Syllabus for
Bachelor of Science in Geology (Honours)
Under Choice Based Credit System

Academic Session:
w.e.f. 2020-2023

for

All Constituent/Affiliated Colleges Under

Binod Bihari Mahto Koyalanchal University,
Dhanbad

UNIVERSITY DEPARTMENT OF GEOLOGY

BINOD BIHARI MAHTO KOYALANCHAL UNIVERSITY,
DHANBAD- 828130 (JHARKHAND)

Members of Board of Studies of CBCS Under- Graduate Syllabus as per Guidelines of the Binod Bihari Mahto Koyalanchal University, Dhanbad.

Name of Members		Signature
1. Prof. (Dr.) Uday Kumar, Retd. Head, Department of Geology, Ranchi University Ranchi	-Chairman	22.09.20
2. Dr. Atul Kumar Sinha, Head,University Dept. of Geology, BBMKU, Dhanbad	-Convenor	22.09.20
3. Dr. Sagar Kumar Swain, Head,Dept. of Geology, P.K.R.M. College, BBMKU, Dhanbad	-Member	22.09.20
4. Mr. Santosh Kumar Singh Retd. Scientist, CIMFR, Dhanbad, Guest Faculty, University Dept. of Geology, BBMKU, Dhanbad	-Member	22/09/20
5. Prof. (Dr.) Deepak Kumar Bhattacharya Retd. Dean, Faculty of Science, Ranchi University, Ranchi	-External Member	22/09/2020
6. Prof. (Dr.) Atul Kumar Varma, Department of Applied Geology, IIT(ISM), Dhanbad	-External Member	22.09.2020

CONTENTS

COURSE STUCTURE

SEMESTER –I

Course	Course Code	Name of Papers	Full Marks	End Semester (Ext. Marks)	Mid Semester (Int. marks)
Core Papers	**GEO-H-C-101-T** (04 Credits, 60 Lectures)	**Earth System Science**	**75**	**60**	**15**
	GEO-H-C-102-T (04 Credits, 60 Lectures)	**Crystallography & Mineralogy**	**75**	**60**	**15**
	GEO-H-C-101 & 102 –P (04 Credits, 60 Lectures)	**Practical Based on 101 & 102**	**50**	**40**	**10**
Generic Elective	**GEO-H-GE-101-T** (04 Credits, 60 Lectures)	**Physics/Chemistry/ Mathematics**	**75**	**60**	**15**
	GEO-H-GE-101-P (02 Credits, 30 Lectures)		**25**	**20**	**05**
AECC Ability Enhancement Compulsory Course	**GEO-H-AECC-101-T** (02 Credits, 30 Lectures)	**Communicative English/ Hindi**	**50**	**40**	**10**

SEMESTER –II

Course	Course Code	Name of Papers	Full Marks	End Semester	Mid Semester (Int. marks)
Core Papers	**GEO-H-C-203-T** (04 Credits, 60 Lectures)	**Elements Of Geochemistry**	**75**	**60**	**15**
	GEO-H-C-204-T (04 Credits, 60 Lectures)	**Structural Geology**	**75**	**60**	**15**
	GEO-H-C-203 & 204 – P (04 Credits, 60 Lectures)	**Practical Based on 203 & 204**	**50**	**40**	**10**
Generic Elective	**GEO-H-GE-202-T** (04 Credits, 60 Lectures)	**Physics/Chemistry/ Mathematics**	**75**	**60**	**15**
	GEO-H-GE-202-P (02 Credits, 30 Lectures)		**25**	**20**	**05**
AECC Ability Enhancement Compulsory Course	**GEO-H-AECC-202-T** (02 Credits, 30 Lectures)	**Environmental Science**	**50**	**40**	**10**

SEMESTER- III

Course	Course Code	Name of Papers	Full Marks	End Semester	Mid Semester (Int. marks)
Core Papers	**GEO-H-C-305-T** (04 Credits, 60 Lectures)	**Igneous Petrology**	**75**	**60**	**15**
	GEO-H-C-306-T (04 Credits, 60 Lectures)	**Sedimentary Petrology**	**75**	**60**	**15**
	GEO-H-C-307-T (04 Credits, 60 Lectures)	**Metamorphic Petrology**	**75**	**60**	**15**
	GEO-H-C-305 & 306 & 307 –P (04 Credits, 60 Lectures)	**Practical Based on 305 & 306 & 307**	**75**	**60**	**15**
Generic Elective	**GEO-H-GE-303-T** (04 Credits, 60 Lectures)	**Physics/Chemistry/ Mathematics**	**75**	**60**	**15**
	GEO-H-GE-303-P (02 Credits, 30 Lectures)		**25**	**20**	**05**
SEC (Skill Enhancement Course)	**GEO-H-SEC-301-T** (02 Credits, 30 Lectures)	**Any one subject from Annexure-1**	**50**	**40**	**10**

SEMESTER- IV

Course	Course Code	Name of Papers	Full Marks	End Semester	Mid Semester (Int. marks)
Core Papers	**GEO-H-C-408-T** (04 Credits, 60 Lectures)	**Stratigraphic Principles & Indian Stratigraphy**	**75**	**60**	**15**
	GEO-H-C-409-T (04 Credits, 60 Lectures)	**Paleontology**	**75**	**60**	**15**
	GEO-H-C-410-T (04 Credits, 60 Lectures)	**Economic Geology**	**75**	**60**	**15**
	GEO-H-C-408 & 409 &410 –P (04 Credits, 60 Lectures)	**Practical Based on 408 & 409 & 410**	**75**	**60**	**15**
Generic Elective	**GEO-H-GE-404-T** (04 Credits, 60 Lectures)	**Physics/Chemistry/ Mathematics**	**75**	**60**	**15**
	GEO-H-GE-404-P (02 Credits, 30 Lectures)		**25**	**20**	**05**
SEC (Skill Enhancement Course)	**GEO-H-SEC-402-T** (02 Credits, 30 Lectures)	**Any one subject from Annexure-1**	**50**	**40**	**10**

SEMESTER- V

Course	Course Code	Name of Papers	Full Marks	End Semester	Mid Semester (Int. marks)
Core Papers	**GEO-H-C-511-T** (04 Credits, 60 Lectures)	**Geomorphology**	**75**	**60**	**15**
	GEO-H-C-512-T (04 Credits, 60 Lectures)	**Hydro Geology**	**75**	**60**	**15**
	GEO-H-C-511 & 512 – P (04 Credits, 60 Lectures)	**Practical Based on 511 & 512**	**50**	**40**	**10**
DSE (Discipline Specific Elective)	**GEO-H-DSE-501 (A/B/C)-T** (04 Credits, 60 Lectures) (Choice to choose any one paper)	**A. Fuel Geology OR B. Earth & Climate OR C. River Science**	**75**	**60**	**15**
	GEO-H-DSE-502-(A/B/C)-T (04 Credits, 60 Lectures) (Choice to choose any one paper)	**A. Ore Geology OR B. Soil Geoscience OR C. Sedimentology**	**75**	**60**	**15**
	GEO-H-DSE-501(A/B/C) & 502-(A/B/C)-P (04 Credits, 60 Lectures)	**Practical Based on DSE 501(A/B/C) & DSE(A/B/C)**	**50**	**40**	**10**

SEMESTER- VI

Course	Course Code	Name of Papers	Full Marks	End Semester	Mid Semester (Int. marks)
Core Papers	**GEO-H-C-613-T** (04 Credits, 60 Lectures)	**Engineering Geology**	**75**	**60**	**15**
	GEO-H-C-614-T (04 Credits, 60 Lectures)	**Remote Sensing & GIS**	**75**	**60**	**15**
	GEO-H-C-613 & 614 – P (04 Credits, 60 Lectures)	**Practical Based on 613 & 614**	**50**	**40**	**10**
DSE (Discipline Specific Elective)	**GEO-H-DSE-603 (A/B/C)-T** (04 Credits, 60 Lectures) (Choice to choose any one paper)	**A. Exploration Geology OR B. Introduction to Geophysics OR C. Urban Geology**	**75**	**60**	**15**
	GEO-H-DSE-604-(A/B/C)-T (04 Credits, 60 Lectures) (Choice to choose any one paper)	**A. Environmental Geology OR B. Evolution of life through time OR C. Fossils & Their Applications**	**75**	**60**	**15**
	GEO-H-DSE-603(A/B/C) & 604-(A/B/C)-P (04 Credits, 60 Lectures)	**Practical Based on DSE -603 (A/B/C) & 604-(A/B/C)**	**50**	**40**	**10**
	Total Marks	**=**	**2400**	**1920**	**480**

SEMESTER-I

GEO-H-C-101-T	**EARTH SYSTEM SCIENCE-C-01**	**(04 Credits, 60 Lectures)**

Instruction to Question Setter for End Semester Examination (ESE): Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

EARTH SYSTEM SCIENCE

Unit 1: Earth as a planet

Holistic understanding of dynamic planet 'Earth' through Geology. Introduction to various branches of Earth Sciences.

General characteristics and origin of the Universe, Solar System and its planets. The terrestrial and jovian planets. Meteorites and Asteroids,

Earth in the solar system - origin, size, shape, mass, density, rotational and revolution parameters and its age.

Unit 2: Interior of Earth

Internal Structure of the earth.

Earth's magnetic field: Convection in Earth's core and production of its magnetic field.

Unit 3: Plate Tectonics

Concept of plate tectonics, sea-floor spreading, Isostacy, and continental drift

Geodynamic elements of Earth- Mid Oceanic Ridges, trenches, transform faults and island arcs Origin of oceans, continents, mountains and rift valleys

Earthquake and earthquake belts

Volcanoes- types, products and their distribution.

Unit 4: Hydrosphere and Atmosphere

Introduction to hydrosphere and atmosphere; Oceanic current system and effect of Coriolis force; Wave erosion and beach processes; Atmospheric circulation; Earth's heat budget.

