

**PRESCRIBED SYLLABUS
FOR CBCS
GEOLOGY NON HONOURS
SEMESTER-WISE COURSES**

Submitted to



**Submitted by
Department of Applied Geology, Dibrugarh University**

OVERALL STRUCTURE

SEMWISE DISTRIBUTION OF COURSES IN B. Sc NON HONOURS IN GEOLOGY (CBCS)

Sem	Core Course(12)	AECC (2)	SEC (2)	DSE (6)
I	DSC 1A (6c)	AECC 1(2c)		
	DSC-2A(6c) DSC-3A(6c)	AECC 2 (2c)		
II	DSC 1B(6c) DSC-2B(6c) DSC-3B(6c)	AECC 3 (4c)		
III	DSC 1C(6c) DSC-2C(6c) DSC-3C(6c)		SEC 1.1(2c)	
IV	DSC 1D(6c) DSC-2D(6c) DSC-3D(6c)		SEC 2.1(2c)	
V			SEC 1.2(6c)	DSE 1A(6c) DSE 2A(6c) DSE 3A(6c)
VI			SEC 2.2(6c)	DSE 1B(6c) DSE 2B(6c) DSE 3B(6c)

CORE COURSE (14c)General Structure:

Semester	Core Course
I	DSC 1A: Introduction to Geology
	DSC 2A: Crystallography and Mineralogy
	DSC-3A: Geochemistry and Optical Mineralogy
II	DSC 1B: Thermodynamics and Igneous Petrology
	DSC 2B: Sedimentary and Metamorphic Petrology
	DSC-3B: Palaeontology
III	DSC 1C: Structural Geology and Tectonics
	DSC 2C: Surveying and Engineering Geology
	DSC-3C: Economic Geology
IV	DSC 1D: Geomorphology, Remote Sensing and GIS
	DSC 2D: Principles of Stratigraphy and Indian Stratigraphy
	DSC 3D: Coal and Petroleum

Skill Enhancement Course SEC (2c) General Structure:

Semester	Paper Structure	Papers available
III	SEC 1.1	Skills of basic Geological field studies
IV	SEC 2.1	Skills of advanced Geological field studies
V	SEC 1.2	Skills of Geological Field studies in igneous and metamorphic terrain
VI	SEC 2.2	Project Work

Elective Discipline Specific DSE (4c) General Structure:

Semester	Paper	Papers available for selection
V	DSE 1A	1. Geological Exploration 2. Geoinformatics 3. Fluvial Geomorphology 4. Environmental Geology
	DSE 2A	
	DSE 3A	
VI	DSE 1B	5. Mining Geology 6. Structural Geology 7. Hydrogeology 8. Earth and Climate
	DSE 2B	
	DSE 3B	

SEMWISE DISTRIBUTION OF COURSES IN B. Sc HONOURS IN GEOLOGY (CBCS)

Sem	Core Course(12)	Course code	AECC (2)	SEC (2)	Course code	DSE (6)	Course code
I	DSC1A 6C		AECC (1)2c				
	DSC2A 6c		AECC(2) 2c				
	DSC3A6c						
II	DSC1B 6c						
	DSC2B6c						
	DSC3B6c						
III	DSC1C6c			SEC1.12c			
	DSC2c6c						
	DSC3C6c						
IV	DSC1D6c			SEC2.12c			
	DSC2D6c						
	DSC3D6c						
V				SEC1.22c		DSE1A 6c	
						DSE2A6c	
						DSE3A6c	
VI				SEC2.22c		DSE1B6c	
						DSE2B6c	
						DSE3B6	

1st Sem

Course	Paper code	Title of the Course	Credit			Marks Distribution				
			Th	Prac	Total	Theory		Practical		Total
						End Sem	In- Sem	End Sem	In- Sem	
DSC 1A	GEOG1 01T4	Introduction to Geology	4		6	48	12			100
	GEOG1 01P2			2				32	8	
DSC 2A	GEOG1 02T4	Crystallography and Mineralogy	4		6	48	12			100
	GEOG1 02P2			2				32	8	
DSC 3A(6 C)	GEOG GE101A T4	Geochemistry and optical mineralogy	4		6	48	12			100
	GEOG GE101A P2			2				32	8	
Total					18					300

2nd Sem

Course	Paper code	Title of the Course	Credit			Marks Distribution				
			Th	Prac	Total	Theory		Practical		Total
						End Sem	In- Sem	End Sem	In- Sem	
DSC1 B 6C	GEOG201 T4	Thermodynamics and Igneous petrology	4		6	48	12			100
	GEOG201 P2			2				32	8	
DSC2 B6C	GEOG202 T4	Sedimentary and metamorphic petrology	4		6	48	12			100
	GEOG202 P2			2				32	8	
DSC3 B 6C	GEOG GE201AT 4	Palaeontology	4		6	48	12			100
	GEOG GE201AP 2			2				32	8	
Total					18					300

3rd Sem

Course	Paper code	Title of the Course	Credit			Marks Distribution				
			Th	Prac	Total	Theory		Practical		Total
						End Sem	In- Sem	End Sem	In- Sem	
DSC 1C	GEOG3 01T4	Structural geology and tectonics	4		6	48	12			100
	GEOG3 01P2			2				32	8	
DSC 2C	GEOG3 02T4	Surveying and engineering geology	4		6	48	12			100
	GEOG3 02P2			2				32	8	
DSC 3C	GEOG3 02T4	Economic geology	4		6	48	12			100
	GEOG3 02P2			2				32	8	
SEC 1.1- 2C	GEOGS EC301A T2	Skills of basic Geological field studies	2		2	24	6			30
Total					20					330

4th Sem

Course	Paper code	Title of the Course	Credit			Marks Distribution				
			Th	Prac	Total	Theory		Practical		Total
						End Sem	In- Sem	End Sem	In- Sem	
DS C1 D	GEOG40 1T4	Geomorphology, Remote sensing and GIS	4		6	48	12			100
	GEOG40 1P2			2				32	8	
DS C2 D	GEOG40 2T4	Principles of Stratigraphy and Indian stratigraphy	4		6	48	12			100
	GEOG40 2P2			2				32	8	
DS C3 D	GEOG40 3T4	Coal and petroleum	4		6	48	12			100
	GEOG40 3P2			2				32	8	

SE C 1.2 2C	GEOGSE C401AT2	Skills of advanced Geological field studies	2		2	24	6			30
Total					26					430

5th Sem

Course	Paper code	Title of the Course	Credit			Marks Distribution				
			Th	Prac	Total	Theory		Practical		Total
						End Sem	In- Sem	End Sem	In- Sem	
SEC1 .2 2C	GEOG5 01T4	Skills of Geological Field studies in igneous and metamorphic terrain	2		2	24	6			30
DSE1 A (6C)	GEOG DSE501 AT4	Geological Exploration	4		6	48	12			100
	GEOG DSE501 AP2			2				32	8	
DSE2 A(6c)	GEOG DSE502 AT4	Geoinformatics	4		6	48	12			100
	GEOG DSE502 AP2			2				32	8	
DSE3 A1(6 C)	GEOG DSE503 AT4	Fluvial geomorphology	4		6	48	12			100
	GEOG DSE503 AP2			2				32	8	
	GEOG DSE503 BT4	Environmental Geology	4		6	48	12	32	8	
	GEOGD SE503B P2			2						
Total					20					330

