNDERGRADUATE PROGRAMME

FIRST AND SECOND SEMESTER

(APPROVED BY ACADEMIC COUNCIL VIDE RESOLUTION NO. 3, DATED: **04 – 07 – 23**)

ARYA VIDYAPEETH COLLEGE (AUTONOMOUS)

ARYA NAGAR, GUWAHATI – 16

INDEX

Structure of Four Year Undergraduate Course

Semester	Type	Core	Minor	SEC	IDC	AEC	VAC/FC	IN
	Credit	4	4	3	3	2	4(2 + 2)	2
I		CE-1114	MN-1114	SE-1113	ID-1113	AE-1112	VL-1112 (Two Courses)	-
II		CE-2114	MN-2114	SE-2113	ID-2113	AE-2112	VL-2112 (Two Courses)	-
III		CE-3214	MN-3214	SE-3213	ID-3213	AE-3212	-	-
		CE-3224						
IV		CE-4214	MN-4214	-	-	AE-4212	-	IN-4212
		CE-4224						
		CE-4234						
V		CE-5314	MN-5214	-	-	-	-	-
		CE-5324						
		CE-5334						
		CE-5344						
VI		CE-6314	MN-6214	-	-	-	-	-
		CE-6324						
		CE-6334						
		CE-6344						
VII		CE-7414	MN-7314	-	-	-	-	-
		CE-7424						
		CE-7434						
		CE-7444						
VIII		CE-8414	MN-8314	-	-	-	-	-
		CE-8424**						
		CE-8434**						
		CE-8444**						

****Students who secure more than 7.5 CGPA at the end of third year (6th semester) may opt for a research dissertation of 12 credits instead of the three core papers.**

Course code: **First two letters is the abbreviation of course component**

First digit implies semester number

Second digit implies course level

Third digit implies course number

Fourth digit implies credit points per course.

Digit	Course Level
1	100 - 199
2	200 - 299
3	300 - 399
4	400 - 499

Semester Wise Credit Distribution

Semester	CREDIT DISTRIBUTION							
	CORE	MINOR	SEC	AEC	IDC	VAC/FC	IN	TOTAL
FIRST	1 x 4	1 x 4	1 x 3	1 x 2	1 x 3	2 x 2	--	20
SECOND	1 x 4	1 x 4	1 x 3	1 x 2	1 x 3	2 x 2	--	20
THIRD	2 x 4	1 x 4	1 x 3	1 x 2	1 x 3	--	--	20
FOURTH	3 x 4	1 x 4	--	1 x 2	--	--	1 x 2	20
FIFTH	4 x 4	1 x 4	--	--	--	--	--	20
SIXTH	4 x 4	1 x 4	--	--	--	--	--	20
SEVENTH	4 x 4	1 x 4	--	--	--	--	--	20
EIGHT	4 x 4	1 x 4	--	--	--	--	--	20

SEC: SKILL ENHANCEMENT COURSE

AEC: ABILITY ENHANCEMENT COURSE

IDC: INTERDISCIPLINARY COURSE

VAC/FC: VALUE ADDED COURSE

IN: INTERNSHIP

Abbreviation of Course Components:

CE (Core), MN (Minor), SE(Skill Enhancement Course), AE (Ability Enhancement Course), VL (Value added Course), ID (Interdisciplinary Course), IN (Internship)

LIST OF PAPERS:

CORE:

1. **Earth systems science (GL – CE – 1114)**
2. **Rocks and Minerals (GL – CE – 2114)**

MINOR:

1. **Earth systems science (GL – MN – 1114)**
2. **Rocks and Minerals (GL – MN – 2114)**

MULTIDISCIPLINARY/INTERDISCIPLINARY COURSE:

1. **Environmental Geology (GL – ID – 1113)**
2. **Disaster Management (GL – ID – 2113)**

SKILL ENHANCEMENT COURSE:

1. **Surveying and map making (GL – SE – 1113)**
2. **Basic field training (GL – SE – 2113)**

FIRST SEMESTER

PAPER NAME: Earth System Science
PAPER CODE: GL – CE – 1114
Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY: 3 CREDITS

Total Lectures: 45

COURSE OBJECTIVE:

The course is intended to teach the fundamental ideas of dynamic earth. It will go over the fundamental principles and processes that regulate the Earth's system. The course will also go through the various systems that exist on the Earth's surface.