Unit 5: Soil

Soils- processes of formation, soil profile and soil types.

Unit 6: Understanding the past from stratigraphic records

Stratigraphy: introduction and scope; Standard stratigraphic time scale Introduction to geo-chronological methods and their application in geological studies; Laws of superposition and faunal succession; Concepts of uniformitarianism.

Suggested Readings:

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

GEO-H-C-102-T	CRYSTALLOGRAPHY & MINERALOGY- C-02	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE): Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

CRYSTALLOGRAPHY & MINERALOGY:

Unit 1: **Crystallography**

Elementary ideas about crystal morphology in relation to internal structures Crystal parameters and indices Crystal symmetry and classification of crystals into six systems and 32 point groups

Unit 2: Crystal symmetry and projections

Elements of crystal chemistry and aspects of crystal structures Stereographic projections of symmetry elements and forms

Unit 3: Rock forming minerals

Minerals - definition and classification, physical and chemical properties Composition of common rock-forming minerals, Silicate and non-silicate structures; CCP and HCP structures

Unit 4: Properties of light and optical microscopy

Nature of light and principles of optical mineralogy, Isotropic & Anisotropic, Birefringence, Interference color, Extinction, Uniaxial & Biaxial Indicatrix,

Introduction to the petrological microscope and identification of common rock-forming minerals

Suggested Readings:

- *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.*
- *Kerr, P. F. (1959). Optical Mineralogy. McGraw-Hill.*
- *Verma, P. K. (2010). Optical Mineralogy (Four Colour). Ane Books Pvt Ltd.*
- *Deer, W. A., Howie, R. A., & Zussman, J. (1992). An introduction to the rock-forming minerals (Vol. 696). London: Longman.*

GEO-H-C-101 & 102-P	PRACTICALS - 101 & 102 P	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Practical Examination (ESE): *The questions in practical examination will be of equal to 60 marks and will be of 3 hours duration. Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.*

Practicals:

1. Study of major geomorphic features and their relationships with outcrops through physiographic models.
2. Detailed study of topographic sheets and preparation of physiographic description of an area
3. Study of soil profile of any specific area
4. Study of distribution of major lithostratigraphic units on the map of India
5. Study of distribution of major dams on map of India and their impact on river systems
6. Study of major ocean currents of the World
7. Study of seismic profile of a specific area and its interpretation
8. Observation and documentation on symmetry of crystals
9. Study of physical properties of minerals in hand specimen: Silicates: Olivine, Garnet, Andalusite, SilIimanite, Kyanite, Staurolite, Beryl, Tourmaline, Augite, Actinolite, Tremolite, Hornblende, Serpentine, Talc, Muscovite, Biotite, Phlogopite, Quartz, Orthoclase, Plagioclase, Microcline, Nepheline, Sodalite, Zeolite ,Quartz varieties: Chert, Flint, Chalcedony, Agate, Jasper, Amethyst, Rose quartz, Smoky quartz, Rock crystal.
10. Native Metals/non-metals, Sulfides, Oxides- Copper, Sulfur, Graphite, Pyrite, Corundum, Magnetite Hydroxides, Halides, Carbonates, Sulfates, Phosphates: Psilomelane, Fluorite, Calcite, Malachite, Gypsum, Apatite.
11. Study of some key silicate minerals under optical microscope and their characteristic properties.

GEO-H-GE-101 T	**Physics/Chemistry/Mathematics-GE- 01**	**(04 Credits, 60 Lectures)**

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

GEO-H-GE-101 P	**Physics/Chemistry/Mathematics – PRACTICALS**	**(02 Credits, 30 Lectures)**

Instruction to Question Setter for End Semester Practical Examination (ESE): *The questions in practical examination will be of equal to 20 marks and will be of 3 hours duration. Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.*

GEO-H-AECC-101-T	**LANGUAGE (ENGLISH/HINDI/NH+MB)**	**(02 Credits, 30 Lectures)**

Any one Compulsory Language Communication prescribed by B.B.M.K. University:
English Communications/ Hindi Communications/ NH+MB Communication.
(Refer AECC Curriculum of B.B.M.K. University)

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (four questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 2 marks (2 Questions).Group B will contain descriptive type eight questions of eight marks each, out of which any four are to answer. Each question carries 08 marks.*

SEMESTER-II

GEO -H-C-203-T	**ELEMENTS OF GEOCHEMISTRY- C-03**	**(04 Credits, 60 Lectures)**

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

ELEMENTS OF GEOCHEMISTRY **Theory: 60 Lectures**

Unit 1: Concepts of geochemistry

Introduction to properties of elements: The periodic table. Chemical bonding, states of matter and atomic environment of elements. Geochemical classification of elements

Unit 2: Layered structure of Earth and geochemistry

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

Unit 3: Element transport

Advection and diffusion. Chromatography.

Aqueous geochemistry- basic concepts and speciation in solutions, Eh, pH relations

Unit 4: Geochemistry of solid Earth

The solid Earth – geochemical variability of magma and its products. The Earth in the solar system, the formation of solar system Composition of the bulk silicate Earth. Meteorites

Unit 5: Cosmic abundance of elements

Distribution of elements in solar system and in Earth Chemical differentiation and composition of the Earth, General concepts about geochemical cycles and mass balance.

Properties of elements, Geochemical behavior of major elements, Mass conservation of elements and isotopic fractionation.

Suggested Readings:

- *Mason, B. (1986) Principles of Geochemistry. 3rd Edition, Wiley New York.*
- *Rollinson, H. (2007) Using geochemical data – evaluation, presentation and interpretation. 2nd Edition. Publisher Longman Scientific & Technical.*
- *Walther, J. V. (2009). Essentials of geochemistry. Jones & Bartlett Publishers.*
- *Albarède, F. (2003). Geochemistry: an introduction. Cambridge University Press.*
- *Faure, Gunter and Teresa M. Mensing (2004). Isotopes: Principles and Applications, Wiley India Pvt. Ltd*

GEO -H-C-204-T	STRUCTURAL GEOLOGY-C-04	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

STRUCTURAL GEOLOGY

Theory: 60 Lectures

Unit 1: Structure and Topography

Effects of topography on structural features, Topographic and structural maps; Importance representative factors of the map

Unit 2: Stress and strain in rocks

Concept of rock deformation: Stress and Strain in rocks, Strain ellipses of different types and their geological significance.

Planar and linear structures; Concept of dip and strike; Outcrop patterns of different structures.

Unit 3: Folds

Fold morphology; Geometric and genetic classification of folds; Introduction to the mechanics of folding: Buckling, Bending, Flexural slip and flow folding

Unit 4: Foliation and lineation

Description and origin of foliations: axial plane cleavage and its tectonic significance, Description and origin of lineation and relationship with the major structures

Unit 5: Fractures, faults and Joints

Geometric and genetic classification of fractures and faults, Effects of faulting on the outcrops

Geologic/geomorphic criteria for recognition of faults and fault plane solutions, Joints types

Suggested Readings:

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

GEO-H-C-203-P & 204-P	PRACTICALS- 203 & 204 P	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Practical Examination (ESE):*The questions in practical examination will be of equal to 60 marks and will be of 3 hours duration. Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.*

Practical:

1. Types of geochemical data analysis and interpretation; of common geochemical plots.
2. Geochemical analysis of geological materials.
3. Geochemical variation diagrams and its interpretations.
4. Basic idea of topographic contours, Topographic sheets of various scales.
5. Introduction to Geological maps: Lithological and Structural maps
6. Structural contouring and 3-point problems of dip and strike
7. Drawing profile sections and interpretation of geological maps of different complexities, Exercises of stereographic projections of mesoscopic structural data (planar, linear, folded etc.)
8. Geological Mapping of two weeks duration in a geologically complex area and Field Work Report based on it

GEO-H-GE-202-T	**Physics/Chemistry/Mathematics-GE-02**	**(04 Credits, 60 Lectures)**

Instruction to Question Setter for End Semester Examination (ESE):*There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

GEO-H-GE-202-P	**Physics/Chemistry/Mathematics-GE-02P**	**(02 Credits, 30 Lectures)**

Instruction to Question Setter for End Semester Practical Examination (ESE):*The questions in practical examination will be of equal to 20 marks and will be of 3 hours duration. Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.*

GEO-H-AECC-202-T	**ENVIRONMENT SCIENCE - AECC-02**	**(02 Credits, 30 Lectures)**

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (four questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 2 marks (2 Questions).Group B will contain descriptive type eight questions of eight marks each, out of which any four are to answer. Each question carries 08 marks.*

SEMESTER-III

GEO -H-C-305-T	IGNEOUS PETROLOGY-C-05	(04 Credits 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

IGNEOUS PETROLOGY **Theory: 60 Lectures**

Unit 1: Concepts of Igneous petrology

Introduction to petrology: Heat flow, geothermal gradients through time, origin and nature of magma

Unit 2: Forms

Classification of igneous rocks, Textures and structures of igneous rocks, Mode of occurrence of igneous rocks

Unit 3: Phase diagrams and Petrogenesis

Binary Phase diagrams in understanding crystal-melt equilibrium–An-Ab, Or-Ab, Di-An, Magma generation in crust and mantle, their emplacement and evolution

Unit 4: Magmatism in different tectonic settings

Magmatism in the oceanic domains (MORB, OIB), Magmatism along the plate margins (Island arcs/continental arcs)

Unit 5: Petrogenesis of Igneous rocks

Petrogenesis of Felsic and Mafic igneous rocks, Komatites, Granitoides, Basalt, Gabbros, Alkaline rocks, Kimberlites and Lamproites.

Suggested Readings:

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

GEO -H-C-306-T	SEDIMENTARY PETROLOGY-C-06	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

SEDIMENTARY PETROLOGY **Theory: 60 Lectures**

Unit 1: Origin of sediments

Weathering and sedimentary flux: Physical and chemical weathering, soils and paleosols.