6th Sem

Course	Paper code	Title of the Course	Credit			Marks Distribution				
			Th	Prac	Total	Theory		Practical		Total
						End Sem	In- Sem	End Sem	In- Sem	
SEC2 .2 2C	GEOGS EC601Pr oject	Project work	2		2	24	6			30
DSE1 B (6C)	GEOG DSE601 BT4	Mining Geology	4		6	48	12			100
	GEOG DSE601 BP2			2				32	8	
DSE2 B(6c)	GEOG DSE602 BT4	Structural Geology	4		6	48	12			100
	GEOG DSE602 BP2			2				32	8	
DSE3 B(6C)	GEOG DSE603 BT4	Hydrogeology	4		6	48	12			100
	GEOG DSE603 BP2			2				32	8	
	GEOGD SE603B 1T4	Earth and climate	4		6	48	12	32	8	
	GEOGD SE603B 2P2			2						
Total					20					330

1st Sem
DEPARTMENT SPECIFIC CORE COURSES (DSC)

DSE 1A:

GEOG101T4: Introduction to Geology (6 Credits) 48hrs
Theory (4 Credits) + Practical (2 Credits) Marks: 60 (End Sem 48+ In Sem 12)

Objectives: The Science of geology is dedicated for the study of earth and deals with all the features of earth's surface along with their origin, composition, structure and inhabitants of the earth.

Solar system, planets, earth and moon, planetary orbital and rotational characteristics of earth, gravity, magnetic field, theories of origin, age of earth, evolution of life on earth. Interior of the Earth: core, mantle and crust.
(L: 4) 4 classes (Marks: 8)

Various branches of geology, minerals and rocks, rock forming minerals, igneous, metamorphic and sedimentary rocks and minerals
(L: 3) 3 classes (Marks: 4)

Uniformitarianism, actualism, catastrophism
(L: 2) 2 classes (Marks: 4)

Activities of running water, wind, gravity, ice and sea waves, rock weathering and erosion, soil profile and classification, geomorphic environments associated with fluvial, glacial, coastal, volcanic and desertic environments, physiographical divisions of Indian subcontinent.
(L: 5 T: 1) 6 classes (Marks: 10)

Concept of plate tectonics, sea-floor spreading and continental drift, mid oceanic ridges and transform faults volcanic and island arcs, trenches, origin of oceans, continents, mountains and rift valleys and earthquake belts.
(L: 5 T: 1) 6 classes (Marks: 8)

Rock cycle
(L: 3) 3 classes (Marks: 6)

Volcanoes: types, types of lava and lava flow
Magma: composition, physical and chemical properties of magma, intrusive igneous bodies

Sedimentary environment, clastic and non-clastic rocks
(L: 5) 5 classes (Marks: 8)

Metamorphism, metamorphic rocks, metasomatism
(L: 5) 5 classes (Marks: 8)

Brief idea about palaeontology, palynology, palaeobotany and palaeozoology
Fossils, fossil taxonomy and nomenclature, modes of preservation of fossils, types of fossil 4 classes

Application of fossil in geological science
(L: 2) 2 classes (Marks: 4)

GEOG101P2: PRACTICAL**Marks: 40 (End Sem 32+ In Sem 8)****24 hrs**

Study of minerals in hand specimen: quartz, feldspar, mica, olivine, amphibole, gypsum, calcite
Study of rocks in hands specimen: sandstone, shale, limestone, rhyolite, basalt, granite, gabbro, gneiss, schist, marble
Study of geomorphic models
Study of Geological maps

SUGGESTED READINGS:

1. Duff, P. M. D., & Duff, D. (Eds.). (1993). *Holmes' principles of physical geology*. Taylor & Francis.
2. Emiliani, C. (1992). *Planet earth: cosmology, geology, and the evolution of life and environment*. Cambridge University Press.
3. Gross, M. G. (1977). *Oceanography: A view of the earth*.

DSE 2A:**GEOG102T4: Crystallography and Mineralogy (6 Credits)****48 hrs****Theory (4 Credits) + Practical (2 Credits)****Marks: 60 (End Sem 48+ In Sem 12)**

Objectives: Use and utility of mineral science in industry is learnt from this subject. In crystallography, one can find how to determine the arrangement of atoms in the crystalline solids and in mineralogy, one can know in detail about the minerals, the basic building blocks of earth material.

Unit 1: Crystallography

(L: 13 T: 2) 15 classes (Marks: 25)

Crystalline and non-crystalline matter, geometrical nature of order of crystal, crystal face, edge and solid angle, Laws of constancy of interfacial angles, axial systems and axial ratio

Crystal symmetry operations, direction and planes in crystal structures, point group and space group symmetry, Classification of crystals into systems and classes of symmetry

Study of the symmetry, forms, stereograms and examples of crystal/mineral of the important crystal classes

Crystal growth and twinning, different types of crystal twins, causes of twinning and twin laws

Unit 2: Mineralogy

(L: 18 T: 2) 20 classes (Marks: 35)

Native elements, mineraloids, minerals, physical and chemical properties

Physical properties of minerals: Colour, luster, streak, density, sp.gr. and hardness; Moh's scale of hardness and determination of hardness of minerals. Cleavage, parting and fracture: their definition and mineral examples. Form and Habit of minerals; types, examples and use in identification

Classification of minerals: study of important minerals of silicate and non-silicate groups.

GEOG102P2: PRACTICAL**Marks: 40 (End Sem 32+ In Sem 8)****24 hrs**

Practical 1: Identification of crystal models

Practical 2: Study of crystals and symmetry elements of given crystal-models.

Practical 3: Study and stereographic projections of crystal models.

Practical 4: Study and identification of minerals in hand specimen

Practical 5: Study of rock forming minerals

SUGGESTED READINGS:

1. Klein, C., Dutrow, B., Dwight, J., & Klein, C. (2007). The 23rd Edition of the Manual of Mineral Science (after James D. Dana). J. Wiley & Sons.
2. Kerr, P. F. (1959). Optical Mineralogy. McGraw-Hill.
3. Verma, P. K. (2010). Optical Mineralogy (Four Colour). Ane Books Pvt Ltd.
4. Deer, W. A., Howie, R. A., & Zussman, J. (1992). An introduction to the rock-forming minerals (Vol. 696). London: Longman.

DSE-3A:**GEOG GE101AT4: Geochemistry and Optical Mineralogy (6 Credits)****Theory (4 Credits) + Practical (2 Credits)****48 hrs****Marks: 60 (End Sem 48+ In Sem 12)**

Objectives: Geochemistry helps in understanding the compositional heterogeneity and geochemical processes that take place in the earth. It is the basic tool used in the geochemical exploration of economic mineral deposits. The knowledge of optical mineralogy is very important for identification of minerals and ores.

Unit 1: Concepts of Geochemistry

(L: 13 T: 2) 15 classes (Marks: 30)

The periodic table, states of matter and atomic environment of elements, geochemical classification of elements

Composition of different Earth reservoirs and the nuclides and radioactivity. Conservation of mass, isotopic and elemental fractionation. Concept of radiogenic isotopes in geochronology and isotopic tracers

The solid Earth – geochemical variability of magma and its products, Meteorites

Geochemical distribution and mobility of elements, Chromatography, Aqueous geochemistry- basic concepts and speciation in solutions, Eh, pH relations

Geochemical behaviour of selected elements like Si, Al, K, Na .