COURSE OUTCOME:

The course outcomes of this course are as follows:

• It will improve students' grasp of the dynamic earth and the processes involved in the earth.

• It will improve students' understanding of the solid earth and its physics and chemistry.

• Students Learn about the physical and chemical properties of the atmosphere and the hydrosphere.

• Students will comprehend climate change and its long and short-term consequences.

Unit- I:Earth as a System(Lectures:15)

Origin, age and general characteristics of the earth and the solar system; Definition and scope of earth systems science; The subsystems/system components and their interactions; Sources of energy.

Laws of uniformitarianism, superposition of strata and faunal succession; The rock cycle, geochemical cycle, erosion cycle, hydrological cycle; Concept of geological time scale.

Evolution of the atmosphere and hydrosphere; Biological evolution through geological history of the earth. Human impact on the earth system during Anthropocene.

Unit- II: Solid earth and its dynamics(Lectures: 15)

Internal structure of the earth, mantle convection, genesis of Earth's magnetic field; Concept of plate tectonics, sea floor spreading and continental drift.

Earthquake and volcanoes-causes of formation and distribution; Earthquake belts and the Pacific ring of fire; Hot spot; Earthquake zones of India.

Origin of the continents and oceans, mountains and rift valleys.The Wilson Cycle. Role of tectonics in landscape development

Unit- III: The atmosphere and hydrosphere(Lectures: 15)

Composition and vertical layered structure of the earth's atmosphere. Insolation and albedo, energy gradient; Hadley cell, the atmospheric pressure belts and circulation, Coriolis effect. The monsoon, upper level waves and jet stream. The meteorological parameters and their spatial and temporal variations, Weather and climate

Chemical composition and physical properties of sea water, thermocline, halocline and pycnocline. Surface and deep water circulation, causes and effects.Land– air-sea interaction. Concepts of eustasy.

Earth's climate and climate change- short and long term. ENSO, Elnino and La-Nina, Impact of oceanic circulation on climate

PRACTICAL:

CREDITS:1 (LECTURES: 30)

1. Model study of different geomorphic features.
2. Study of geomorphological features from topographic maps.
3. Study of major ocean currents of the world.
4. Study of seismic profile of a specific area and its interpretations.
5. Basic statistical analysis of hydro meteorological data

RECOMMENDED BOOKS:

1. Brian J. Skinner, B. J. & Porter, S. C.: (2012). The Blue Planet: An Introduction to Earth System Science. John Wiley & Sons. Inc.
2. Emiliani, C. (1992). Planet earth: cosmology, geology, and the evolution of life and environment. Cambridge University Press.
3. Holmes' Principles of Physical Geology, 1992.Chapman & Hall.
4. Patwardhan, A. M., The Dynamic Earth System, PHI Learning.
5. Bloom A.L.,(1998). Geomorphology: A Systematic Analysis of Late Cenozoic Landforms. Pearson Education.
6. Esterbrook D.J.,(1992).Surface Processes and Landforms, Mac Millan Publ.
7. Kale,V. Sand Gupta A.(2001).1ntoduction to Geomorphology, Orient Longman Ltd.
8. Summerfield. M. A. (1991). Global Geomorphology, Prentice Hall.
9. Environmental Geology by K.S.Valdiya. Tata McGraw Hill Publishing Co. Ltd.
10. Text Book of Environmental Sciences by Subramaniam. V. Narosa International publisher.

PAPER NAME: Earth System Science
PAPER CODE: GL – MN – 1114
Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY: 3 CREDITS

Total Lectures: 45

COURSE OBJECTIVE:

The course is intended to teach the fundamental ideas of dynamic earth.It will go over the fundamental principles and processes that regulate the Earth's system.The course will also go through the various systems that exist on the Earth's surface.

