CBCS STRUCTURE (Modified) of North Bengal University

Department of Geology

Department : Geology		Programme Name: M.Sc in Applied Geology		
Semester 1				
Course Type	Choice	Course Title	Course credit	Total Credit
Core	None	1. Mineralogy 2. Structural Geology 3. Sedimentology	4 4 4	16
DSE	Choose 1	1. Quaternary Geology 2. Environmental Geology	2	
AEC	Choose from Basket 1		2	
Semester 2				
Core	None	4.Igneous Petrology 5. Metamorphic Petrology 6. Hydrogeology	4 4 4	16
DSE	Choose 1	3. Geomorphology 4. Geotectonics	2	
SEC	Choose 1 from Basket 2		2	
Semester 3				
Core	None	7. Palaeontology	4	16
DSE	Choose 3	5. Sedimentary Basin 6. Engineering Geology 7. General Fieldwork 8. Fuel Geology 9. Industrial Training & Presentation 10. Climatology	2x3=6	
AEC	Choose 1 from Basket 3		2	
GE	Choose 1	1. Geochemistry 2. Isotope Geology	4	
Semester 4				
Core	None	8.Ore Geology 9.Dissertation Report	4 4	16
DSE	Choose 1	11.Stratigraphy 12. Ocean Science	2	
SEC	Choose 1 from Basket 4		2	
GE	Choose 1	3. Geophysics 4. Remote Sensing	4	

Department Name: GEOLOGY

Program Name: M.SC IN APPLIED GEOLOGY

Program Code: 311

Semester: Semester I √ Semester II □ Semester III □ Semester IV □

Course Name: MINERALOGY

Course Code: (keep it blank; else enter the old course code)

Course Credit: 4

Marks Allotted: Theoretical/Practical: 50+25 Continuing Evaluation: 25

Course Type (tick the correct alternatives):

Core √

Department Specific Elective □

Generic Elective □

Is the course focused on employability / entrepreneurship? YES √ NO □

Is the course focused on imparting life skill? YES √ NO □

Is the course based on Activity ? YES □ NO √

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%) □

Moderate (>15% and up to 50%) √

Major (>50%) □

Summary of changes

The previous course has been divided into two separate courses to expand the knowledge base in the individual subjects. The course content remains unchanged.

PG BOS Meeting Reference Number: Geol/PGBSO/11/22 Date: 02-06-2022

Course Code:

Course Name: MINERALOGY

Brief Course Description: The course deals with topics in mineral science. It describes the structures, physical and chemical properties of minerals and their reaction relation from magma melt. Introduction to rock forming minerals.

Prerequisite(s) and/or Note(s):

(1) Expanding knowledge in mineral science.
(2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:

1. Basic knowledge on crystal structures and bonding and laws
2. Silicate structures and their physical and chemical properties
3. Bragg's law, application of X-ray technique in identification of minerals through crystal structures

Skills gained:

(1) Analysis of mineral structures,

(2) Solving reaction relation in rocks and minerals, and,

(3) Identification of basic rock forming minerals

Competency Developed:

(1) Applying the concept to differentiate silicate structures
(2) Grouping of minerals in their silicate groups
(3) Knowledge can be applied in exploration geology.

Course Syllabus:

Mineralogy 50 Marks (2 credit)

Bonding in crystal structures; Closed pack structures, CCP and HCP, body-centered cubic structure, Interstitial sites in close-packed structures; Structure types based on close packing; Structures built from polyhedral.

Crystal structure of silicates; The [SiO4] tetrahedron, generalized idea on silicate structure and composition; Effect of changing pressure, temperature and composition in silicate structures; Composition and generalized formula of different mineral groups.

X-Ray Crystallography: Bragg's Law, single crystal and powder methods - Principle and application in determination of crystal structure. Defects in minerals.