Unit 2: Optical Mineralogy

(L: 18 T: 2) 20 classes (Marks: 30)

Natural light, ordinary and polarized light, polarization of light and polaroids, refractive index and relief, becke line and its use, double refraction, birefringence, behavior of isotropic and anisotropic mineral,

pleochroism and pleochroic scheme, interference colour, extinction, polarizing microscope, interference figure, optic sign and determination of optic sign.

Study of important rock forming mineral groups/species, their classification, physical and optical characters and paragenesis : 1) Quartz 2) Feldspar 3) Mica 4) Amphibole 5) Pyroxene 6) Olivine 7) Garnet 8) Chlorite 9) Calcite 10) Feldspathoids.

GEOG GE101AP2: PRACTICAL **Marks: 40 (End Sem 32+ In Sem 8)** **24 hrs**

Practical 1: Identification and understanding of different parts of petrological microscope.

Practical 2: Preparation of slides.

Practical 2: Identification of rock-forming minerals under petrological microscope.

Practical 3: Study of interference figure and determination of optic signs from mineral oriented sections.

SUGGESTED READINGS:

1. Mason, B. (1986) Principles of Geochemistry. 3rd Edition, Wiley New York.
2. Walther, J. V. (2009). Essentials of geochemistry. Jones & Bartlett Publishers.
3. Faure, Gunter and Teresa M. Mensing (2004). Isotopes: Principles and Applications, Wiley India Pvt. Ltd
4. Klein, C., Dutrow, B., Dwight, J., & Klein, C. (2007). The 23rd Edition of the Manual of Mineral Science (after James D. Dana). J. Wiley & Sons.
5. Kerr, P. F. (1959). Optical Mineralogy. McGraw-Hill.

2nd Sem

DEPARTMENT SPECIFIC CORE COURSES (DSC)

DSE 1B:

GEOG201T4: Thermodynamics and Igneous Petrology (6 Credits)

Theory (4 Credits) + Practical (2 Credits)

48 hrs

Marks: 60 (End Sem 48+ In Sem 12)

Objectives: The primary objective of learning thermodynamics is to know in detail about heat and temperature and their relationship to energy and work and that of igneous petrology is to understand the process of magma generation, evolution and volcanism. This subject also deals with interaction of plate tectonics, magma generation and ore localization.

Unit 1: Thermodynamics

(L: 8 T: 2) 10 classes (Marks: 25)

Energy and Matter, Types of Energy, Transformation of Energy

Thermodynamic systems and boundaries, Laws of Thermodynamics

Concept of Heat and Temperature

Conversion between temperature Scale

Thermodynamic properties: state functions

Concept of entropy, enthalpy, activity, chemical potential, chemical equilibrium and equilibrium constants

Concept of free energy, component, phase and degrees of freedom

Phase rule for closed and open system

Phase diagrams

Unit 2: Igneous Petrology

(L: 22 T: 3) 25 classes (Marks: 35)

General idea of igneous petrology, generation of magma, physical properties, composition & chemical properties, primary and magma derivatives, classification of magma

Concept of component, equilibrium, phase, degrees of freedom, phase rule: general idea, phase rule for open and closed systems, phase diagrams: one, two and three component systems, congruent and incongruent melting

Reaction principles, Evolution of Magma, Magmatic differentiation, Mixing and Assimilation, Role of volatiles in magma, Rock association (consanguinity)

Textures, structures and mode of occurrences of igneous rocks, Petrographical significances of igneous rocks.

Textural and IUGS Classification of igneous rocks

Petrogenesis of Igneous rocks: Petrogenesis of Felsic and Mafic igneous rocks, Komatiites, Granitoides, Basalt, Gabbros, Alkaline rocks, kimberlites and lamproites, Sylhet trap and AborVolcanics.

Formation of economic deposits from igneous processes

GEOG201P2: PRACTICAL

Marks: 40 (End Sem 32 + In Sem 8)

24 hrs

Practical 1: Identification and study of igneous rocks in hand specimens

Practical 2: Identification and study of igneous rocks in thin sections

Practical 3: Identification of economic minerals derived from igneous processes

SUGGESTED READINGS:

1. Philpotts, A., & Ague, J. (2009). Principles of igneous and metamorphic petrology. Cambridge University Press.
2. Winter, J. D. (2014). Principles of igneous and metamorphic petrology. Pearson.
3. Rollinson, H. R. (2014). Using geochemical data: evaluation, presentation, interpretation. Routledge.
4. Raymond, L. A. (2002). Petrology: the study of igneous, sedimentary, and metamorphic rocks. McGraw-Hill Science Engineering.
5. McBirney, A. R. (1984). Igneous Petrology. San Francisco (Freeman, Cooper & Company) and Oxford (Oxford Univ. Press),
6. Myron G. Best (2001). Igneous and Metamorphic Petrology,
7. K. G. Cox, J. D. Bell. (1979). The Interpretation of Igneous Rocks. Springer/Chapman & Hall.
8. Bose M.K. (1997). Igneous Petrology.
9. G W Tyrrell. (1926). Principles of Petrology. Springer

DSE 2B:

GEOG202T4: Sedimentary and Metamorphic Petrology (6 Credits)

Theory (4 Credits) + Practical (2 Credits)

48hrs

Marks: 60 (End Sem 48+ In Sem 12)

Objectives: The major objective of learning sedimentary petrology is to know the process of formation of sediments and their transformation to sedimentary rock as well as their characteristics and classifications.

Metamorphic petrology deals with the dynamic processes of the earth that has affected the pre existing rocks. This subject also helps us to understand ore localization and genesis.

Unit 1: Sedimentary Petrology

(L: 18 T: 2) 20 classes (Marks: 30)

Weathering and erosion of rocks, transportation of weathered rock via air, water, ice and gravity, residual sediments, source and provenance, sedimentary basins

Textural properties of sedimentary rocks- concept of size, grade scale, sphericity, roundness and fabric. Sedimentary textures, structures and environment, sedimentary structures

Textural and genetic classification of clastic and non-clastic rocks

Diagenesis: compaction, cementation, lithification, authigenesis, replacement and recrystallisation;

Concept of sedimentary facies, depositional environments,

Petrographic description of the following rock types: Sandstones (Arenite, Arkose and Wacke), siltstone, shale, limestone, dolomite, breccia, conglomerate and evaporate.

Formation of economic deposits from sedimentary processes

Unit 2: Metamorphic Petrology

(L: 18 T: 2) 20 classes (Marks: 30)

Metamorphism, types of metamorphism, mechanism of metamorphic transformation

Index minerals, metamorphic zones and isogrades, facies and grade

Structure and textures of metamorphic rocks

Relationship between metamorphism and deformation, Metamorphic mineral reactions (prograde and retrograde)

Regional metamorphism of argillaceous, calcareous and basic rocks, Metasomatism and role of fluids in metamorphism

Descriptive petrography of the following rocks: Slate, phyllite, schist, blue schists, gneiss, quartzite, marble, amphibolite, granulite, hornfels, eclogites, khasi greenstone, charnockite and khondalite.