Unit 2: Sediment granulometry

Grain size scale, particle size distribution, Environmental connotation; particle shape and fabric

Unit 3: Sedimentary textures, structures and environment

Fluid flow, sediment transport and sedimentary structures: Types of fluids, Laminar vs. turbulent flow, Particle entrainment, transport and deposition.

Paleocurrent analysis- Paleocurrents for different sedimentary environments, Sedimentary structure-Primary and syn-sedimentary structures

Unit 4: Varieties of sedimentary rocks

Siliciclastic rocks: Conglomerates, sandstones, mudrocks.

Carbonate rocks, controls of carbonate deposition, components and classification of limestone, dolomite and dolomitisation

Unit 5: Diagenesis

Concepts of diagenesis, Stages of diagenesis, Compaction and cementation.

Suggested Readings:

- *Prothero, D. R., & Schwab, F. (2004). Sedimentary geology. Macmillan.*
- *Tucker, M. E. (2006) Sedimenary Petrology, Blackwell Publishing.*
- *Collinson, J. D. & Thompson, D. B. (1988) Sedimentary structures, Unwin- Hyman, London.*
- *Nichols, G. (2009) Sedimentology and Stratigraphy Second Edition. Wiley Blackwell.*

GEO -H-C-307-T	METAMORPHIC PETROLOGY-C-07	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

METAMORPHIC PETROLOGY **Theory: 60 Lectures**

Unit 1: Metamorphism: controls and types.

Definition of metamorphism. Factors controlling metamorphism Types of metamorphism - contact, regional, fault zone metamorphism, impact metamorphism.

Unit 2: Metamorphic facies and grades Index minerals, Chemographic projections, Metamorphic zones and isograde s.

Concept of metamorphic facies and grade Mineralogical phase rule of closed and open system Structure and textures of metamorphic rocks

Unit 3: Metamorphism and Tectonism

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

Unit 4: Migmatites and their origin

Metasomatism and role of fluids in metamorphism

Unit 5: Metamorphic rock associations- Schists, Gneisses, Khondalites, Charnockites, Blueschists and Eclogites

Suggested Readings:

- *Philpotts, A., & Ague, J. (2009). Principles of igneous and metamorphic petrology. Cambridge University Press.*
- *Winter, J. D. (2014). Principles of igneous and metamorphic petrology. Pearson.*
- *Rollinson, H. R. (2014). Using geochemical data: evaluation, presentation, interpretation. Routledge. Raymond, L. A. (2002). Petrology: the study of igneous, sedimentary, and metamorphic rocks. McGraw- Hill Science Engineering.*
- *Yardley, B. W., & Yardley, B. W. D. (1989). An introduction to metamorphic petrology. Longman Earth Science Series.*

GEO-H-C-305-P & 306-P & 307-P	**PRACTICALS – 305-P, 306-P & 307-P**	**(06 Credits, 60 Lectures)**

Instruction to Question Setter for End Semester Practical Examination (ESE):*The question s in practical examination will be of equal to 60 marks and will be of 3 hours duration. Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.*

Practical:

1. Study of important igneous rocks in hand specimens and Microscopic thin sections.
2. Megascopic & Microscopic studies of important Sedimentary rocks.
3. Megascopic study of sedimentary structures, Particle size distribution and statistical treatment,
4. Paleocurrent analysis, Petrography of clastic and non-clastic rocks through hand specimens and thin sections
5. Megascopic and microscopic study (textural and mineralogical) of the following metamorphic rocks, Graphic plots for petrochemistry and interpretation of assemblages: ACF and AKF diagrams.

GEO-H-GE-303-T	**Physics/Chemistry/Mathematics-GE-03**	**(04 Credits, 60 Lectures)**

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

GEO-H-GE-303-P	**Physics/Chemistry/Mathematics–GE-03**	**(02 Credits, 30 Lectures)**

Instruction to Question Setter for End Semester Practical Examination (ESE): *The questions in practical examination will be of equal to 20 marks and will be of 3 hours duration. Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.*

GEO-H-SEC-301-T	**SKILL ENHANCEMENT COURSE - SEC- 01 (See Annexure-1)**	**(02 Credits, 30 Lectures)**

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (four questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 2 marks (2 Questions).Group B will contain descriptive type eight questions of eight marks each, out of which any four are to answer. Each question carries 08 marks*

SEMESTER-IV

GEO-H-C-408-T	**STRATIGRAPHIC PRINCIPLES & INDIAN STRATIGRAPHY- C-08**	**(04 Credits, 60 Lectures)**

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

STRATIGRAPHIC PRINCIPLES & INDIAN STRATIGRAPHY

Theory: 60 Lectures

Unit 1: Principles of stratigraphy, Introduction to the concepts of lithostratigraphy, biostratigraphy, chronostratigraphy, seismic stratigraphy, chemostratigraphy, Magnetostratigraphy; International Stratigraphic Code – development of a standardized stratigraphic nomenclature. Concepts of Stratotypes. Global Stratotype Section and Point (GSSP).

Unit 2: Principles of stratigraphic analysis and Physiographic and tectonic subdivisions of India
Walther's Law of Facies. Concept of paleogeographic reconstruction; Sequence stratigraphy and their subdivisions with Indian examples. Introduction to the physiographic and tectonic sub divisions of India. Introduction to Indian Shield

Unit 3: Pre-Cambrian Stratigraphy of India
Pre-Cambrian geology of Singhbhum and Karnataka; Introduction to Proterozoic basins of India; Geology of Vindhyan and Cudappah basins of India

Unit 4: Phanerozoic Stratigraphy of India
Geology, Structure and hydrocarbon potential of Gondwana basins.

Mesozoic stratigraphy of India:

a. Triassic successions of Spiti,

b. Jurassic of Kutch,

c. Cretaceous successions of Cauvery basins

Cenozoic stratigraphy of India:

a. Siwalik successions,

b. Assam basins.

Stratigraphy and structure of Krishna-Godavari basin, Cauvery basin, Bombay offshore basin, Kutch and Saurashtra basins and their potential for hydrocarbon exploration

Unit 5: Volcanic provinces of India and Stratigraphic boundaries

a. Deccan Traps,

b. Rajmahal,

Important Stratigraphic boundaries in India - a. Precambrian-Cambrian boundary, b. Permian-Triassic boundary, and c. Cretaceous-Tertiary boundary

Suggested Readings:

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

GEO-H-C-409-T	PALEONTOLOGY - C-09	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

PALEONTOLOGY **Theory: 60 Lectures**

Unit 1: Fossilization and fossil record

Nature and importance of fossil record; Fossilization processes and modes of preservation

Unit 2: Taxonomy and Species concept

Species concept with special reference to paleontology, Theory of organic evolution.

Unit 3: Invertebrates

Brief introduction of important fossils groups: morphology and geological history of Trilobita, Brachiopoda, Gastropoda, Cephalopoda and Lamellibranch.

Unit 4: Vertebrates and other fossils

Evolution of horse and intercontinental migrations. Human evolution. Gondwana Flora, Introduction to Ichnology.

Unit 5. Application of fossils in Stratigraphy

Biozones, index fossils, correlation Fossils and paleo-environmental analysis

Fossils and paleobiogeography, biogeographic provinces Paleoecology – fossils as a window to the evolution of ecosystems.

SUGGESTED READINGS

- *Raup, D. M., Stanley, S. M., Freeman, W. H. (1971) Principles of Paleontology*

- *Clarkson, E. N. K. (2012) Invertebrate paleontology and evolution 4th Edition by Blackwell Publishing.*
- *Benton, M. (2009). Vertebrate paleontology. John Wiley & Sons.*
- *Shukla, A. C., & Misra, S. P. (1975). Essentials of paleobotany. Vikas Publisher*
- *Armstrong, H. A., & Brasier, M.D. (2005) Microfossils. Blackwell Publishing.*

GEO-H-C-410-T	ECONOMIC GEOLOGY - C-10	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

ECONOMIC GEOLOGY **Theory: 60 Lectures**

Unit 1 Ores and gangues: Ores, gangue minerals, tenor, grade and lodes
Resources and reserves- definitions; classification of economic deposits. Structure and texture of ore deposits

Unit 2: Mineral deposits and concepts of Ore formation:
Endogenous processes: Magmatic concentration, skarns, greisens, and hydrothermal deposits
Exogenous processes: weathering products and residual deposits, oxidation and supergene enrichment, placer deposits,

Unit 3: Mineral exploration
Exploration techniques: Geological, Geophysical and Geochemical Explorations techniques

Unit 4: Metallic and Nonmetallic ores
Mode of Occurrence, chemical composition, uses and distribution in India of following: Metallic deposits: Ores of Iron, Aluminum, Copper, Manganese, Lead and Zinc.
Non-metallic deposits: Mica, Asbestos and Limestone.

Unit 5: Metallogenic provinces and epochs
An introduction to atomic minerals and gemstones. Introduction to gemstones.

Suggested Readings:

- *Guilbert, J.M. and Park Jr., C.F. (1986) The Geology of Ore deposits. Freeman & Co.*
- *Bateman, A.M. and Jensen, M.L. (1990) Economic Mineral Deposits. John Wiley.*
- *Evans, A.M. (1993) Ore Geology and Industrial minerals.*
- *Wiley Laurence Robb. (2005) Introduction to ore forming processes. Wiley.*

- *Gokhale, K.V.G.K. and Rao, T.C. (1978) Ore deposits of India their distribution and processing, Tata- McGraw Hill, New Delhi.*
- *Deb, S. (1980) Industrial minerals and rocks of India. Allied Publishers.*
- *Sarkar, S.C. and Gupta, A. (2014) Crustal Evolution and Metallogeny in India. Cambridge Publications.*

GEO-H-C-408-P & 409-P & 410-P	**PRACTICALS – 408-P, 409-P & 410-P**	**(06 Credits, 60 Lectures)**

Instruction to Question Setter for End Semester Practical Examination (ESE):*The questions in practical examination will be of equal to 60 marks and will be of 3 hours duration. Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.*

Practical:

1. Study of geological map of India and identification of major stratigraphic units; Study of rocks in hand specimens from known Indian stratigraphic horizons; Drawing various Paleo-geographic maps of Precambrian time; Study of different Proterozoic supercontinent reconstructions.
2. Study of fossils showing various modes of preservation; Study of diagnostic morphological characters, systematic position, stratigraphic position and age of various invertebrate, vertebrate and plant fossils
3. Megascopic identification ore forming minerals (Oxides and sulphides).
4. Study of microscopic properties of ore forming minerals (Oxides and sulphides).
5. Preparation of maps: Distribution of important ores and other economic minerals in India.
6. Geological Mapping of two weeks duration in a geologically complex area and Field Work Report based on it.