Continuous evaluation 25 Marks (1 credit)

Mineralogy (Practical) 25 Marks 1 credit

Study ofthesymmetryofcrystals.
Study of physicalproperties of mineralsinhand specimen
Study of optical properties of common rock-formingminerals

Suggested Reference Books

- 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.
- Deer, W. A., Howie, R. A., &Zussman, J. (1992). An introduction to the rock-forming minerals (Vol. 696). London: Longman.
- Nesse, W. D. (2011). Introduction to Optical Mineralogy (Fourth Edition). Oxford University Press.
- Putnis, A. (1992): Introduction to Mineral Sciences. Cambridge University Press.
- Whalstrom, E.E. (1969): Optical Crystallography. John Wiley & Sons

Department Name: GEOLOGY

Program Name: M.SC IN APPLIED GEOLOGY

Program Code: 311

Semester: Semester I √ Semester II □ Semester III □ Semester IV □

Course Name: STRUCTURAL GEOLOGY

Course Code: GEOL-CT-102& GEOL-CP-106 (keep it blank; else enter the old course code)

Course Credit: 4

Marks Allotted: Theoretical/Practical: 50+25 Continuing Evaluation: 25

Course Type (tick the correct alternatives):

Core √

Department Specific Elective □

Generic Elective □

Is the course focused on employability / entrepreneurship? YES √ NO □

Is the course focused on imparting life skill? YES √ NO □

Is the course based on Activity ? YES □ NO √

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%) □

Moderate (>15% and up to 50%) □

Major (> 50%) □

Summary of changes

No changes

PG BOS Meeting Reference Number: Geol/PGBOS/11/22 Date: 02-06-2022

Course Code: GEOL-CT-102& GEOL-CP-106

Course Name: Structural Geology

Brief Course Description: GEOL-CT-102&GEOL-CP-106 deals with geological structures of rocks and minerals in mesoscopic and microscopic level. The course deals with fold, faults and others geological structures with their genetic significance.

Prerequisite(s) and/or Note(s):

(1) Advance knowledge in structural geology.
(2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:

(1) Rheological behavior of rocks
(2) Deformation mechanism, calculation of stress
(3) Measurement of strains, elastic and plastic deformation
(4) Classification, origin, mechanisms of folds, faults shear zones

Skills gained:

(1) Analysis of strain and stress,

(2) Structural analysis of an area, and,

(3) Analysis of tectonism

Competency Developed:

(1) Applying the knowledge for geological mapping
(2) Mine planning
(3) Knowledge can be applied in exploration geology.

Course Syllabus:

Structural Geology (Theory) 50 Marks (2 credit)

Rheology: Behaviors of rocks under stress; Rheological models; Flow law for steady state creep; factors influencing flow of rocks; Deformation mechanism; Estimation of paleostress.

Stress: Basic concept of stress; Analysis of stress in three dimensions; stress filed description; equilibrium condition; trajectory patterns and boundary condition.

Strain: Infinitesimal strain; measurement of strain; progressive deformation; Role of fluid in deformation; Stress –Strain curves for elastic, viscous and plastic; Concept ofRockdeformation:Brittle andductile deformation.

Folds; Geometricandgeneticclassificationoffolds, Fold interference in single and multilayer; Mechanism of folding and superposed folding; Structural analysis for deformed terrain.

Faults and Fractures; Origin, Mechanics, dynamics and significance.

Foliation; Lineation; Boudinage; Origin and significance.

Shear Zones, Grain scale deformation mechanism and its manifestation in microstructure: Solid State Diffusion Creep. Granular flow and Superplasticity.

Continuous evaluation 25 Marks (1 credit)

Structural Geology(Practical) 25 Marks 1 credit

Interpretationoftopographic andGeological maps, Stereographicprojections; Interpretation of outcrop patterns of deformed lithounits involving folding and faulting on flat and undulating topography; Strain analysis.