Formation of economic deposits from metamorphic and metasomatic processes

GEOG202P2: PRACTICAL**Marks: 40 (End Sem 32+ In Sem 8)****24 hrs**

Practical 1: Identification and study of sedimentary rocks in hand specimens

Practical 2: Identification and study of metamorphic rocks in thin sections

SUGGESTED READINGS:

1. Prothero, D. R., & Schwab, F. (2004). Sedimentary geology. Macmillan.
2. Tucker, M. E. (2006) Sedimentary Petrology, Blackwell Publishing.
3. Collinson, J. D. & Thompson, D. B. (1988) Sedimentary structures, Unwin- Hyman, London.
4. Nichols, G. (2009) Sedimentology and Stratigraphy Second Edition. Wiley Blackwell1.
5. Philpotts, A., & Ague, J. (2009). *Principles of igneous and metamorphic petrology*. Cambridge University Press.
6. Winter, J. D. (2014). *Principles of igneous and metamorphic petrology*. Pearson.
7. Rollinson, H. R. (2014). *Using geochemical data: evaluation, presentation, interpretation*. Routledge.
8. Raymond, L. A. (2002). *Petrology: the study of igneous, sedimentary, and metamorphic rocks*.
9. McGraw-Hill Science Engineering.
10. Yardley, B. W., & Yardley, B. W. D. (1989). An introduction to metamorphic petrology. Longman Earth Science Series.

DSE-3B:**GEOG GE201AT4: Palaeontology(6 Credits)****48hrs****Theory (4 Credits) + Practical (2 Credits)****Marks: 60 (End Sem 48+ In Sem 12)**

Objectives: Paleontology deals with identification, classification and taxonomic description of past life forms as fossils. It aids in the reconstruction of paleoclimate, paleo bathymetry and paleogeography. It is very much used as a tool of hydrocarbon exploration.

(L: 28 T: 2) 30 classes

Palaeontology: definition, branches, allied subjects, scopes and applications of palaeontology.

Fossil: definition, types, process of fossilization, mode of preservation

Nomenclature of fossil: two fold system of nomenclature, types of specimens (Prototype, Neotype, Lectotype etc.)Taxonomy and Species concept: Species concept with special reference to paleontology, Taxonomic hierarchy Theory of organic evolution interpreted from fossil record

Vertebrate fossils: Palaeozoic and Mesozoic vertebrate organisms, origin diversity and extinction of dinosaurs. Evolution of horse, Human evolution.

Brief introduction to important invertebrate groups: Foraminifera, Brachiopoda, Pelecypoda, Gastropoda, Cephalopoda, Trilobita, Echinoidea and Anthozoa and their biostratigraphic significance

Gondwana Flora of India

Application of fossils in Stratigraphy, Biozones, index fossils, correlation, Role of fossils in sequence stratigraphy, Fossils and paleoenvironmental analysis, Fossils and paleobiogeography, biogeographic provinces, dispersals and barriers, Paleoecology – fossils as a window to the evolution of ecosystems

GEOG GE201AP2: PRACTICAL

Marks: 40 (End Sem 32 + In Sem 8)

24 hrs

Practical 1: Study of fossils showing various modes of preservation

Practical 2: Study of diagnostic morphological characters, systematic position, stratigraphic position and age of various invertebrate, vertebrate and plant fossils

SUGGESTED READINGS

1. Raup, D. M., Stanley, S. M., Freeman, W. H. (1971) Principles of Paleontology
2. Clarkson, E. N. K. (2012) Invertebrate paleontology and evolution 4th Edition by Blackwell Publishing.
3. Benton, M. (2009). Vertebrate paleontology. John Wiley & Sons.
4. Shukla, A. C., & Misra, S. P. (1975). Essentials of paleobotany. Vikas Publisher
5. Armstrong, H. A., & Brasier, M.D. (2005) Microfossils. Blackwell Publishing.

3rd Sem

DEPARTMENT SPECIFIC CORE COURSES (DSC)

DSE 1C:

GEOG301P2: GEOG301T4: Structural Geology and Plate Tectonics (6 Credits)

Theory (4 Credits) + Practical (2 Credits)

48hrs

Marks: 60 (End Sem 48+ In Sem 12)

Objectives: The primary goal of structural geology is to uncover the history of deformation in the rocks. The deformation of the lithospheric rocks by tectonic forces can be learned through this subject. Structural geology also helps to understand the geodynamics of regional to global dimension.

Unit 1: Structural Geology

(L: 18 T: 2) 20 classes (Marks: 35)

Deformation in rocks: stress and strain in rocks, type of stress and strain, strain ellipses,

Effects of topography on structural features, topographic and structural maps; importance representative factors of the map, concept of planar and linear structures; dip and strike;

Study of components, morphology, classification and occurrences of deformational features: fold, joint-fracture, faults, lineation and foliation

Role of structural features for the development of typical topographical landscapes, economic mineral reserves and in accumulation of oil and natural gas

Unit 2: Tectonics

(L: 14 T: 1) 15 classes (Marks: 25)

Concept of tectonic plates, continental and oceanic crust, boundaries between lithosphere and mantle, divergent, convergent and transform plate boundaries, important features associated with different plate boundaries

Theories of development of concept of plate tectonics, continental drifting, formation of ocean

Role of tectonic activities in rock deformation, development of structural features and typical landforms,

GEOG301P2: PRACTICAL

Marks: 40 (End Sem 32+ In Sem 8)

24 hrs

Practical 1: study of structural maps

Practical 2: use of compass

Practical 3: 3 point problems of structural geology

Practical 4: stereo projections of beds, fold, fault, lineation etc.

SUGGESTED READINGS:

1. Davis, G. R. (1984) Structural Geology of Rocks and Region. John Wiley
2. Billings, M. P. (1987) Structural Geology, 4th edition, Prentice-Hall.
3. Park, R. G. (2004) Foundations of Structural Geology. Chapman & Hall.
4. Pollard, D. D. (2005) Fundamental of Structural Geology. Cambridge University Press.
5. Ragan, D. M. (2009) Structural Geology: an introduction to geometrical techniques (4th Ed). Cambridge University Press (For Practical)
6. Lahee F. H. (1962) Field Geology. McGraw Hill

DSE 2C:

GEOG302T4: Surveying and Engineering Geology (6 Credits)

Theory (4 Credits) + Practical (2 Credits)

48hrs

Marks: 60 (End Sem 48+ In Sem 12)

Objectives: Surveying and Engineering geology provides geological and geotechnical recommendations, analysis, and design associated with human development and various types of civil structural construction.

Unit 1: Surveying

(L: 9 T: 1) 10 *classes* (Marks: 20)

The Great Trigonometrical Survey of India, Geodetic and Plane Surveying, Datum, Control Points, Horizontal and Vertical Controls, Geoid, Azimuth and bearing, Triangulation and Traversing.

Surveying with Compass, Chain and Plane Table Surveying, GPS and its use in surveying

Level, Types of levels and Methods of Levelling

Geology vs. Engineering, Role of Engineering geologists in planning, design and construction of major man-made structural features. Geological Field Investigation for engineering project. Reconnaissance study, Detail Site Investigation and Characterization and Regional Scale Study.

Unit 2: Engineering Geology

(L: 18 T: 2) **20 classes** (Marks: 40)

Role and duties of geologist in engineering project: surveying, leveling, reconnaissance study, detail study, design and layout of engineering project, determining viability and risk, use of local construction materials

Intact Rock and Rock Mass properties, Rock Quality Designation (RQD), Rock Structure Rating (RSR), Rock Mass Rating (RMR)

Geological, Geotechnical and Environmental considerations for Dams and Reservoirs, Tunnels and Tunneling Methods.