COURSE OUTCOME:

The course outcomes of this course are as follows:

• It will improve students' grasp of the dynamic earth and the processes involved in the earth.

• It will improve students' understanding of the solid earth and its physics and chemistry.

• Students Learn about the physical and chemical properties of the atmosphere and the hydrosphere.

• Students will comprehend climate change and its long and short-term consequences.

Unit- I:Earth as a System(Lectures: 15)

Origin, age and general characteristics of the earth and the solar system; Definition and scope of earth systems science; The subsystems/system components and their interactions; Sources of energy.

Laws of uniformitarianism, superposition of strata and faunal succession; The rock cycle, geochemical cycle, erosion cycle, hydrological cycle; Concept of geological time scale.

Evolution of the atmosphere and hydrosphere; Biological evolution through geological history of the earth. Human impact on the earth system during Anthropocene.

Unit- II: Solid earth and its dynamics(Lectures: 15)

Internal structure of the earth, mantle convection, genesis of Earth’s magnetic field; Concept of plate tectonics, sea floor spreading and continental drift.

Earthquake and volcanoes-causes of formation and distribution; Earthquake belts and the Pacific ring of fire; Hot spot; Earthquake zones of India.

Origin of the continents and oceans, mountains and rift valleys. The Wilson Cycle. Role of tectonics in landscape development

Unit- III: The atmosphere and hydrosphere (Lectures: 15)

Composition and vertical layered structure of the earth’s atmosphere. Insolation and albedo, energy gradient; Hadley cell, the atmospheric pressure belts and circulation, Coriolis effect. The monsoon, upper level waves and jet stream. The meteorological parameters and their spatial and temporal variations, Weather and climate

Chemical composition and physical properties of sea water, thermocline, halocline and pycnocline. Surface and deep water circulation, causes and effects. Land – air-sea interaction. Concepts of eustasy.

Earth's climate and climate change- short and long term. ENSO, Elnino and La-Nina, Impact of oceanic circulation on climate

PRACTICAL:

CREDITS:1 (LECTURES: 30)

1. Model study of different geomorphic features.
2. Study of geomorphological features from topographic maps.
3. Study of major ocean currents of the world.
4. Study of seismic profile of a specific area and its interpretations.
5. Basic statistical analysis of hydro meteorological data

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1. Brian J. Skinner, B. J. & Porter, S. C.: (2012). The Blue Planet: An Introduction to Earth System Science. John Wiley & Sons. Inc.
2. Emiliani, C. (1992). Planet earth: cosmology, geology, and the evolution of life and environment. Cambridge University Press.
3. Holmes' Principles of Physical Geology,1992.Chapman & Hall.
4. Patwardhan, A. M., The Dynamic Earth System, PHI Learning.
5. Bloom A.L.,(1998).Geomorphology: A Systematic Analysis of Late Cenozoic Land forms. Pearson Education.
6. Esterbrook D.J.,(1992).Surface Processes and Landforms, Mac Millan Publ.
7. Kale,V. Sand Gupta A.(2001).1ntoductiontoGeomorphology,Orient Longman Ltd.
8. Summerfield. M. A. (1991). Global Geomorphology, Prentice Hall.
9. Environmental Geology by K.S.Valdiya. Tata McGraw Hill Publishing Co. Ltd.
10. Text Book of Environmental Sciences by Subramaniam. V. Narosa International publisher.

PAPER NAME: Surveying and Map making
PAPER CODE: GL – SE – 1113
Total Credits: 3 (Theory: 2 + Practical/Tutorial: 1)

THEORY

Total Lectures: 30

COURSE OBJECTIVE:

The course is proposed to be introducing for the student to understand the principles and methods of surveying and associated map production techniques. As an earth science student they will be always connected with maps in field. Thus elementary plane surveying procedures need to be emphasized in this course. Geodetic principles will also be incorporated into the discussion of the Global Positioning System and digital mapping techniques.