GEO-H-GE-404-T	**Physics/Chemistry/Mathematics-GE-04**	**(04 Credits, 60 Lectures)**

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

GEO -H-GE-404-P	**Physics/Chemistry/Mathematics PRACTICALS - GE-04**	**(02 Credits, 30 Lectures)**

Instruction to Question Setter for End Semester Practical Examination (ESE):*The questions in practical examination will be of equal to 60 marks and will be of 3 hours duration. Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.*

GEO-H-SEC-402-T	**SKILL ENHANCEMENT COURSE SEC- 02 (See Annexure-1)**	**(02 Credits, 30 Lectures)**

Instruction to Question Setter for End Semester Examination (ESE):*There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (four questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 2 marks (2 Questions).Group B will contain descriptive type eight questions of eight marks each, out of which any four are to answer. Each question carries 08 marks.*

SEMESTER V

GEO-H-C-511-T	GEOMORPHOLOGY- C-11	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

GEOMORPHOLOGY

Theory: 60 Lectures

Unit 1: Introduction to Geomorphology, Endogenic and Exogenic processes

Unit 2: Geoid, Topography, Hypsometry, Global Hypsometry; Major Morphological features Large Scale Topography - Ocean basins, Large scale mountain ranges (with emphasis on Himalaya).

Unit 3: Surficial Processes and geomorphology: Weathering and associated landforms, Glacial, Periglacial processes and landforms, Fluvial processes and landforms, Aeolian Processes and landforms, Coastal Processes and landforms, Landforms associated with igneous activities

Unit 4: Endogenic- Exogenic interactions, Rates of uplift and denudation, Tectonics and drainage development, Sea-level change, Long-term landscape development

Unit 5: Overview of Indian Geomorphology.

Suggested Readings:

- *Robert S. Anderson and Suzzane P. Anderson (2010):*
- *Geomorphology - The Mechanics and Chemistry of Landscapes. Cambridge University Press. M.A. Summerfield (1991) Global Geomorphology. Wiley & Sons.*

GEO-H-C-512-T	HYDRO GEOLOGY- C-12	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE):*There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

HYDRO GEOLOGY **Theory: 60 Lectures**

Unit 1

Hydrologic Cycle, Distribution of water in Earth crust, Groundwater in hydrologic cycle; Ground water, origin, types, importance; Aquifer, their types and characteristics; Hydrologic properties of aquifer materials: porosity; permeability; specific yield; specific retention, hydraulic conductivity, transmissivity , storage coefficient ;

Unit 2

Forces and laws of groundwater movement; Darcy law and its application in hydrogeology; Confined, unconfined, steady, unsteady and radial flows of groundwater; Methods of pumping test and evaluation of aquifer parameters. Springs: types, origin and movement of water; Water Table map and its significance;

Unit 3

Hydrographic analyses, Water budget studies; Water resource inventory of the basin; Consumptive and conjunctive use of surface and groundwater; Causative factors for Water Table fluctuation. Wells: types, drilling methods, construction, design and development of wells;

Unit4

Physical and Chemical characteristics of groundwater. Interpretation of chemical analysis. Relationship of quality to use. Ground water pollution; Sources of surface and subsurface pollution; Control of ground water pollution

Unit 5

Chemical characteristics of groundwater in relation to various uses – domestic, industrial and irrigation; Water contaminants and pollutants, natural (geogenic) and anthropogenic contaminants; Saline water intrusion in coastal and other aquifers and its prevention; Groundwater contamination and problems of arsenic and fluoride in Indian subcontinent with special reference to Jharkhand .

Suggested Books

- *C.F. Tolman (1937): Groundwater, McGraw Hill , New York and London.*
- *D.K. Todd (1995): Groundwater HydrolGeology, John Wiley and Sons.*
- *F.G. Driscoll (1988): Groundwater and Wells, UOP, Johnson Div.St.Paul. Min. USA.*

- *H.M. Raghunath (1990): Groundwater, Wiley Eastern Ltd.,*
- *H.S. Nagabhushaniah (2001): Groundwater in Hydrosphere (Groundwater hydrolGeology), CBS Publ..*
- *K. R. Karanth (1989): HydroGeology, Tata McGraw Hill Publ..*
- *S.N. Davies and R.J.N. De Wiest (1966): HydroGeology, John Wiley and Sons, New York.*
- *Patra, H. P., Adhikari, Shyamal Kumar, Kunar, Subrata(2016)Groundwater Prospecting and Management,Springer*
- *Jakeman, A.J., Barreteau, O., Hunt, R.J., Rinaudo, J.-D.,Ross, A. (2016) Integrated Groundwater Management:Concepts, Approaches and Challenges,Springer*
- *Ramanathan, A., Johnston, S., Mukherjee, A., Nath, B. (Eds.)2015,Safe and Sustainable Use of Arsenic- Contaminated Aquifers in the Gangetic Plain*

GEO-H-C-511-P & 512-P	**PRACTICAL- C-11P & C-12P**	**(04 Credits, 60 Lectures)**

Instruction to Question Setter for End Semester Practical Examination (ESE): *The questions in practical examination will be of equal to 60 marks and will be of 3 hours duration. Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.*

Practicals:

1. Reading topographic maps ,Concept of scale Preparation of a topographic profile , Preparation of longitudinal profile of a river; Preparing Hack Profile; Calculating Stream length gradient index, Morphometry of a drainage basin, Calculating different morphometric parameters , Preparation of geomorphic map , Interpretation of geomorphic processes from the geomorphology of the area.
2. Plotting of Ground water provinces of India in political map of India.
3. Study, preparation and analysis of hydrographs for differing groundwater conditions
4. Water potential zones of India (map study).
5. Hydrological Properties of rocks

GEO-H-DSE-501A-T	FUEL GEOLOGY –DSE-01A	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

FUEL GEOLOGY

Theory: 60 Lectures

Unit 1: Coal: Definition and origin of Coal; Basic classification of coal;
Fundamentals of Coal Petrology - Introduction to lithotypes, microlithotypes and macerals in coal. Proximate and Ultimate analysis

Unit 2: Coal as a fuel

Coal Bed Methane (CBM): global and Indian scenario. Underground coal gasification, Coal liquefaction

Unit 3: Petroleum

Chemical composition and physical properties of crudes in nature. Origin of petroleum.

Unit 4: Petroleum Reservoirs and Traps

Reservoir rocks: general attributes, Classification of reservoir rocks Cap rocks - definition and general properties.

Hydrocarbon traps: definition, Classification of hydrocarbon traps - structural, stratigraphic and combination. Plate tectonics and global distribution of hydrocarbon reserves

Nuclear Fuel & Gas Hydrate

Unit 5: Indian Occurrences:

Coalfields of India with special reference to Jharkhand

Suggested Readings:

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

GEO-H-DSE-502A-T	ORE GEOLOGY - DSE-02A	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

ORE GEOLOGY **Theory: 60 Lectures**

Unit-1

Ore deposits and ore minerals. Classification of ore deposits. Magmatic processes of mineralization. Porphyry, skarn and hydrothermal mineralization.

Unit-2

Structure and texture of ores, Paragenesis, Controls of ore localisation. Spatial and temporal distribution of ore deposits.

Unit-3

Plate tectonics and ore genesis. Ore bearing fluids, movement of ore bearing fluids, Fluid inclusion studies of ores, Geothermometry.

Unit-4

Mineralization associated with ultramafic, mafic and acidic rocks, Wall rock alteration, Magma related mineralization through geological time.

Unit-5

Mineralization associated with sedimentary rocks, submarine volcanism, Weathering and metamorphic processes. Strati-form and strata-bound ores.

Suggested Books:

- *Edwards, R. and Atkinson, K. (1986) Ore Deposit Geology. Chapman and Hall, London.*
- *Craig, J.M. and Vaughan, D.J. (1981) Ore Petrography and MineralGeology. John Wiley.*
- *Evans, A.M. (2012) Ore Geology and Industrial Minerals. Third Edition (Reprint), Blackwell*
- *Sawkins, F.J. (1984) Metal Deposits in relation to Plate Tectonics. Springer Verlag.*
- *Stanton, R.L. (1972) Ore Petrology. McGraw Hill.*
- *Torling, D.H. (1981) Economic Geology and Geotectonics. Blackwell Sci. Publ.*
- *Barnes, H.L (1979) Geochemistry of Hydrothermal Ore Deposits. John Wiley.*
- *Klemm, D.D. and Schneider, H.J. (1977) Time and Strata Bound Ore Deposits. Springer Verlag.*
- *Guilbert, J.M. and Park, Jr. C.F. (1986) The Geology of Ore Deposits. Freeman.*
- *Mookherjee, A. (2000) Ore genesis -a Holistic Approach. Allied Publishers.*
- *Wolf, K.H. (1981) Hand book of Strata Bound and Stratiform Ore Deposits. Elsevier.*

GEO-H-DSE-501A & 502A- P	PRACTICALS- 501A & 502A- P	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Practical Examination (ESE):*The questions in practical examination will be of equal to 40 marks and will be of 3 hours duration. Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.*

Practical:

1. Study of hand specimens of coal
2. Reserve estimation of coal and economic mineral deposits
3. Study of Geological Section Coal and Petroleum fields and identification of hydrocarbon prospect
4. Identification of anomaly
5. Concept of weighted average in anomaly detection
6. Study of Geological cross-section of important mineral deposits
7. Study of distribution of important ore deposits in India
8. Megascopic & microscopic study of important ores and their textures.
9. Megascopic study of important industrial, metallic and non-metallic, precious and semi-precious stones.
10. Ore petrographic study of ore minerals and establishment of paragenetic sequence
11. Exercises on ore reserve calculations.
12. Estimation of grade of ores.