Preventive measures for: landslides, earthquakes, structural disturbances.
Case histories related to Indian Civil Engineering Projects

GEOG302P2: PRACTICAL

Marks: 40 (End Sem 32+ In Sem 8) 24 hrs

Practical 1: Use of compass for determining forward, backward bearing and azimuths

Practical 2: Surveying with compass, chain and plate table

Practical 3: Computation of reservoir area, catchment area, reservoir capacity and reservoir life.

Practical 4: Computation of Index properties of rocks.

SUGGESTED READINGS:

1. Krynin, D.P. and Judd W.R. 1957. Principles of Engineering Geology and Geotechnique, McGraw Hill (CBS Publ).
2. Johnson, R.B. and De Graf, J.V. 1988. Principles of Engineering Geology, John Wiley.
3. Goodman, R.E., 1993. Engineering Geology: Rock in Engineering constructions. John Wiley & Sons, N.Y.
4. Waltham, T., 2009. Foundations of Engineering Geology (3rd Edn.) Taylor & Francis.
5. Bell: F.G-, 2006. Basic Environmental and Engineering Geology Whittles Publishing.
6. Bell, .F.G, 2007. *Engineering Geology*, Butterworth-Heinemann

DSE-3C:

GEOG302T4: Economic Geology (6 Credits)

48 Hours

Theory (4 Credits) + Practical (2 Credits)

Marks: 60 (End Sem 48+ In Sem 12)

Objectives: Economic geology is the study of the formation and extraction of earth materials that have economic potential in the society. It helps us to understand the genesis, occurrences and distribution of mineral resources and its uses a raw material in mineral based industries.

Definition of ore, ore minerals, gangue and tenor

(L: 28 T: 2) 30 classes

Morphology of mineral deposit

Controls on ore localization

Processes of formation of Mineral deposit: volcanogenic, orthomagmatic, hydrothermal, supergene enrichment, sedimentary deposits, residual deposits, alluvial deposits, metasomatic alteration

Origin, occurrence and distribution in India and uses of the economic minerals/ores of aluminium, chromium, copper, gold, lead, zinc, iron, manganese and atomic minerals.

Deposits of minerals used as abrasives, refractories and in ceramics, cement, fertilizer, glass industries and their occurrences especially in N.E. India.

Origin and occurrence of coal and petroleum and their distribution in India with special reference of N.E. India.

National Mineral Policy.Strategic, Essential and Critical minerals of India.

GEOG302P2: PRACTICAL

Marks: 40 (End Sem 32+ In Sem 8)

24 hrs

Study and identification of economic minerals

Identification of set of Industrial Minerals

Ore Reserve Estimation

SUGGESTED READINGS:

1. Guilbert, J.M. and Park Jr., C.F. (1986) The Geology of Ore deposits. Freeman & Co.
2. Bateman, A.M. and Jensen, M.L. (1990) Economic Mineral Deposits. John Wiley.
3. Evans, A.M. (1993) Ore Geology and Industrial minerals. Wiley
4. Laurence Robb. (2005) Introduction to ore forming processes. Wiley.
5. Gokhale, K.V.G.K. and Rao, T.C. (1978) Ore deposits of India their distribution and processing,
Tata-McGraw Hill, New Delhi.
6. Deb, S. (1980) Industrial minerals and rocks of India. Allied Publishers.
7. Sarkar, S.C. and Gupta, A. (2014) Crustal Evolution and Metallogeny in India. Cambridge Publications.

3rd Sem

GEOGSEC301AT2: Skill Enhancement Courses (SEC)

Marks: 30 (End Sem 24+ In Sem 6)

SEC 1.1 Skills of basic Geological Field Studies (2 Credits) (L: 18 T: 2) **20 classes**

Objectives: The purpose of basic geological field studies is the skill enhancement to enable us the basic field techniques and procedures.

Use of base map/topographic sheet in field, tracing data from base map/toposheet, bearing (front andback) and pacing, map reading, distance, height and pace approximation, reading contours and topography

Identification of rock types in field; structures and texture of rocks, Use of hand lense

Basic field measurement techniques: dip and strike, trend, plunge, rake

Collection of rock samples from field

SUGGESTED READINGS:

1. Lahee, F.H. 1916. Field Geology.
2. Compton, R.R, 1985. Geology in the Field.

4th Sem

DEPARTMENT SPECIFIC CORE COURSES (DSC)

DSE 1D:

GEOG401T4: Geomorphology, Remote Sensing and GIS (6 Credits)

Theory (4 Credits) + Practical (2 Credits)

48hrs

Marks: 60 (End Sem 48+ In Sem 12)

Objectives: Geomorphology is the scientific study of the origin and evolution of landforms and bathymetric features created by physical, chemical or biological processes operating at or near the Earth's surface.

Remote sensing is the acquisition of information about an object or phenomenon without making physical contact with them. Remote sensing and GIS are used as tools for geological investigation and various other purposes.

Unit 1: Geomorphology

(L: 19 T: 1) **20 classes** (Marks: 25)

Endogenic and Exogenic processes, geomorphic cycle,

Surficial Processes and geomorphology, Weathering and Erosion, activities of running water, wind, ice, gravity and sea waves, Soil, Soil Profile and its classification. Mass movement and debris flow processes.

Landforms of: Fluvial, Glacial, Aeolian, Coastal and Volcanic Environments.

Overview of Indian Geomorphology

Unit 2: Remote Sensing

(L: 9 T: 1) **10 classes** (Marks: 20)

Photogeology, aerial photographs; scale and resolution, air photo interpretation: identification of sedimentary, igneous and metamorphic rocks and various aeolian, glacial, fluvial and marine landforms

Remote Sensing: definition, applications, sensors and scanners, satellites and their characteristics, data formats- raster and vector, Indian remote sensing satellites, satellite data products

Application of Remote Sensing in Geological Science

Unit 3: Geographical Information System

(L: 8 T: 2) **10 classes** (Marks: 15)

Geographic Information System, Components of GIS, working mechanism of GIS, GIS Data types: Raster and Vector Data, Point Data, Line Data, Polygonal Data, Datum, Coordinate systems and Projection systems. Georeferencing. Spatial data models and data editing

General idea about of Global Positioning System (GPS) of America, Indian Regional Navigation Satellite System (IRNSS) and Indian Navigation System NAVIC

GEOG401P2: PRACTICAL

Marks: 40 (End Sem 32 + In Sem 8)

24 hrs

Practical 1: Study of landforms from given geomorphic model/image/map

Practical 2: Interpretation of aerial photo/satellite image

Practical 3: Use of GPS

SUGGESTED READINGS:

1. Robert S. Anderson and Suzanne P. Anderson (2010): *Geomorphology - The Mechanics and Chemistry of Landscapes*. Cambridge University Press.
2. M.A. Summerfield (1991) *Global Geomorphology*. Wiley & Sons.
3. Demers, M.N., 1997. *Fundamentals of Geographic Information System*, John Wiley & sons. Inc.
4. Hoffmann-Wellenhof, B., Lichtenegger, H. and Collins, J., 2001. *GPS: Theory & Practice*, Springer Wien New York.
5. Jensen, J.R., 1996. *Introductory Digital Image Processing: A Remote Sensing Perspective*, Springer- Verlag.
6. Lillesand, T. M. & Kiefer, R.W., 2007. *Remote Sensing and Image Interpretation*, Wiley.
7. Richards, J.A. and Jia, X., 1999. *Remote Sensing Digital Image Analysis*, Springer-Verlag.