COURSE OUTCOME:

- *The course will improve in understanding about land surveying theory and principles.*
- *Students will become familiar with land surveying methods.*
- *Students will be able to use different types of land surveying instruments.*
- *Digital survey techniques will enhance the capability of students in preparing maps.*

Unit-I:Basic principles of Surveying and mapping(Lectures: 15)

Definition and principle of surveying, aim and objective of surveying, importance of surveying in Geology.
Important surveying terminologies – datum (MSL), reduced level (RL), benchmark (BM), temporary bench mark (TBM), back sight(BS), foresight(FS), intermediate sight(IS), elevation of line of sight, etc.
Classification of survey- land based – topographical, cadastral, urban or city, marine based - hydrographical survey, astronomical survey etc.
Application of surveying in engineering, military, mine, geology, archaeology etc. Levelling-dumpy level, theodolite with tripod, prismatic compass with tripod.

Unit-II:Digital surveying techniques(Lectures: 15)

Remote Sensing & Image processing, Total Station Survey, Global Positioning System Survey

PRACTICAL:

CREDITS:1 (LECTURES: 30)

1. ETS/GPS Survey (Traverse, Triangulation, DGPS)
2. Plane Table Survey
3. Digital map preparation using Remote Sensing software's.

RECOMMENDED BOOKS:

1. Elements Of Geological Maps For Geology, Geography & Civil Engineering, 2Nd Edition by Chadha S K, CBS Publishers.
2. A Guide to Field Geology (Pb 2015) By Gokhale N. W, CBS Publishers.
3. Basic Geological Mapping (Geological Field Guide Book 43) 5th Edition, Kindle Edition. Wiley Publisher .
4. Exercises On Geological Maps And Dip Strike Problems For B.Sc Students (Pb 2019) By Gokhale N. W. CBS Publishers.
5. A Textbook on Surveying and Mapping: Answers to Questions, 2018 by International Correspondence Schools.
6. Coordinates of Elementary Surveying Paperback by John Charles Lounsbury Fish. Kessinger Pub (15 March 2009)

PAPER NAME: Environmental Geology
PAPER CODE: GL – ID – 1113
Total Credits: 3 (Theory)

THEORY

Total Lectures: 45

COURSE OBJECTIVE:

This course will introduce students about the natural and anthropogenic geological activities related to environment and possible solutions about the environmental related geological problems. This paper helps to understand the chemistry of different spheres of the earth such as atmosphere, hydrosphere, lithosphere, and their interactions. Additionally, concepts of toxic elements and related health hazards are also considered for the studies.

COURSE OUTCOME:

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

- *Understand fundamentals of Environmental geology.*
- *Develop skills to identify the natural and anthropogenic geological activities related to environment. The course will improve the understanding about the Physico-chemical conditions of different spheres of the Earth. And, boost the students in understanding the interrelationship between the spheres.*
- *Studies related to different biogeochemical cycles will enhance the understanding about the Earth and environment.*
- *Studies of the Heavy metals will allow the students to rethink about the toxicity level and potential health hazards prevailing in the society.*

Unit-I: Basics of Environmental Geology(Lectures: 15)

Definition and scope of environmental geology. Natural and anthropogenic environmental hazards. Impact of geological hazards : Earthquakes, Volcanism, flood , landslide and mining on environment.

Unit-II: Introduction to Environmental Chemistry(Lectures: 15)

Atmosphere: Troposphere air composition, aerosol in troposphere (sources, composition, chemistry, transport, residence times, and sinks). Chemistry of stratosphere, formation and destruction of O_3.
Lithosphere: Weathering (physical and chemical), dissolution and precipitation of solids, stable and meta-stable processes, Soil composition and characteristics.
Hydrosphere: Freshwater and Sea water and their composition, physico-chemical processes, redox reactions.
Biosphere: Natural processes in the biosphere and processes associated.

Unit-III: Environmental pollution, Toxic Elements and Health hazard(Lectures: 15)

Environmental pollution.Toxic elements such as As, Cd, Pb, Hg, and SOx, NOx, in the environment, carcinogens. Concept of global warming and climate change. Carbon cycles (short and long term), atmospheric and marine Carbon; Nitrogen - forms of nitrogen, Nitrogen biochemistry, fertilization, human influences on nitrogen cycling.