GEO-H-DSE-501B-T	EARTH & CLIMATE – DSE-01B	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

EARTH & CLIMATE **Theory: 60 Lectures**

Unit 1:

Climate system: Forcing and Responses, Components of the climate system, Climate forcing, Climate controlling factors, Climate system response, response rates and interactions w ithin the climate system

Feedbacks in climate system

Unit 2:

Heat budget of Earth

Incoming solar radiation, receipt and storage of heat

Heat transformation

Earth's heat budget. Interactions amongst various sources of earth's heat

Unit 3:

Atmosphere – Hydrosphere, Layering of atmosphere and atmospheric Circulation, Atmosphere and ocean interaction and its effect on climate, Heat transfer in ocean, Global oceanic conveyor belt and its control on earth's climate, Surface and deep circulation, Sea ice and glacial ice

Unit 4:

Response of biosphere to Earth's climate, Climate Change: natural vs. anthropogenic effects, Humans and climate change, Future perspectives, Brief introduction to archives of climate change,

Archive based climate change data from the Indian continent

Unit 5:

Orbital cyclicity and climate, Milankovitch cycles and variability in the climate, Glacial-interglacial stages, The Last Glacial maximum (LGM), Pleistocene Glacial-Interglacial cycles, Younger Dryas, Marine isotope stages

Unit 6:

Monsoon, Mechanism of monsoon, Monsoonal variation through time, Factors associated with monsoonal intensity, Effects of monsoon

Suggested Books:

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

GEO-H-DSE-502B-T	SOIL GEOSCIENCE- DSE-02B	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

SOIL GEOSCIENCE **Theory: 60 Lectures**

Unit 1:
Soil forming processes: Chemical weathering, major buffer maintaining ocean/atm/biosphere O2 and CO2, new compounds/minerals of greater volume and lower density; Oxidation; Carbonation; Hydrolysis; Hydration; Base Exchange; Chelation; Microbial weathering

Unit 2:
General soil forming regimes: Gleization; podzolization; lessivage; ferrallitizatin; calcification; salinization, Soil forming processes: Physical weathering, loosening and particle size reduction; pressure release; thermal expansion; growth of foreign crystal, Modern soils and key pedofeatures: Soil structures; horizons; roots; Fe-Mn mottles and concretions; pedogenic carbonate

Unit 3:
Introduction to paleopedology and paleosols; role of factors controlling paleosol formation- parent material, climate, vegetation, topography, time. Introduction to soil taxonomy and paleosol taxonomy, Micromorphology: Thin section analysis of paleosols

Unit 4:
Geochemistry: molecular rations; chemical weathering indices, Stable isotope geochemistry: carbon13 and oxygen18 system for vegetation, temperature, pCO2 , Diagenetic overprinting in fossil soils: compaction; oxidation of organic matter; cementation; illitization, Geological record of fossil soils- Precambrian paleosols- evolution of paleoatmospheric conditions

Unit 5:
Geological record of fossil soils- Paleozoic paleosols- evolution of land animals and plants, coal, Permian-Triassic transition paleosols and extinction events, Geological record of fossil soils- Mesozoic-Cenozoic paleosols- fossil soils at K-T extinction event, Paleogene fossil soils at green house to ice house transition, evolution of Asian monsoon system.

Suggested Books:

- *Micromorphic detailing of the paleosols- structure, horizonation, color, rhizocretions, pedogenic carbonate etc.*
- *Particle size analysis and clay mineral analysis of the paleosols*
- *Micromorphological analysis- thin section preparation, description, and interpretation*
- *Geochemical analysis- bulk geochemistry, molecular rations and weathering indices*
- *Field trip to examine modern and fossil soils- field characterization and sampling procedures*

GEO-H-DSE-501B & 502B –P	PRACTICALS- 501B & 502B –P	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Practical Examination (ESE):*The questions in practical examination will be of equal to 40 marks and will be of 3 hours duration. Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.*

Practicals

Practical:

1. Study of distribution of major climatic regimes of India on map
2. Distribution of major wind patterns on World map
3. Preparation of paleogeographic maps (distribution of land and sea) of India during specific geological time intervals
4. Numerical exercises on interpretation of proxy records for paleoclimate
5. Micromorphic detailing of the paleosols- structure, horizonation, color, rhizocretions, pedogenic carbonate etc.
6. Particle size analysis and clay mineral analysis of the paleosols
7. Micromorphological analysis- thin section preparation, description, and interpretation
8. Geochemical analysis- bulk geochemistry, molecular rations and weathering indices
9. Field trip to examine modern and fossil soils- field characterization and sampling procedures.

.

GEO-H-DSE-501C-T	SEDIMENTOLOGY- DSE-01C	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

SEDIMENTOLOGY

Theory: 60 Lectures

Unit-1

Concept of soil, components of soil, soil profile; Process of soil formation, pedogenic processes, Factors of soil formation;

Unit 2

Classification of soil, mineral and chemical composition of soils, mineral stability during weathering; Soil organic matter form and function;

Unit-3

Fabric analysis - size and shape, concepts of size and shape, grade scale, methods of analysis, presentation of data, analysis and field grading; Concepts of structure fabric: Soil fabric, soil structure, soil texture and field grading units;

Unit-4

Paleosols - field recognition, description, origin and causes; Paleosol in stratigraphic records; Significance of paleosol study; Paleosols and human evolution. Causes of Soil erosion and degradation, A brief introduction to methods of soil conservation.

Unit-5

Calcrete - definition, classification, calcrete formation, pedogenic calcrete soil profile, macro features in calcretes, micromorphoGeology (petrography), calcretes from Quaternary and ancient sedimentary sequences; significance of calcretes; Laterite - characteristics, genesis, Indian occurrences.

Suggested Books:

- *Boul, S.W., Hole, F.D., Mc Craken, R.J. and South, R.J. (1997): Soil Genesis and classification. 4th Edn, State University Press.*
- *Braddy, N.C. (2002): Nature and Properties of Soils.*
- *Govinda Rajan, S.V. and Gopala Rao, K. H.G. (1979): Studies of Soils of India.*
- *Sposito, Garrison. (1989): The Chemistry of Soils, Oxford Univ. Press.*
- *Terzaghi, K. and Pock, R.G. 1996): Soil Mechanics in Engineering (3rd Ed.), John Wiley.*
- *Wright; V. Paul (1992): Paleosols: their recognition and interpretation, Blackwell Scientific Publ.*
- *Wright, V. Paul and Tucker, M.E. (1991): Calcretes. Blackwell Scientific Publ.*

GEO-H-DSE-502C-T	RIVER SCIENCE -DSE-02C	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE):*There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

RIVER SCIENCE **Theory: 60 Lectures**

Unit –1

Stream hydrology : Basic stream hydrology , Physical properties of water, sediment and channel flow, River discharge, River hydrographs (UH, IUH, SUH, GIUH) and its application in hydrological analysis, Flood frequency analysis

Unit-2

River basin: Sediment source and catchment erosion processes, Sediment load and sediment yield, Sediment transport processes in rivers, Erosion and sedimentation processes in channel.

Unit-3

Drainage: Drainage network, Quantitative analysis of network organization – morphometry, Random Topology (RT) model and fractal analysis, Role of drainage network in flux transfer, Evolution of drainage network in geological time scale.

Unit 4

Rivers in time and space : River diversity in space, Patterns of alluvial rivers - braided, meandering and anabranching channels, Dynamics of alluvial rivers, Channel patterns in stratigraphic sequences, Different classification approaches in fluvial geomorphology and its applications.

Unit-5

Bedrock channels, Bedrock incision process, River response to climate, tectonics and human disturbance, Bedrock channel processes and evolution of fluvial landscapes, Integrated approach to stream management

Introduction to river ecology.

Suggested Books:

- *Davies, T. (2008) Fundamentals of hydrology. Routledge Publications.*
- *Knighton, D. (1998) Fluvial forms and processes: A new perspective. Amold Pubs.*
- *Richards. K. (2004) Rivers: Forms and processes in alluvial channels. Balckburn Press.*
- *Bryirely and Fryirs (2005) Geomorphology and river management. Blackwell Pub.,*
- *Julien, P.Y. (2002) River Mechanics. Cambridge University Press.*
- *Robert, A. (2003) River Processes: An introduction to fluvial dynamics. Arnold Publications.*
- *Vanoni, V.A. (2006) Sedimentation Engineering. ASCE Manual, Published y American Society of Civil Engineering,*
- *Tinkler, K.J., Wohl, E.E. (eds.) 1998. Rivers over rock. American Geophyscial UnionMonogrpah, Washington, DC.*

GEO-H-DSE-501C & 502C –P	PRACTICALS- 501C & 502C –P	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Practical Examination (ESE):*The questions in practical examination will be of equal to 40 marks and will be of 3 hours duration. Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.*

Practical:

- Graphic plot of size data and calculation of statistical parameters.
- Study of Mechanical, Chemical and Biogenic Sedimentary structures and their Sedimentological significance
- Megascopic and microscopic study of clastic and non-clastic rocks.
- Study of vertical profile sections of selected sedimentary environments;
- Study of Heavy Minerals.
- Graphic representation of Trace Element data and Heavy Minerals
- Stream power calculation
- Longitudinal profile analysis
- Hydrograph analysis and other related problems.