DSE 2D:

**GEOG402T4: Principles of Stratigraphy and Indian Stratigraphy (6 Credits)
Theory (4 Credits) + Practical (2 Credits)**

48hrs

Marks: 60 (End Sem 48+ In Sem 12)

Objectives: The principles of stratigraphy help us to understand the order of superposition of rocks in space and time. Indian stratigraphy helps us to know distribution of different stratigraphic horizons in India and their significance.

Unit 1: Principles of Stratigraphy

(L: 13 T: 2) **15 classes** (Marks: 25)

Principles of stratigraphy: Fundamentals of litho-, bio- and chrono-stratigraphy

Codes of stratigraphic nomenclature: International Stratigraphic Code – development of a standardized stratigraphic nomenclature. Concepts of Stratotypes. Brief introduction to the concepts of lithostratigraphy, biostratigraphy, chronostratigraphy

Walther's Law of Facies. Concept of paleogeographic reconstruction

Unit 2: Stratigraphy of India

(L: 18 T: 2) **20 classes** (Marks: 35)

Physiographic and tectonic subdivisions of India

Stratigraphy, distribution and economic importances of: Dharwar, Vindhyan, Cudappah, Delhi supergroups,
Gondwana of Indian subcontinent

Triassic successions of Spiti, Jurassic of Kutch, Mesozoic rocks of NE India

Volcanic provinces of India: Deccan, Rajmahal, Sylhet Trap

Siwalik successions, Tertiary of Meghalaya and Assam-Arakan basins.

GEOG402P2: PRACTICAL

Marks: 40 (End Sem 32 + In Sem 8)

24 hrs

Practical 1: Study of geological map of India and identification of major stratigraphic units.

Practical 2: Study of rocks in hand specimens from known Indian stratigraphic horizons

SUGGESTED READINGS:

1. Krishnan, M. S. (1982) Geology of India and Burma, CBS Publishers, Delhi
2. Doyle, P. & Bennett, M. R. (1996) Unlocking the Stratigraphic Record. John Wiley
3. Ramakrishnan, M. & Vaidyanadhan, R. (2008) Geology of India Volumes 1 & 2, Geological society of India, Bangalore.
4. Valdiya, K. S. (2010) The making of India, Macmillan India Pvt. Ltd

DSE 3D:**GEOG403T4: Coal and Petroleum (6 Credits)****48hrs****Theory (4 Credits) + Practical (2 Credits)****Marks: 60 (End Sem 48+ In Sem 12)**

Objectives: The purpose of learning coal and petroleum geology is to know in detail about their formation, properties, occurrences, distribution, extraction and uses.

Unit 1: Coal**(L: 13 T: 2) 15 classes (Marks: 30)**

Coal: definition, type, formation, origin and occurrences

Application of coal as fossil fuel

Distribution of coal in space and time

Chemical composition, Proximate and ultimate composition, calorific value

Rank & Grade of coal

Distribution of coal in India with special reference to NE India

Introduction to coal bed methane

Unit 2: Petroleum**(L: 13 T: 2) 15 classes (Marks: 30)**

Introduction to petroleum, natural gas and petroleum bearing shale sediments

Process of formation of petroleum, maturation and migration, mode of occurrences

Distribution of petroleum in time and space

Geological conditions in favour of formation and accumulation of petroleum

Physical properties and chemical composition

Gas hydrates, Shale gas and shale oil

Oil-Gas bearing territories of India with special reference to NE India

GEOG403P2: PRACTICAL**Marks: 40 (End Sem 48+ In Sem 12)****24 hrs**

Physical identification of types of coal

Study of petroleum basin of India from given map

Study of seismic profiles to identify possible lithological/structural features

SUGGESTED READINGS:

1. Chandra D. (2007). Chandra's Textbook on applied coal petrology. Jijnasa Publishing House.
 2. Shelly R. C. (2014). Elements of Petroleum geology: Third Edition, Academic Press
 3. Bjorlykke, K. (1989). Sedimentology and petroleum geology. Springer-Verlag.
 4. Bastia, R., & Radhakrishna, M. (2012). Basin evolution and petroleum prospectivity of the continental margins of India (Vol. 59). Newnes.
 5. Leverson, A.L. (2006) Geology of Petroleum.
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SEC 2.1

GEOGSEC401AT2: Skill of advanced Geological Field Studies

Marks :30 (End Sem 24+ In Sem 6) (2 Credits)

20 Classes

Geological mapping, stratigraphic correlation

Primary (scalars and vectors) and secondary structures (linear and planar)

Determination of lithological contacts, unconformities, fault-shear zones

Study of rock structures: genetic and deformational

Procedure of oriented sample collection

Stereoplots of linear and planar structures, orientation analyses

SUGGESTED READINGS:

1. Lahee, F.H. 1916. Field Geology.
2. Compton, R.R, 1985. Geology in the Field.

5th Sem

Skill Enhancement Courses SEC

SEC 1.2

GEOG501T4: Skills of Geological Field Investigation-III (Advance)

Marks: 30 (End Sem 24+ In Sem 6) (2 Credits)

Objectives: The purpose of geological field investigation is the skill enhancement to enable us the basic field techniques and procedures.

20 classes

Field transect in any Precambrian terrain

Study of craton ensemble including basic intrusive suites

Precambrian sedimentary basin

Basement-Cover relation in: a. fold belts, b. sedimentary successions

SUGGESTED READINGS:

1. Lahee, F.H. 1916. Field Geology.
2. Compton, R.R, 1985. Geology in the Field.

5th Sem
Department Specific Electives (DSE)

DSE 1A:

GEOG DSE501AT4: EXPLORATION GEOLOGY

(6 Credits = Theory 4 + Practical 2)

48hrs

Marks: 60 (End Sem 48+ In Sem 12)

Objectives: Aims to study the mineral resources of the earth, its prospect, reserve estimation and different exploration technique.

Unit 1: Mineral Resources

(L: 5) **5 classes** (Marks: 10)

Resource reserve definitions, Mineral resources in industries – historical perspective and present, A brief overview of classification of mineral deposits with respect to processes of formation in relation to exploration strategies.

Unit 2: Prospecting and Exploration

(L: 9 T: 1) **10 classes** (Marks: 15)

Principles of mineral exploration, Prospecting and exploration- conceptualization, methodology and stages, Sampling, subsurface sampling including pitting, trenching and drilling, Geochemical exploration.

Unit 3: Evaluation of data

(L: 5) **5 classes** (Marks: 10)

Evaluation of sampling data
Mean, mode, median, standard deviation and variance

Unit 4: Drilling and Logging

(L: 9 T: 1) **10 classes** (Marks: 15)

Core and non-core drilling
Planning of bore holes and location of boreholes on ground
Core-logging

Unit 5: Reserve estimations and Errors

(L: 4 T: 1) **5 classes** (Marks: 10)

Principles of reserve estimation, density and bulk density
Factors affecting reliability of reserve estimation
Reserve estimation based on geometrical models (square, rectangular, triangular and polygon blocks)
Regular and irregular grid patterns, statistics and error estimation

GEOG DSE501AP2: PRACTICAL

Marks: 40 (End Sem 32+ In Sem 8)

24 hrs

1. Identification of anomaly
2. Concept of weighted average in anomaly detection
3. Geological cross-section
4. Models of reserve estimation

SUGGESTED READINGS:

1. Clark, G.B. 1967. Elements of Mining. 3rd Ed. John Wiley & Sons.

2. Arogyaswami, R.P.N. 1996 Courses in Mining Geology. 4th Ed. Oxford-IBH.
3. Moon, C.J., Whateley, M.K.G., Evans, A.M., 2006, Introduction to Mineral Exploration, Blackwell Publishing.