RECOMMENDED BOOKS:

1. E. A. Keller (2010), Environmental Geology. Pearson.
2. C.W. Montogomery (2002), Environmental Geology.
3. K.S. Valdiya (2013), Environmental Geology: Ecology, Resource and Hazard Management. McGraw Hill Education (India) Private Limited, New Delhi.
4. V. Subramaniam .Text Book in Environmental Sciences, Narosa International
5. Manahan, S. E., 2009, Environmental Chemistry, CRC Press.
6. Andrews, J. E.,Brimblecombe, P., Jickells, T. D., Liss, P. S., and Reid. B. J., 2004, Introduction to Environmental Chemistry, Blackwell Publications.
7. Schlesinger, W. H., 1997, Biogeochemistry: An Analysis of Global Change, Academic Press.
8. Kumar, U. Geochemistry and Environmental Geology

SECOND SEMESTER

PAPER NAME: Rocks & Minerals

PAPER CODE: GL – CE – 2114

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY: 3 Credits

TOTAL LECTURES: 45

COURSE OBJECTIVE:

The course objectives of this course are as follows:

- *To provide a holistic understanding about the basics of minerals, crystals and rocks.*
- *Students will be able to recognise and differentiate rocks, minerals and crystals.*
- *This paper helps to understand about ore and economic minerals and their significances*

COURSE OUTCOME:

The course outcomes of this course are as follows:

- *Students can learn about the rocks and minerals and their economic importance in the present day context.*
- *They can know about the minerals and its relation to crystal, difference between crystal and amorphous substance, different crystal system.*
- *They can learn about physical and optical properties of mineral and their usefulness to identify a mineral.*
- *Students can get a basic knowledge about various rock types and their significances.*

Unit- I:Concepts of rocks, minerals and crystals(LECTURES: 15)

Elementary ideas about crystal and amorphous substance, crystal morphology in relation to internal structures, crystal systems. Composition of common rock forming minerals.Silicate and non-silicate structures, CCP and HCP structures, Definition of rocks, types of rocks - Igneous, metamorphic, sedimentary.Rock cycle.

Unit-II: Mineralogy (LECTURES: 15)

Minerals: definition, scope, classification, physical and chemical properties. Optical properties of minerals - Nature of light; Reflection and refraction of rays; Refractive index, Polarization of light; Polarizing Microscope,Cleavage, Extinction, Interference colour, Isotropic and Anisotropic minerals: Uniaxial and Biaxial.
Study of optical properties of the following minerals: Quartz, Orthoclase, Microcline, Hypersthene, Hornblende, Garnet, Muscovite, Biotite, Enstatite, Olivine, Kyanite, Sillimanite, Calcite, Plagioclase.

Study of chemical composition and diagnostic physical properties of the following minerals: Quartz, Orthoclase, Microcline, Hypersthene, Hornblende, Garnet, Muscovite, Biotite, Enstatite, Olivine, Kyanite, Sillimanite, Calcite, Plagioclase.

Unit- III: Concepts of petrology (LECTURES: 15)

Igneous petrology: Magma, its composition, origin and types; Crystallization of Magma, Bowen's reaction; Magmatic differentiation; Assimilation. Igneous rocks: Definition; Mode of occurrence; Textures and structures; Classification of igneous rocks on textural, mineralogical and chemical criteria. Significances of different igneous rocks - Granite, Dolerite, Gabbro, Rhyolite, Syenite, Basalt and Diorite.

Sedimentary Petrology: Introduction; Processes of formation of sedimentary rocks– weathering, transportation, deposition, diagenesis. Textures and structures of sedimentary rocks; Sedimentary structures: lamination, ripple marks, current bedding, graded bedding, mud cracks, rain prints. Classification of sedimentary rocks; Petrographic description of: sandstone, siltstone, shale, limestone, breccia and conglomerate.