SEMESTER VI

GEO-H-C-613-T	**ENGINEERING GEOLOGY-C-13**	**(04 Credits, 60 Lectures)**

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

ENGINEERING GEOLOGY

Theory: 60 Lectures

Unit 1:

Engineering Geology and its applications, Scope of Engineering Geology;

Elementary concepts of rock mechanics - Strength and Elastic properties. Engineering properties and characteristics of soils. Properties of building stones.

Unit 2:

Basic concept of-Rock Quality Designation (RQD), Rock Structure Rating (RSR), Rock Mass Rating (RMR), Tunneling Quality Index (Q)

Unit 3: Dams and reservoirs: Types of Dams-masonary or concrete dams- gravity, arch and butress. Earth Dams and composite dams. Geological considerations- topography, structure and lithology.

Foundation and seepage problems in dams and their treatment. Reservoir: Reservoir problems- seepage and silting.

Unit 4: Tunnels: terminology, definition, types- hard rock and soft rock tunnels. Geological considerations- topography, structure and lithology

Bridge sites: Terminology, Bridge structure, types, bridge problems, and stability of bridges. Geology of bridge sites.

Unit 5: Stability of rock slopes and cutting in rocks: Classification of slopes- stable and unstable slopes- Geological parameters. Measures for stabilization of slopes. Foundation treatment; Grouting, Rock Bolting and other support mechanisms; soil stabilization.

Suggested Readings:

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

GEO-H-C-614-T	REMOTE SENSING & GIS –C-14	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE):*There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

REMOTE SENSING & GIS

Theory: 60 Lectures

Unit 1: Photogeology

Types and acquisition of aerial photograph, Scale and resolution, Elements of air photo interpretation. Identification of sedimentary, igneous and metamorphic rocks and various aeolian, glacial, fluvial and marine landforms.

Unit 2: Remote Sensing

Concepts in remote sensing, Sensors and scanners, Satellites and their characteristics, Data formats-Raster and Vector.

Unit 3: Digital Image Processing

Fundamentals of Image processing, Image Correction, Image enhancement, Image classification, FCC and Image Ratioing,

Unit 4: GIS

Datum, Coordinate systems and Projection systems, Introduction to DEM analysis; GIS integration and Case studies-Indian Examples

Unit 5: GPS, Concepts of GPS

Integrating GPS data with GIS, Applications in earth system sciences

Suggested Readings:

- *Demers, M.N., 1997. Fundamentals of Geographic Information System, John Wiley & sons. Inc.*
- *Hoffmann-Wellenhof, B., Lichtenegger, H. and Collins, J., 2001. GPS: Theory & Practice, Springer Wien New York.*
- *Jensen, J.R., 1996. Introductory Digital Image Processing: A Remote Sensing Perspective, Springer- Verlag.*
- *Lillesand, T. M. & Kiefer, R.W., 2007. Remote Sensing and Image Interpretation, Wiley. Richards, J.A. and Jia, X., 1999. Remote Sensing Digital Image Analysis, Springer-Verlag.*

GEO-H-C-613-P & 614-P	PRACTICALS – C-13P & C-14P	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Practical Examination (ESE):*The questions in practical examination will be of equal to 40 marks and will be of 3 hours duration. Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.*

Practical :

1. Computation of reservoir area, catchment area, reservoir capacity and reservoir life.
2. Merits, demerits & remedial measures based upon geological cross sections of project sites.
3. Computation of index properties of rocks.
4. Computation of RQD, RSR, RMR and 'Q'
5. Plotting of Major Dams/ Tunnels on the outline map of India.
6. Study of Seismic / landslide zones of India.
7. Aerial Photo/ imagery interpretation, identification of sedimentary, igneous and metamorphic rocks
8. Identification of structural features in Aerial Photo/Satellite imagery
9. Identification of geomorphic features in Aerial Photo/Satellite imagery

Reference Books:

Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House

GEO-H-DSE-603A-T	EXPLORATION GEOLOGY - DSE-03A	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

EXPLORATION GEOLOGY **Theory: 60 Lectures**

Unit 1: Mineral Resources

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

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

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

Unit 4: Drilling and Logging

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

Unit 5: Reserve estimations and Errors

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

Suggested Books:

- *Clark, G.B. 1967. Elements of Mining. 3rd Ed. John Wiley & Sons.*
- *Arogyaswami, R.P.N. 1996 Courses in Mining Geology. 4th Ed. Oxford-IBH*
- *Moon, C.J., Whateley, M.K.G., Evans, A.M., 2006, Introduction to Mineral Exploration, Blackwell Publishing*

GEO-H-DSE-604A-T	ENVIRONMENTAL GEOLOGY - DSE-04A	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE):*There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

ENVIRONMENTAL GEOLOGY **Theory: 60 Lectures**

Unit 1

Basics of Environment; Type of Environment; Man and Environment; Components of environmental Geology, Concepts and principles of Environmental Geology; Time scales of global changes in the ecosystem and climate;

Unit 2

Atmosphere, structure and composition of atmosphere; Global warming. Greenhouse effect: CO2 increase and global warming in the present and past atmospheres;

Unit 3

Environmental Pollution: Sources of Air Pollution, emission of major industrial air pollutants, effects of air pollution on atmospheric processes, oxides of carbon as pollutants, greenhouse effect, global warming, chlorofluro carbons (CFC's), depletion of ozone layer, effects of ozone depletion, smog, acid rain;

Unit 4

Components of Hydrosphere; Water cycle; solubility of gases in water, Acidification of Ocean; Impact of oceanic and atmospheric circulation on climate and rain fall. Fluctuation of water table due to anthropogenic and geogenic causes.

Unit 5

Water Pollution: Types of water pollution, groundwater pollution and its effects, sources of water pollution; organic and inorganic contamination of groundwater and its remedial measures.

Suggested Books:

- *Abhijit Dutta.Environmental Issues and Challenges*
- *K. Sharma Environmental Pollution*
- *Bell, F.G. (1999): ogical Hazards, Routledge, London.*
- *Bryant, E. (1985): Natural Hazards, Cambridge Univ. Press.*
- *Keller, E.A. (1978) Environmental Geology*
- *Rekha Ghosh and D. S. Chatterjee :Environmental Geology*

- *Valdiya, K.S. (1987) Environmental Geology- Indian Context*
- *Patwarrdhan, A.M. (1999) The Dynamic Earth System*
- *Smith, K.(1992) Environmental Hazards*
- *Subramaniam,V.(2001) Textbook of Environmental Hazards*
- *Strahler and Strahler: Environmental Geology*

GEO-H-DSE-603A & 604A –P	**PRACTICALS- 603A & 604A –P**	**(04 Credits, 60 Lectures)**

Instruction to Question Setter for End Semester Practical Examination (ESE):*The questions in practical examination will be of equal to 40 marks and will be of 3 hours duration. Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.*

Practical:

1. Identification of anomaly
2. Concept of weighted average in anomaly detection
3. Geological cross-section
4. Models of reserve estimation
5. Study of Metallogenic provinces of India.
6. Analyses of alkalinity, acidity etc. in water samples.
7. Analyses of pH and Electrical Conductivity in water.
8. Preparation of ocean and atmospheric circulation maps.
9. Preparation of seismic and volcanic zonation maps of India and world.
10. Demarcation of flood prone areas in the outline map of India
11. Presentation of chemical analyses data

GEO-H-DSE-603B-T	INTRODUCTION OF GEOPHYSICS-DSE-03B	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

INTRODUCTION OF GEOPHYSICS **Theory: 60 Lectures**

Unit 1: Geology and Geophysics
Interrelationship between geology and geophysics, Role of geological and geophysical data in explaining internal structure of the earth.

Unit 2: General and Exploration geophysics
Different types of geophysical methods - gravity, magnetic, electrical and seismic; their principles and applications

Unit 3: Basics of subsurface geophysical logging: Basic principles of SP log, Resistivity log, Sonic log, Gamma log, Neutron log etc. and their applications

Unit 4: Geophysical field operations
Different types of surveys, grid and route surveys, profiling and sounding techniques Scales of survey, Presentation of geophysical data

Unit 5: Applications:
Application of Geophysical methods in oil and gas, ore and groundwater investigations;

Suggested Readings:

- *Outlines of Geophysical Prospecting - A manual for geologists by Ramachandra Rao, M.B., Prasaranga, University of Mysore, Mysore, 1975.*
- *Exploration Geophysics - An Outline by Bhimasarikaram V.L.S., Association of Exploration Geophysicists, Osmania University, Hyderabad, 1990.*
- *Dobrin, M.B. (1984) An introduction to Geophysical Prospecting. McGraw-Hill, New Delhi.*
- *Telford, W. M., Geldart, L. P., & Sheriff, R. E. (1990). Applied geophysics (Vol. 1). Cambridge University press.*
- *Lowrie, W. (2007). Fundamentals of geophysics. Cambridge University Press. Jensen, J.R., 1996. Introductory Digital Image Processing: A Remote Sensing Perspective, Springer-Verlag.*

- *Lillesand, T. M. & Kiefer, R.W., 2007. Remote Sensing and Image Interpretation, Wiley. Richards, J.A. and Jia, X., 1999. Remote Sensing Digital Image Analysis, Springer-Verlag*

GEO-H-DSE-604B-T	EVOLUTION OF LIFE THROUGH TIME -DSE-04B	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE):*There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

EVOLUTION OF LIFE THROUGH TIME **Theory: 60 Lectures**

Unit 1 Life through ages

Fossils and chemical remains of ancient life. Geological Time Scale with emphasis on major bio-events.