DSE 1B:

GEOG DSE502AT4: GEOINFORMATICS

(6 Credits = Theory 4 + Practical 2)

48hrs

Marks: 60 (End Sem 48+ In Sem 12)

Objectives: Through this subject one can learn how to apply information technology to address the problems of geosciences.

(L: 33 T: 2) 35classes

Introduction to geoinformatics: application of information technology in geological science, advantage and disadvantages of geoinformatics, scopes and prospects in the geoinformatics

Cartography, Remote Sensing, Geographical Information System, realtime, online and offline monitoring of earth

Introduction to information technology: hardware and software of computer, personal computer, workstation computer and super computer, FLOPS, components and peripherals of computer system

Operating system, programming language, introduction to HTML, C++, C# and ActionScript

Geographical information system: GIS data types: raster and vector data, point data, line data and polygonal data, georeferencing, Digital Elevation Model

GEOG DSE502AP2: PRACTICAL

Marks: 40 (End Sem 32+ In Sem 8)

24 hrs

Simple programming in C++, C# and ActionScript

Raster and Vector data processing and analyses

Spatial analyses of DEM

SUGGESTED READINGS:

1. Principles of geoinformatics by .R.K. Gupta and Subhash Chander.
2. Geoinformatics by Saiful Islam.

DSE 1C

GEOG DSE503AT4: FLUVIAL GEOMORPHOLOGY

(6 Credits = Theory 4 + Practical 2)

48 hrs

Marks: 60 (End Sem 48+ In Sem 12)

Objectives: Fluvial geomorphology is the scientific study of the form and function of streams and the interactions between streams and the landscapes around them.

Weathering of rock and transportation of weathered material through running water

Water Cycle, surface and subsurface runoff, permanent, sessional and temporal flow of water

(L5) 5 classes

Stream flow, classification of streams

(L: 2) 2 classes (Marks: 5)

Drainage system: drainage basin, basinal area, network of streams, stream ordering

Stream morphology, morphometric parameters and their significances (L: 5) 5 classes (Marks: 10)

Stream patterns, controls over the development of stream patterns

(L: 5) 5 classes (Marks: 10)

Landforms associated with fluvial processes, waterfall, rapids, alluvial fans, flood plain features, delta

Avulsion, River Capturing, Channel bar and islands, Bank Erosion (L: 4 T: 1) 5 classes (Marks: 10)

Estuaries, lagoons and lakes, outwash plains

Drainage system of North East India

(L: 5) 5 classes (Marks: 10)

Major drainage system of Indian Subcontinents

Flood, Palaeoflood, Flood Monitoring, Disaster and Mitigation, Preparedness for flood condition

(L: 4 T: 1) 5 classes (Marks: 10)

Significance of fluvial processes in gradational change in earth surface, determination of structural features and in exploration of economic deposits

(L: 3) 3 classes (Marks: 5)

GEOG DSE503AP2: PRACTICAL

Marks: 40 (End Sem 32 + In Sem 8)

24 hrs

Tracing of drainage network and demarcation of drainage basin

Morphometrical analyses of a particular drainage system

Demarcation of areas vulnerable to flood from DEM

SUGGESTED READINGS:

1. Robert S. Anderson and Suzzane P. Anderson (2010): *Geomorphology - The Mechanics and Chemistry of Landscapes*. Cambridge University Press.
2. M.A. Summerfield (1991) *Global Geomorphology*. Wiley & Sons.
3. Demers, M.N., 1997. *Fundamentals of Geographic Information System*, John Wiley & sons. Inc.
4. Knighton, D. (1998) *Fluvial forms and processes: A new perspective*. Amold Pubs.
5. Richards. K. (2004) *Rivers: Forms and processes in alluvial channels*. Balckburn Press.

6. Bryirely and Fryirs (2005) Geomorphology and river management. Blackwell Pub.,
7. Julien, P.Y. (2002) River Mechanics. Cambridge University Press.
8. Robert, A. (2003) River Processes: An introduction to fluvial dynamics. Arnold Publications.

DSE 2A

GEOG DSE503BT4: ENVIRONMENTAL GEOLOGY

(6 Credits = Theory 4 + Practical 2)

48hrs

Marks: 60 (End Sem 48+ In Sem 12)

Objectives: Through environmental geology one can learn how to manage geological and hydrogeological resources such as fossil fuels, minerals, surface and ground water as well as land use. It also deals with natural and artificial hazards as well as pollution.

Introduction to Environmental Geology: Cosmic, Galactic and Physical Environments of Earth
Natural and man-made activities and their effects on the Physical Environment of Earth

2 classes (Marks: 4)

Natural resource, energy, radiation from terrestrial and extra-terrestrial objects, solar flare, solar wind, electric charge, magnetism, ecological units, habitats

5 classes (Marks: 6)

Water on Earth: surface and subsurface water, ocean, streams, lakes, atmospheric water
Climate and Weather, El Nino-La Nina Oscillations, Tide, Estuaries, Lagoons and Delta

8 classes (Marks: 22)

Gradational Processes: Weathering and erosion, activities of running water, moving ice, coastal activities, wind activities

5 classes (Marks: 6)

Natural hazards: volcanic eruptions, release of poisonous gas and fluids, rainfall, floods, landslides, coastal erosions, earthquake and mitigation.

5 classes (Marks: 6)

Artificial hazards: urbanization, sanitary, septic tanks, open-cast and underground mining, drilling, industrial and radioactive waste disposal

5 classes (Marks: 6)

Pollution of ground water and surface water, marine pollution, pollution from agricultural practices

5 classes (Marks: 6)

Environmental protection-legislative measures in India

2 classes (Marks: 4)

GEOG DSE503BP2: PRACTICAL

Marks: 40 (End Sem 32+ In Sem 8) 24 hrs

Study of Environmental impacts of rapid urbanization, agriculture, industrialization and mining from field visit and preparation of report

SUGGESTED READINGS:

1. Geomorphology and Environment by Savindra Singh, H.S. Sarmah and Sunil Kumar Dev.
2. Environmental Geology by C.W. Montgomery.

6th Sem

SEC 2.2

GEOGSEC601: Project Work

Marks: 30 (End Sem 24+ In Sem 6) (2 Credits)

DSE 1B

GEOG DSE601BT4: MINING GEOLOGY

(6 Credits = Theory 4 + Practical 2)

48hrs

Marks: 60 (End Sem 48+ In Sem 12)

(L: 28 T: 2) **30 classes**

Objectives: Through this applied science one can learn the development of a defined mineral resource with the help of combine principles of economic geology and mining engineering.