Metamorphic Petrology: Metamorphic rocks: Definition; Factors or Agents of Metamorphism; Types of Metamorphism; Grade of Metamorphism, Zones of Metamorphism; Metamorphic facies; Textures and Structures of Metamorphic rocks. Descriptive petrography of Slate, Phyllite, Schist, Gneiss, Quartzite and Marble.

PRACTICAL:

CREDITS:1 (LECTURES: 30)

1. Identification of following minerals in hand specimen: Quartz, Orthoclase, Microcline, Hypersthene, Hornblende, Garnet, Muscovite, Biotite, Enstatite, Olivine, Kyanite, Sillimanite, Calcite, Plagioclase.
2. Study of optical properties of the following minerals in thin section: Quartz, Orthoclase, Microcline, Hypersthene, Hornblende, Garnet, Muscovite, Biotite, Enstatite, Olivine, Staurolite,Kyanite, Sillimanite, Calcite, Plagioclase.
3. Identification of following rocks in hand specimen:
    i. Igneous rocks - Granite, Dolerite, Gabbro, Rhyolite, Syenite, Basalt and Diorite.
    ii. Sedimentary rocks -Sandstone, Siltstone, Shale, Limestone, Breccia, Conglomerate.
    iii. Metamorphic rocks -Slate, Phyllite, Schist, Gneiss, Quartzite and Marble.

RECOMMENDED BOOKS:

1. Text of Geology by G.B. Mahapatra.
2. Deer, W. A., Howie, R. A., &Zussman, J. (1992). An introduction to the rock-forming minerals (Vol. 696). London: Longman.
3. Mineralogy: Perkins and Henke
4. J.D. Dana. Textbook of Mineralogy
5. Winter, J. D. (2014). Principles of igneous and metamorphic petrology. Pearson.
6. Raymond, L. A. (2002). Petrology: the study of igneous, sedimentary, and metamorphic rocks. McGraw-Hill Science Engineering.
7. Myron G. Best (2001). Igneous and Metamorphic Petrology
8. Fundamentals of Geology by A.B. Roy.
9. Engineering and General Geology by Parbin Singh.

PAPER NAME: Rocks & Minerals

PAPER CODE: GL – MN – 2114

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY: 3 Credits

TOTAL LECTURES: 45

COURSE OBJECTIVE:

The course objectives of this course are as follows:

- *To provide a holistic understanding about the basics of minerals, crystals and rocks.*
- *Students will be able to recognise and differentiate rocks, minerals and crystals.*
- *This paper helps to understand about ore and economic minerals and their significances*

COURSE OUTCOME:

The course outcomes of this course are as follows:

- *Students can learn about the rocks and minerals and their economic importance in the present day context.*
- *They can know about the minerals and its relation to crystal, difference between crystal and amorphous substance, different crystal system.*
- *They can learn about physical and optical properties of mineral and their usefulness to identify a mineral.*
- *Students can get a basic knowledge about various rock types and their significances.*

Unit- I: Concepts of rocks, minerals and crystals (LECTURES: 15)

Elementary ideas about crystal and amorphous substance, crystal morphology in relation to internal structures, crystal systems.Composition of common rock forming minerals.Silicate and non-silicate structures, CCP and HCP structures, Definition of rocks, types of rocks - Igneous, metamorphic, sedimentary.Rock cycle.

Unit-II: Mineralogy (LECTURES: 15)

Minerals: definition, scope, classification, physical and chemical properties.Optical properties of minerals - Nature of light; Reflection and refraction of rays; Refractive index, Polarization of light; Polarizing Microscope, Cleavage, Extinction, Interference colour, Isotropic and Anisotropic minerals: Uniaxial and Biaxial.
Study of optical properties of the following minerals: Quartz, Orthoclase, Microcline, Hypersthene, Hornblende, Garnet, Muscovite, Biotite, Enstatite, Olivine, Kyanite, Sillimanite, Calcite, Plagioclase.

Study of chemical composition and diagnostic physical properties of the following minerals: Quartz, Orthoclase, Microcline, Hypersthene, Hornblende, Garnet, Muscovite, Biotite, Enstatite, Olivine, Kyanite, Sillimanite, Calcite, Plagioclase.