Fossilization processes and modes of fossil preservation. Exceptional preservation sites- age and fauna

Unit 2 Geobiology

Biosphere as a system, processes and products, Biogeochemical cycles, Abundance and diversity of microbes, extremophiles, Microbes-mineral interactions, microbial mats

Unit 3 Origin of life

Possible life sustaining sites in the solar system, life sustaining elements and isotope records, Archean life: Earth's oldest life, Transition from Archean to Proterozoic, the oxygen revolution and radiation of life,

Precambrian macrofossils – The garden of Ediacara,

The Snow Ball Earth Hypothesis

Unit 4 Paleozoic Life

The Cambrian Explosion. Biomineralization and skeletalization, Origin of vertebrates and radiation of fishes

Origin of tetrapods - Life out of water, Early land plants and impact of land vegetation

Mesozoic Life: Life after the largest (P/T) mass extinction, life in the Jurassic seas, Origin of mammals, Rise and fall of dinosaurs , Origin of birds; and spread of flowering plants

Unit 5 Cenozoic Life

Aftermath of end Cretaceous mass extinction – radiation of placental mammals, Evolution of modern grasslands and co-evolution of hoofed grazers, Rise of modern plants and vegetation, Back to water – Evolution of Whales,

The age of humans: Hominid dispersals and climate setting, Climate Change during the Phanerozoic - continental break-ups and collisions, Plate tectonics and its effects on climate and life, Effects of life on climate and geology

Suggested Books

- *Stanley, S.M., 2008 Earth System History*
- *Jonathan I. Lumine W.H.Freeman Earth-Evolution of a Habitable World, Cambridge University Press.*
- *Canfield, D.E. & Konhauser, K.O., 2012 Fundamentals of Geobiology Blackwell*
- *Cowen, R., 2000 History of Life, Blackwell*

GEO-H-DSE-603B & 604B –P	PRACTICALS- 603B & 604B –P	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Practical Examination (ESE):*The questions in practical examination will be of equal to 40 marks and will be of 3 hours duration. Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.*

Practical -

1. Study of various surface and subsurface geophysical data.
2. Identification of anomalies by Graphical methods: (a) Data obtained from equipotential method, (b) Data obtained from self-potential method.
3. Geophysical calculation based on seismic method: refraction, reflection
4. Problems based on electrical resistivity methods:
   (a) Wenner's array (b) Schlumberger's array
5. Study of modes of fossil preservation
6. Study of fossils from different stratigraphic levels
7. Exercises related to major evolutionary trends in important groups of animals and plants

Reference Books:

- *Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House*

GEO-H-DSE-603C-T	URBAN GEOLOGY -DSE-03C	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

URBAN GEOLOGY **Theory: 60 Lectures**

Unit 1 Geology and Society

Necessity of Geology in Urban life. Geology in Urban Constructions, Geotechnical feature and mapping for subsurface in Metropolitan areas, Building materials, Excavation and cutting in urban areas.

Unit 2 Geology and Urban Agriculture

Soil studies, Chemistry and geochemistry of soil in relation to ground water and fertilizer, Effect of pollutants on vegetable contamination,

Urban land use: Geotechnical site characterization, Geotechnical and land use mapping, Decision making in urban landuse, Geological problems in construction of underground structures in urban areas, Urban Tunneling: Tunneling for road and rail in urban areas, Method, Equipments, Importance of Geology

Unit 3 Urban water

Water lagging in built-up areas, Source of water, Standards for various uses of water,

Sources of contamination, Waste waters: Sources and its disinfection and treatment, Ground water surveys and resource development

Unit 4

Urban wastes and Treatment, Geotechnical characterization for waste sites, Domestic waste, Industrial waste, Mine drainage, Power production waste, Radioactive waste, Need for special purpose mapping for selection of waste disposal sites.

Unit 5 GIS in Urban Geology

GIS-An introduction, Application in Urban development, Application in landuse, Application in GW Exploration

Precaution from seismic hazard in Urban planning : Seismic Hazards: Micro-zonations of hazard based on engineering geological features, Urban-subservice network.

Suggested Books

- *Huggenberger, P. and Eptin, J. 2011 Urban Geology: Process-Oriented Concepts for Adaptive and Integrated Resource Management. Springer*
- *Lollino, G. et al. (Ed.), Engineering Geology for Society and Territory. Springer*

GEO-H-DSE-604C-T	FOSSILS & THEIR APPLICATIONS - DSE-04C	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE):*There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

FOSSILS & THEIR APPLICATIONS

Theory: 60 Lectures

Unit 1: Introduction to fossils

Definition of fossil, fossilization processes, modes of fossil preservation and uses.

Unit 2: Species concept

Definition of species, methods of description and naming of fossils.

Unit 3: Introduction to various fossils groups

Brief introduction of important fossils groups: morphology and geological history of Brachiopoda, Gastropoda and lamellibranchia

Important age diagnostic fossiliferous horizons of India.

Unit 4: Application of fossils

Application of fossils in the study of paleoecology, paleobiogeography and paleoclimate.

Unit 5: Societal importance of fossils

Implication of larger benthic and micropaleontology in hydrocarbon exploration: identification of reservoirs and their correlation.

Application of spore and pollens in correlation of coal seams. Fossils as an indicator of pollution

Suggested Readings:

- *Schoch, R.M. 1989. Stratigraphy, Principles and Methods. VanNostrand Reinhold.*
- *Clarkson, E.N.K.1998. Invertebrate Palaeontology and Evolution George AlIen & Unwin*
- *Prothero, D.R. 1998. Bringing fossils to life - An introduction to Palaeobiology, McGraw Hill.*
- *Benton, M.J. 2005. Vertebrate palaeontology (3rd edition). Blackwell Scientific, Oxford.*
- *Colbert's Evolution of the Vertebrates: A History of the Backboned Animals Through Time,Edwin H.*
- *Colbert, Michael Morales, Eli C. Minkoff, John Wiley & Sons, 1991.*

GEO-H-DSE-603C & 604C –P	PRACTICALS- 603C & 604C –P	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Practical Examination (ESE):*The questions in practical examination will be of equal to 40 marks and will be of 3 hours duration. Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.*

Practical:

1. Map Reading
2. Ground water flow direction estimation
3. Case studies of Urban flood; Flood hydrographs
4. Case studies of urban planning
5. Study of fossils showing various modes of fossilization.
6. Distribution of diagnostic fossils in India.
7. Study of morphological characters of important Invertebrate fossils.
8. Drawing and labeling of important invertebrate fossils.

Reference Books:

- *Huggenberger, P. and Eptin, J. 2011 Urban Geology: Process-Oriented Concepts for Adaptive and Integrated Resource Management. Springer*
- *Lollino, G. et al. (Ed.), Engineering Geology for Society and Territory. Springer*

GEO-H-GE-101 T	ESSENTIALS OF GEOLOGY-GE- 01	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

ESSENTIALS OF GEOLOGY

Theory: 60 Lectures

Unit 1: Earth in the solar system - origin, size, shape, mass, density, rotational and revolution parameters. Age of the earth & its applications by various methods, Internal structure of the earth: core, mantle and crust.

Unit 2: Introduction to hydrosphere, biosphere and atmosphere, Concept of plate tectonics, sea-floor spreading,

Unit 3: Isostacy, continental drift, Mid Oceanic Ridges, trenches, transform faults and island arcs, Origin of oceans, continents, mountains and rift valleys; Earthquake: causes, effects and distribution; Volcanoes: types, products and distribution.

Unit 4: Elementary ideas about crystal morphology in relation to internal structures Crystal parameters and indices Crystal symmetry and classification of crystals into six systems and 32 point groups, Minerals - definition and classification, physical and chemical properties Composition of common rock-forming minerals, Silicate Structure

Unit 5: **Properties of light and optical microscopy**

Nature of light and principles of optical mineralogy, Isotropic & Anisotropic, Birefringence, Interference color, Extinction,

Introduction to the petrological microscope and identification of common rock-forming minerals

Suggested Readings:

- *Holme's Principles of Physical Geology. 1992. Chapman & Hall.*
- *Emiliani, C, 1992. Planet Earth, Cosmology, Geology and the Evolution of Life and Environment. Cambridge University Press.*
- *Gross,M.G., 1977. Oceanography: A view of the Earth, Prentice Hall.*

GEO-H-GE-101 P	PRACTICALS-GE-01	(02 Credits, 30 Lectures)

Instruction to Question Setter for End Semester Practical Examination (ESE): *The questions in practical examination will be of equal to 20 marks and will be of 3 hours duration. Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.*

Practical:

1. Contour maps: profile drawing, identification and description of important topographical features.
2. Physical properties of minerals: Study and Documentation.
3. Study of physical properties of important rock forming minerals in hand specimen:
4. Plotting of major Dams on the outline map of India, mention name of the river and utility of the dam.
5. Study of Seismic Zones of India.

GEO-H-GE-202-T	Petrology, Geochemistry & Structural Geology - GE-02	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE):*There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

Petrology, Geochemistry & Structural Geology — Theory: 60 Lectures

Unit 1: Rocks- Definitions and types, Basics of rock formation.

Igneous rock- texture and Structure, magma: origin and composition, Bowen's reaction series and magmatic differentiation.

Sedimentary rocks- process of formation, texture and Structure.

Metamorphic rocks- Agents and types of metamorphism, texture and Structure.

Unit 2: Concepts of geochemistry

Introduction to properties of elements: The periodic table. Chemical bonding, states of matter and atomic environment of elements. Geochemical classification of elements, Distribution of elements in solar system

Unit 3: Structural Geology

Effects of topography on structural features, Topographic and structural maps; Concept of dip and strike; Outcrop patterns of different structures.

Unit 4: Folds

Fold morphology; Geometric and genetic classification of folds;

Unit 5: Fractures, faults, Joints and Unconformity

Geometric and genetic classification of fractures and faults, Effects of faulting on the outcrops

Geologic/geomorphic criteria for recognition of faults and fault plane solutions, Joints types, Unconformity types.