Suggested Reference Books

- 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
- Ghosh, S.K. (1993) Fundamentals and Modern Developments of Structural Geology. Pergamon Press
- Ramsay, J. G. (1967). Folding and Fracturing of Rocks. Mc-Graw Hill, New York
- Twiss, J.R. and Moores, M.E. (2006). Structural Geology. W.H. Freeman and Company, New York

Department Name: GEOLOGY

Program Name: M.SC IN APPLIED GEOLOGY

Program Code: 311

Semester: Semester I √ Semester II ☐ Semester III ☐ Semester IV ☐

Course Name: SEDIMENTOLOGY

Course Code: GEOL-CT-103 & GEOL-CP-107 (keep it blank; else enter the old course code)

Course Credit: 4

Marks Allotted: Theoretical/Practical: 50+25 Continuing Evaluation: 25

Course Type (tick the correct alternatives):

Core √

Department Specific Elective ☐

Generic Elective ☐

Is the course focused on employability / entrepreneurship? YES √ NO ☐

Is the course focused on imparting life skill? YES √ NO ☐

Is the course based on Activity ? YES ☐ NO √

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%) ☐

Moderate (>15% and up to 50%) ☐

Major (> 50%) ☐

Summary of changes

No changes

PG BOS Meeting Reference Number: Geol/PGBOS/11/22 Date: 02-06-2022

Course Code: GEOL-CT-103 & GEOL-CP-107

Course Name: Structural Geology

Brief Course Description: GEOL-CT-103&GEOL-CP-107 deal with sedimentology. The course deals with physical, chemical and biological environment of sediment deposition.

Prerequisite(s) and/or Note(s):

(1) Advance knowledge in sedimentology.
(2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:

(1) Sedimentary process-product relationship
(2) Sedimentary facies – palaeoenvironmental and palaeogeographic reconstruction
(3) Tectonics and sedimentation
(4) Application of geochemistry for sedimentological, palaeobiologiocal and palaeoclimatic problems

Skills gained:

(1) Analysis of sediments,

(2) granulometric analysis, and,

(3) chemical analysis of sediments

Competency Developed:

(1) Application in petroleum and mining sectors
(2) Palaeoenvironment and palaeoclimate analysis
(3) Facies modeling and sequence stratigraphic application.

Course Syllabus:

Sedimentology (Theory) 50 Marks (2 credit)

Process-Product relationship: Sedimentation processes and products in major clastic and chemogenic depositional systems.

Sedimentary facies - philosophy and procedure, facies successions and facies models; Palaeogeographic and palaeoenvironmetal reconstruction.

Tectonics and sedimentation: Role of extrabasinal and intrabasinal factors in sedimentation pattern.

Application of trace elements, rare earth elements and stable isotope geochemistry to sedimentological problems, Provenance determination, Palaeoclimate reconstruction

Sequence stratigraphy: Concept, methods and application

Continuous evaluation 25 Marks (1 credit)

Sedimentology (Practical) 25 Marks 1 credit

Description and interpretation of sedimentary structures in hand specimen; Analysis of granulometry; Microscopic study of sandstones and limestone;Palaeocurrent analysis.

Suggested Reference Books

- 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
- Walker, R.G. 1984. Facies models. Geol. Assoc. Can., Newfoundland, Canada, 317pp
- Catuneanu, O., 2006. Principles of sequence stratigraphy. Elsevier Publ., Amsterdam, 336pp.

Department Name: Geology

Program Name: Applied Geology

Program Code: 311

Semester: Semester I ✓ Semester II □ Semester III Semester IV □

Course Name: Quaternary Geology

Course Code: GEOL-EP-404E (or new course keep it blank; else enter the old course code)

Course Credit: 2

Marks Allotted: Theoretical/Practic 50 Continuing Eva

Course Type (tick the correct alternatives):

Core □

Department Specific Elective √

Generic Elective □

Is the course focused on employability / entrepreneurship? YES □ NO √

Is the course focused on imparting life skill? YES √ NO □

Is the course based on Activity ? YES □ NO √

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%) √

Moderate (>15% and up to 50%) □

Major (> 50%) □

Summary of changes

The course remains same as earlier.

PG BOS Meeting Reference Number Geol/PGBOS/11/22 02-06-2022

Course Code: GEOL-EP-404E

Course Name: Quaternary Geology

Brief Course Description:

This course has evolved from a traditional Quaternary Geology course to become an Earth systems science course focusing on processes and history of the Quaternary.