Unit- III: Concepts of petrology (LECTURES: 15)

Igneous petrology: Magma, its composition, origin and types; Crystallization of Magma, Bowen's reaction; Magmatic differentiation; Assimilation. Igneous rocks: Definition; Mode of occurrence; Textures and structures; Classification of igneous rocks on textural, mineralogical and chemical criteria. Significances of different igneous rocks - Granite, Dolerite, Gabbro, Rhyolite, Syenite, Basalt and Diorite.

Sedimentary Petrology: Introduction; Processes of formation of sedimentary rocks– weathering, transportation, deposition, diagenesis. Textures and structures of sedimentary rocks; Sedimentary structures: lamination, ripple marks, current bedding, graded bedding, mud cracks, rain prints. Classification of sedimentary rocks; Petrographic description of: sandstone, siltstone, shale, limestone, breccia and conglomerate.

Metamorphic Petrology: Metamorphic rocks: Definition; Factors or Agents of Metamorphism; Types of Metamorphism; Grade of Metamorphism, Zones of Metamorphism; Metamorphic facies; Textures and Structures of Metamorphic rocks. Descriptive petrography of Slate, Phyllite, Schist, Gneiss, Quartzite and Marble.

PRACTICAL:

CREDITS:1 (LECTURES: 30)

1. Identification of following minerals in hand specimen: Quartz, Orthoclase, Microcline, Hypersthene, Hornblende, Garnet, Muscovite, Biotite, Enstatite, Olivine, Kyanite, Sillimanite, Calcite, Plagioclase.
2. Study of optical properties of the following minerals in thin section: Quartz, Orthoclase, Microcline, Hypersthene, Hornblende, Garnet, Muscovite, Biotite, Enstatite, Olivine, Staurolite, Kyanite, Sillimanite, Calcite, Plagioclase.
3. Identification of following rocks in hand specimen:
    i. Igneous rocks - Granite, Dolerite, Gabbro, Rhyolite, Syenite, Basalt and Diorite.
    ii. Sedimentary rocks -Sandstone, Siltstone, Shale, Limestone, Breccia, Conglomerate.
    iii. Metamorphic rocks -Slate, Phyllite, Schist, Gneiss, Quartzite and Marble.

RECOMMENDED BOOKS:

1. Deer, W. A., Howie, R. A., &Zussman, J. (1992). An introduction to the rock-forming minerals (Vol. 696). London: Longman.
2. Mineralogy: Perkins and Henke
3. J.D. Dana. Textbook of Mineralogy
4. Winter, J. D. (2014). Principles of igneous and metamorphic petrology. Pearson.
5. Raymond, L. A. (2002). Petrology: the study of igneous, sedimentary, and metamorphic rocks. McGraw-Hill Science Engineering.
6. Myron G. Best (2001). Igneous and Metamorphic Petrology
7. Fundamentals of Geology by A.B. Roy.
8. Engineering and General Geology by Parbin Singh.
9. Text of Geology by G.B. Mahapatra.

PAPER NAME: Basic Field Training
PAPER CODE: GL – SE – 2113
Total Credits: 3 (Theory: 2 + Practical/Tutorial: 1)

THEORY

Total Lectures: 30

COURSE OBJECTIVE:

Basic Field Training (BFT) is a fundamental course designed for the students of Geology to improve the understanding the geology in the real world. Primary focus is to improve the quality the future geologist of the nation. It includes all the necessary fundamental field techniques related to any geological fieldwork.

COURSE OUTCOME:

- *Develop skills to identify rocks and minerals in fields.*
- *Develop skills to identify the different small to large scale deformational structures in the outcrop.*
- *Develop skills to carry out individual measurements during field and develop idea to prepare geological maps.*

Unit-I: (Lectures: 15)

Methods of orientation of topographic sheet in field, Marking location in topo-sheet, methods of taking bearing (front & back), Concepts of map reading. Reading contours and topography.

Unit-II: (Lectures: 15)

Identification of rock types in field. Identification of different structural elements in field.

Basic field measurement techniques: bedding, dip and strikes etc. Litholog measurement.