Suggested Readings:

- *Earth Materials- Introduction to Mineralogy and Petrology, Cornelis Klein and Anthony Philpotts, Cambridge University Press, 2013.*
- *Understanding Earth (Sixth Edition), John Grotzinger and Thomas H. Jordan, 2010, W.H. Freeman and company, New York.*
- *Davis, G. R. (1984) Structural Geology of Rocks and Region. John Wiley Billings, M. P. (1987) Structural Geology, 4th edition, Prentice-Hall.*
- *Park, R. G. (2004) Foundations of Structural Geology. Chapman & Hall.*
- *Mason, B. (1986) Principles of Geochemistry. 3rd Edition, Wiley New York.*

- *Rollinson, H. (2007) Using geochemical data – evaluation, presentation and interpretation. 2nd Edition. Publisher Longman Scientific & Technical.*

GEO-H-GE-202-P	PRACTICALS - GE-02P	(02 Credits, 30 Lectures)

Instruction to Question Setter for End Semester Practical Examination (ESE):*The questions in practical examination will be of equal to 20 marks and will be of 3 hours duration. Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.*

Practical:

1. Observation and documentation of important structures of sedimentary and metamorphic rocks.
2. Observation and documentation of forms of igneous rocks.
3. Study of rocks in hand specimen.
4. Basic idea of topographic contours, Topographic sheets of various scales.
5. Introduction to Geological maps: Lithological and Structural maps

GEO-H-GE-303-T	EARTH RESOURCES - GE-03	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

EARTH RESOURCES

Theory: 60 Lectures

Unit 1: Earth Resources

Definition: Mineral, Ore and Gangue, Tenor, Grade. Introduction to Essential, Critical and Strategic minerals.

A brief overview of Classification of Mineral deposits with respect to processes of formation and mode of occurrences.

Unit 2: Definition of Energy

Primary and Secondary Energy.

Renewable and Non-Renewable Sources of Energy. Environmental Dimension of Energy.

Unit 3: Major Types and Sources of Energy

Resources of Natural Oil and Gas.

Coal and Nuclear Minerals: Types and distribution.

Introduction to Hydroelectric Power, Solar Energy, Wind, Wave and Biomass based power and Energy

Unit 4: Groundwater resources and its management

Groundwater resources and its role in economic development of a country. Rainwater harvesting and artificial recharge to groundwater.

Watershed management.

Suggested Readings:

- *Energy and the Environment by Fowler, J.M 1984. McGraw-Hill*
- *Global Energy Perspectives by Nebojsa Nakicenovic 1998, Cambridge University Press.*
- *Energy Resources and Systems: Fundamentals and Non-Renewable Resources by Tushar K. Ghosh and M. A. Prelas. 2009, Springer*
- *Introduction to Wind Energy Systems: Hermann-Josef Wagner and Jyotirmay Mathur. 2009, Springer.*
- *Renewable Energy Conversion, Transmission and Storage. Bent Sorensen, 2007, Springer.*

GEO -H-GE-303-P	PRACTICALS - GE-03	(02 Credits, 30 Lectures)

Instruction to Question Setter for End Semester Practical Examination (ESE):*The questions in practical examination will be of equal to 60 marks and will be of 3 hours duration. Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.*

Practicals:

1. Plotting of major Indian oil fields on map of India.
2. Plotting of major Indian coalfields on the map of India / Jharkhand.
3. Plotting of natural hazards on the map of India.
4. Megascopic study of important ore forming minerals.

GEO-H-GE-404-T	STRATIGRAPHY & PALAENTOLOGY -GE-04	(04 Credits, 60 Lectures)

Instruction to Question Setter for End Semester Examination (ESE): *There will be two groups of questions. Five Questions to be answered out of Nine Questions. Group A is compulsory and will contain two questions. Question No.1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 Questions).Group B will contain descriptive type eight questions of twelve marks each, out of which any four are to answer. Each question carries 12 marks.*

STRATIGRAPHY & PALAENTOLOGY **Theory: 60 Lectures**

Unit 1: Principles of stratigraphy, Introduction to the concepts of lithostratigraphy, biostratigraphy, chronostratigraphy, Introduction to the physiographic and tectonic sub divisions of India

Unit 2: Pre-Cambrian Stratigraphy of India

Pre-Cambrian geology of Singhbhum and Karnataka; Introduction to Proterozoic basins of India; Geology of Vindhyan and Cudappah basins of India

Unit 3: Phanerozoic Stratigraphy of India

Geology, Structure and hydrocarbon potential of Gondwana basins.

Unit 4: Fossilization and fossil record

Nature and importance of fossil record; Fossilization processes and modes of preservation, Brief introduction of important fossils groups: morphology and geological history of Trilobita, Brachiopoda, Gastropoda

Unit 5.

Gondwana Flora, Biozones, index fossils, Evolution of horse and intercontinental migrations. Human evolution

Suggested Readings:

- *Krishnan, M. S. (1982) Geology of India and Burma, CBS Publishers,*
- *Delhi Doyle, P. & Bennett, M. R. (1996) Unlocking the Stratigraphic Record. John Wiley*
- *Ramakrishnan, M. & Vaidyanadhan, R. (2008) Geology of India Volumes 1 & 2, Geological Society of India, Bangalore.*
- *Raup, D. M., Stanley, S. M., Freeman, W. H. (1971) Principles of Paleontology*
- *Clarkson, E. N. K. (2012) Invertebrate paleontology and evolution 4th Edition by Blackwell Publishing.*
- *Benton, M. (2009). Vertebrate paleontology. John Wiley & Sons.*

GEO-H-GE-404-P	PRACTICALS – GE-04	(02 Credits, 30 Lectures)

Instruction to Question Setter for End Semester Practical Examination (ESE): *The questions in practical examination will be of equal to 20 marks and will be of 3 hours duration. Distribution of marks in practical paper of an end-semester examination will be of 60% in performance of experiment, 20% in record/note book and 20% in viva-voce.*

Practical:

1. Study of geological map of India and identification of major stratigraphic units;
2. Study of rocks in hand specimens from known Indian stratigraphic horizons.
3. Study of diagnostic morphological characters, systematic position, stratigraphic position and age of various invertebrate, vertebrate and plant fossils.

Format of question Papers of End-Semester Theory Examination

Binod Bihari Mahto Koyalanchal University, Dhanbad

End-Semester Examination xxxx(Session: xxxx-xx)

Subject/Code:

Full Marks: 80 Pass Marks: 32 Time:3Hours

General Instructions:

Candidates are required to give their answers in their own words as far as practicable.

The Questions are of equal value.

Answer any five questions of the following in which Q.1 is compulsory.

Group A

1. (A) Multiple Choice Questions (1x8=08)

(i) ……
(ii) ……
(iii) ……
(iv) ……
(v) ……
(vi) ……
(vii) ……
(viii) ……

(B) Short answer type questions (4x2=08)

(a) ……
(b) ……

Group B

(Long answer type questions)

Answer any four of the following. (16x4=64)

2. ……
3. ……
4. ……
5. ……
6. ……
7. ……
8. ……
9. Short notes type questions (8x2=16)

(a) ……
(b) ……
(c) ……
(d) ……

……x……

Binod Bihari Mahto Koyalanchal University, Dhanbad

End-Semester Examination xxxx(Session: xxxx-xx)

Subject/Code:

Full Marks: 60 Pass Marks: 24 Time: 3Hours

General Instructions:

Candidates are required to give their answers in their own words as far as practicable.

The Questions are of equal value.

Answer any five questions of the following in which Q.1 is compulsory.

Group A

1. (A) Multiple Choice Questions (1x6=06)

(i) ……..
(ii) ……..
(iii) ……..
(iv) ……..
(v) ……..
(vi) ……..

(B) Short answer type questions (3x2=06)

(a) ……..
(b) ……..

Group B

(Long answer type questions)

Answer any four of the following. (12x4=48)

2. ……..
3. ……..
4. ……..
5. ……..
6. ……..
7. ……..
8. ……..
9. Short notes type questions (6x2=12)

(a) ……..
(b) ……..
(c) ……..
(d) ……..

……x……

Binod Bihari Mahto Koyalanchal University, Dhanbad

End-Semester Examination xxxx(Session: xxxx-xx)

Subject/Code:

Full Marks: 40 Pass Marks: 16 Time: 2Hours

General Instructions:

Candidates are required to give their answers in their own words as far as practicable.

The Questions are of equal value.

Answer any five questions of the following in which Q.1 is compulsory.

Group A

1. (A) Multiple Choice Questions (1x4=04)

(i) ……..

(ii) ……..

(iii) ……..

(iv) ……..

(B) Short answer type questions (2x2=04)

(a) ……..

(b) ……..

Group B

(Long answer type questions)

Answer any four of the following. (8x4=32)

2. ……..

3. ……..

4. ……..

5. ……..

6. ……..

7. ……..

8. ……..

9. Short notes type questions (4x2=8)

(a) ……..

(b) ……..

(c) ……..

(d) ……..

.

Annexure-1

Skill Development Courses (Common for All Programmes)

For Honours Degree:

(I) Third Semester: Compulsory for All Disciplines

Any one of the following three in a particular college depending upon the facility available:

1. Constitution of India and Human Rights
2. Environment and Public Health
3. Computer Applications and Information Technology

(II) Fourth semester: One from the following may be chosen may be common for a faculty. The courses may include the following:

1. Entrepreneurship
2. Life Skills and Personality Development
3. Human Resource Development
4. Legal Aid and Awareness
5. Indian History, Culture and Diversity
6. Science and Life
7. Banking and Finance
8. Building Mathematical Ability
9. Capital and Stock Market
10. Any other subject to be decided by the Academic Council.

For General Degree:

(I) Compulsory for All Disciplines

1. Constitution of India and Human Rights
2. Environment and Public Health
3. Computer Applications and Information Technology **in Semester 3, Semester 4, and Semester 5 respectively.**

(II) Sixth semester: One from the following may be chosen, may be common for a faculty or all faculties. The courses may include the following:

1. Entrepreneurship
2. Life Skills and Personality Development
3. Human Resource Development
4. Legal Aid and Awareness
5. Indian History, Culture and Diversity
6. Science and Life
7. Banking and Finance
8. Building Mathematical Ability
9. Capital and Stock Market