Prerequisite(s) and/or Note(s):

1) Basic understanding of sedimentary environments.
2) Understanding about various proxy records.

Course Objectives:

Knowledge acquired:

- Definition and scope of Quaternary Geology
- Evolution of landscape and interactions between tectonic, climatic, and geomorphic processes
- Radiogenic Carbon and Optical stimulated luminescence (OSL) radiogenic dating method
- Dendrochronology; Tephrochronology, Climatostratigraphy, Magnetostratigraphy
- Global climate pattern, Climate controlling factors and Milankovitch Hypothesis, Quaternary Environments, Quaternary Sea-level changes
- Fossil records of the Quaternary; Pollen analysis, Mammalian fauna Paleoclimatic reconstruction; Effect of Anthropogenic activity on Global climate

Skills gained:

This course aims to improve skills in student research and analysis, expressed in written and oral form.

Competency Developed:

1. Students should be able to evaluate and interpret data and concepts related to paleoclimatology, Earth surface processes, and the history of global change in the Quaternary Period.

2. Students should be able to collect, analyze and synthesize field and laboratory data related to Earth surface materials and landforms.

Course Syllabus:

Introduction: Definition and scope of Quaternary Geology.
Quaternary Geomorphology: Evolution of landscape and interactions between tectonic, climatic, and geomorphic processes.
Quaternary Geochronology: Radiogenic Carbon and Optical stimulated luminescence (OSL) dating method.
Quaternary Stratigraphy: Glacial verves; Dendrochronology; Tephrochronology, Climatostratigraphy, Magnetostratigraphy.

Global climate pattern, Climate controlling factors and Milankovitch Hypothesis, Quaternary Environments, Quaternary Sea-level changes.
Fossil records of the Quaternary; Pollen analysis, Mammalian fauna, Deep sea Biostratigraphy
Continental and marine Quaternary record of India; Neotectonic, stratigraphic, sedimentologic and geomorphic evolution of Quaternary terrain of India.
Paleoclimatic reconstruction; Pleistocene Glacial-Interglacial cycles, Anthropocene; Effect of Anthropogenic activity on Global climate

Suggested Readings:

Lowe JJ, Walker M. 2014. Reconstructing quaternary environments. Routledge

Mathur U. 2005. Quaternary geology: Indian perspective: with notes on the Quaternary of Gujarat. Geological Society of India

Miller A-AL. 1999. The Quaternary sediments and seismostratigraphy of the Grand Banks of Newfoundland and the Northeast Newfoundland Shelf: Foraminiferal refinements and constraints. The George Washington University

Murray-Wallace CV, Woodroffe CD. 2014. Quaternary sea-level changes: a global perspective. Cambridge University Press.

Department Name: GEOLOGY

Program Name: M.SC IN APPLIED GEOLOGY

Program Code: 311

Semester: Semester I √ Semester II □ Semester III □ Semester IV □

Course Name: ENVIRONMENTAL GEOLOGY

Course Code: (keep it blank; else enter the old course code)

Course Credit: 2

Marks Allotted: Theoretical/Practical: 50 Continuing Evaluation:

Course Type (tick the correct alternatives):

Core □

Department Specific Elective √

Generic Elective □

Is the course focused on employability / entrepreneurship? YES √ NO □

Is the course focused on imparting life skill? YES √ NO □

Is the course based on Activity ? YES □ NO √

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%) □

Moderate (>15% and up to 50%) √

Major (>50%) □

Summary of changes

The course splits into two separate courses for better understanding and expanding the scope in the subjects. The content of the courses almost remains unchanged.

PG BOS Meeting Reference Number: Geol/PGBOS/11/22 Date: 02-06-2022

Course Code:

Course Name: Environmental Geology

Brief Course Description: The coursedeals with Environmental Geology. The course deals with impact of geological processes on environment.