PRACTICAL/FIELD WORK:

CREDITS:1 (LECTURES/HOURS: 30)

1. Duration of field work is to be minimum 7 days and is compulsory for all students.
2. An area with good rock exposures in the vicinity of the institution (Local) is to be selected for this field trip.
3. Students are to be trained how to take reading s like strike direction, amount and direction of dip, plunge, and bearing (front and back) with the help of clinometer and Brunton compass.

RECOMMENDED BOOKS:

1. Field Geology–F.H. Lahee.
2. Introduction to Sedimentology – S.N. Sengupta.
3. An Introduction to igneous and sedimentary rocks–John D. Winter.
4. A Guide to Field Geology - N. W. Gokhale,
5. Sedimentary Rocks in the Field - M. E. Tucker, Wiley-Blackwell
6. The Field Description of Igneous Rocks - D. Jerram and N. Petford, Wiley-Blackwell
7. The Field Description of Metamorphic Rocks - N. Fry, Wiley-Blackwell 10.
8. The Mapping of Geological Structures - K. R. Mc. Clay, Wiley-Blackwell

PAPER NAME: Disaster Management

PAPER CODE: GL – ID – 2113

Total Credits: 3 (THEORY)

Total Lectures: 45

COURSE OBJECTIVE:

The objectives of the course are:

- *To impart knowledge and concepts of disaster and disaster management.*
- *To enhance the students understanding on Hazard, Vulnerability and Risk.*
- *To develop positive attitude towards practical response to different stages of disaster management.*
- *To ensure disaster response skills,*

COURSE OUTCOME:

After completion of the course, the learners will be able to:

- *Define and analysis factors contributing to disasters, threats to development, life and nature.*
- *Demonstrate and practice disaster risk reduction activities towards sustainable development.*
- *Formulate, organize and access disaster risk reduction activities according to the nature of disaster and factors of vulnerabilities.*

Unit- I:Concepts of Disaster and Vulnerability(LECTURES: 15)

Hazard, disaster, vulnerability and risk. Types of hazard and disaster – Natural (Earthquake, flood and landslide) & anthropogenic hazard and disasters. Causes and impacts of disasters; impact on – natural ecosystem, physical, psychological and social impact. Concept of GIS and Remote sensing application. Disaster vulnerability profile of India with specific reference to North- east India

Unit-II:Disaster Intervention Practices (LECTURES: 15)

Disaster Management Cycle-Rescue, relief, rehabilitation, reconstruction, prevention, mitigation and preparedness. Disaster risk reduction (DRR)- Community based DRR, Institutions concerned with safety, Disaster mitigation and construction techniques as per Indian Standard. Early warning systems.T rauma and Stress management. First-aid and emergency procedures.

Unit-III:Disaster Management (LECTURES: 15)

Components of disasters management-Preparedness of rescue & relief, mitigation, rehabilitation & reconstruction. Institutional framework of disaster management in India (NDMA-SDMA-DDMA,NDRF,Civic volunteers, NIDM), Phases of disasters/risk management and post-disaster responses. Applications of remote sensing & GIS in disaster management. Disaster Management Act-2005.

RECOMMENDED BOOKS:

1. Singh, R.(2017),"Disaster Management Guidelines for Earthquakes, Landslides, Avalanches and Tsunami". Horizon Press Publications
2. Taimpo (2016),"Disaster Management and Preparedness "CRC Press Publications.
3. Nidhi, G.D.(2014),"Disaster Management Preparedness". CBS Publications Pvt .Ltd.
4. Keller E.A. (2012) Introduction to Environmental Geology, Pearson Prentice Hall. Fifth Edition Types of hazards-Earthquake, flood, Tsunami, other water related hazards and events cyclone etc.
5. Clark, T. D. (2017). Natural Disasters, Vulnerability, and Resilience in Indigenous Communities: Literature Review and Conceptual Framework. (PDF)
6. Natural Disasters, Vulnerability and Resilience in Indigenous Communities: Literature Review and Conceptual Framework I Timothy, David Clark–Academic