Ore, gangue, tenor

Development of mining technology in human history

Ancient techniques of mining of iron, gold, copper, aluminium and coal

General idea on the exploration of economic deposit, estimation of volume and reserve of the ore deposit

Mining terminologies used in surface and sub-surface mining

Classification of mining methods

Selection of mining technique from the structure of ore, lithology of host and orientation of ore deposit

Description of alluvial, surface (open-cast) and subsurface mining methods and discussion on tools used

Mine safety measures, lining: types and needs, ventilation of air, water and electricity, transportation of workers

GEOG DSE601BP2: PRACTICALS

Marks: 40 (End Sem 32+ In Sem 8)

24 hrs

Estimation of volume of overburden, ore body

Estimation of reserve

Modeling of ore deposits from given geological map

SUGGESTED READINGS:

1. Clark, G.B. 1967. Elements of Mining. 3rd Ed. John Wiley & Sons.
2. Arogyaswami, R.P.N. 1996 Courses in Mining Geology. 4th Ed. Oxford-IBH.

DSE 2B

GEOG DSE602BT4: Structural geology

(6 credits=Theory 4+ Practical 2)

48 hrs

Marks: 60 (End Sem 48+ In Sem 12)

Objectives: The primary goal of structural geology is to uncover the history of deformation in the rocks. The deformation of the lithospheric rocks by tectonic forces can be learnt through this subject. Structural geology also helps to understand the geodynamics of regional to global dimension. Structural control on ore localization and landscape evolution are learnt through this subject. Application of structural geology in the engineering geology project is enormous.

Relation between the geological structure and topography. Outcrop patterns of different structures
(L: 2) 2 classes (Marks: 3)

Concept of stress and strain. Brittle and ductile behaviors of rocks. Stress-strain relationships for different substances
(L: 4) 4 classes (Marks: 6)

Folds: Definition, terminologies, classifications (geometric, genetic and morphological)
(L: 4) 4 classes (Marks: 10)

Faults: Definition, terminologies, classification (geometric and genetic). Recognition of faults in the field.
(L: 3 T: 1) 4 classes (Marks: 10)

Foliations: Definition, terminologies and classification
(L: 3) 3 classes (Marks: 5)

Lineations: Definition, terminologies and classification
(L: 3) 3 classes (Marks: 5)

Joints: Definition, terminologies and classification
(L: 3) 3 classes (Marks: 5)

Unconformities: Definition, terminologies, types. Recognition of unconformities in the field
4classes
(L: 3)

Concept of plate tectonics. Types of plate boundaries. Subduction zones, mid oceanic ridges. Island arcs, earthquake and volcanic belts
(L: 4 T: 1) 5 classes (Marks: 10)

Structural framework of North East India
(L:2) 2 classes (Marks: 6)

GEOG DSE602BP2: PRACTICAL

Marks: 40 (End Sem 32+ In Sem 8)

24 hrs

Use of Clinometers and Brunton compass for measurements
Study of contour maps and structural maps and construction of profiles
Three point structural problems and structural projections

SUGGESTED READINGS:

1. Davis, G. R. (1984) Structural Geology of Rocks and Region. John Wiley
2. Billings, M. P. (1987) Structural Geology, 4th edition, Prentice-Hall.
3. Park, R. G. (2004) Foundations of Structural Geology. Chapman & Hall.
4. Pollard, D. D. (2005) Fundamental of Structural Geology. Cambridge University Press.
5. Ragan, D. M. (2009) Structural Geology: an introduction to geometrical techniques (4th Ed). Cambridge University Press (For Practical)
6. Lahee F. H. (1962) Field Geology. McGraw Hill

DSE 2C

GEOG DSE603BT4: Hydrogeology (6 Credits = Theory 4 + Practical 2)

48hrs

Marks: 60 (End Sem 48+ In Sem 12)

Objectives: Hydrogeology deals with hydrogeologic cycle, occurrences, movement and distribution of groundwater in different regions and its utility.

Occurrence and origin of groundwater; (L: 3) **3 classes** (Marks: 5)

Hydrologic cycle; Hydrological properties of water bearing formations: porosity, permeability, transmissivity, specific yield, storage coefficient. (L: 5) **5 classes** (Marks: 5)

Movement of ground water; types of openings in rocks; types of springs. (L: 5) **5 classes** (Marks: 5)

Concept of water table and piezometric surface, free and confined water; Aquifer- different types; (L: 6 T: 2) **8 classes** (Marks: 15)

Quality of ground water- problems of fluoride and arsenic in ground water; (L: 4) **4 classes** (Marks: 5)

Exploration for ground water; Groundwater recharge- concept of safe yield and overdraft. Rainwater harvesting. (L: 6 T: 1) **7 classes** (Marks: 15)

Groundwater provinces of India. (L: 3) **3 classes** (Marks: 5)

GEOG DSE603BP: PRACTICAL

Marks: 40 (End Sem 32 + In Sem 8)

24 hrs

Preparation of water table contour map using supplied water level data and interpretation of the same

Interpretation of supplied water table map

Determination of flow well area from supplied ground level contour and piezometric level contours

Solution of hydrogeological problems using Darcy's equation

Suggested Readings:

1. Todd, D. K. 2006. Groundwater hydrology, 2nd Ed., John Wiley & Sons, N.Y.
2. Davis, S. N. and De Weist, R.J.M. 1966. Hydrogeology, John Wiley & Sons Inc., N.Y.
3. Karanth K.R., 1987, Groundwater: Assessment, Development and management, Tata McGraw-Hill Pub. Co. Ltd.
3. Gross, M.G., 1977. *Oceanography: A view of the Earth*, Prentice Hall.

DSE 3B
GEOGDSE603B1T4: Earth and climate
(6 Credits = Theory 4 + Practical 2)

48hrs
Marks: 60 (End Sem 48+ In Sem 12)

Objectives: Aims in study of the earth, its heat budget, its climate, atmosphere and hydrosphere and their changes through time and its effects and responses produced by the biosphere.

Components of the climate system

Climate system response, response rates and interactions within the climate system

(L: 6) **6classes** (Marks: 10)

Incoming solar radiation, receipt and storage of heat

Heat transformation

(L: 6) **6classes** (Marks: 10)

Layering of atmosphere and atmospheric Circulation

Atmosphere and ocean interaction and its effect on climate

Heat transfer in ocean

(L: 6 T: 2) **8classes** (Marks: 15)

Climate Change: natural vs. anthropogenic effects

Humans and climate change

(L: 6) **6classes** (Marks: 10)

Milankovitch cycles and variability in the climate

Glacial-interglacial stages

The Last Glacial maximum (LGM)

(L: 6) **6classes** (Marks: 10)

Mechanism of monsoon

Monsoonal variation through time

(L: 3) **3classes** (Marks: 5)

DSE3B

GEOGDSE603B2P2: (PRACTICAL)

Marks: 40 (End Sem 32 + In Sem 8)

24 hrs

Study of distribution of major climatic regimes of India on map

Distribution of major wind patterns on World map

Preparation of paleogeographic maps (distribution of land and sea) of India during specific geological time intervals

SUGGESTED READINGS:

1. Rudiman, W.F., 2001. Earth's climate: past and future. Edition 2, Freeman Publisher.
2. Rohli, R.V., and Vega, A.J., 2007. Climatology. Jones and Barlett
3. Lutgens, F., Tarbuck, E., and Tasa, D., 2009. The Atmosphere: An Introduction to Meteorology. Pearson Publisher
4. Aguado, E., and Burt, J., 2009. Understanding weather