Prerequisite(s) and/or Note(s):

(1) Environment and geology.
(2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:

(1) Fundamental concept of environmental geology, problems and issues
(2) Pollution: air water and land
(3) Solid and nuclear waste
(4) Global climate change and deforestation
(5) Disaster management, concept of environmental impact assessment (EIA)

Skills gained:

(1) Analysis of air and water pollution,

(2) analysis of global warming and climate change, and,

(3) Waste management

Competency Developed:

(1) Application in controlling global warming and climate change
(2) Application in solid and nuclear waste management
(3) Application in disaster management.

Course Syllabus:

Environmental Geology (Theory) 50 Marks (2 credit)

Fundamental concepts; Problems and issues: local, regional and global.

Pollution: air, water and land. Nature and effects of air and water pollution, disposal of solid wastes and nuclear wastes.

Global climate change, deforestation, soil degradation.

Hazardous geological processes: Types, prediction and warning, disaster management.

Mineral resources: Mineral consumption on reserves, conservation of mineral resources, impact of mining activity on the environment, environmental management in mining.

Geological and environmental considerations for construction of dams, roads and tunnels; Concepts of Environmental Impact Assessment (EIA).

Suggested Reference Reading:

- T.E. Gredel and P.J. Crutzen (1995): Atmosphere, Climate, and Change (New York: Freeman, 1995).
- E.A. Keller (2010): Environmental Geology (9thEdition). Pearson

Department Name: Geology

Program Name:M.Sc in Applied Geology

Program Code:311

Semester: Semester I ☐ Semester II ✓ Semester III ☐ Semester IV ☐

Course Name: Igneous Petrology

Course Code: GEOL-CT-201 and GEOL-CP-205 (For new course keep it blank; else enter the old course code)

Course Credit: 4

Marks Allotted: Theoretical/Practical: 50/25 Continuing Evaluation: 25

Course Type (tick the correct alternatives):

Core ✓

Department Specific Elective ☐

Generic Elective ☐

Is the course focused on employability / entrepreneurship? YES ✓ NO ☐

Is the course focused on imparting life skill? YES ✓ NO ☐

Is the course based on Activity ? YES ☐ NO √

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%) ☐

Moderate (>15% and up to 50%) ☐

Major (>50%) ☐

Summary of changes

No changes.

Course Code: GEOL-CT-201 and GEOL-CP-205

Course Name: Igneous Petrology

Brief Course Description:

GEOL-CT-201and GEOL-CP-205 deal with Magma generation and emplacement, physical properties, Classification, texture and structures in igneous rocks, Thermodynamic and phase rule: phase diagram and application in understanding melt-crystal equillibria

Prerequisite(s) and/or Note(s):

(1) Good knowledge of Physics and chemistry
(2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course

Course Objectives:

Knowledge acquired:

(1) Physical and chemical properties of magma

(2) Phase diagrams of common magmatic rocks

(3) Mechanisms of partial melting

Skills gained:

(1) To analyse Variation diagrams

(2) To understand textural charecteristics of common Igneous rocks

(3) Interpreting geochemical charecteristics

Competency Developed:

(1) Ability to do thin section study
(2) Ability to interpret Magmatic differentiation and assimilation

Course Syllabus:

Igneous Petrology Theory Credit-2

- Magma generation, Mode of emplacement; Physical properties and forms of igneous rocks.
- Mode of Occurrence, Classification, texture and microtexture of igneous rocks.

- Thermodynamics and Phase Diagram: Introduction to thermodynamics, Phase rule, and its application to binary and ternary systems, Phase Diagrams in understanding crystal melt equilibria.
- Physical, chemical and mineralogical composition of upper mantle; Partial melting; Segregation and ascent of magma.
- Petrogenesis: Important felsic, mafic and ultramafic rocks.
- Magmatism in relation to tectonic settings.

Continuous evaluation **credit 1**

Igneous Petrology Practical **Credit-1**

- Study of important igneous rocks and rock associations in hand specimen and in thin section with special reference to texture and structure; Norms calculation and determination of structural formula of minerals from given chemical data.

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.
- Best, M.G. (2001): Igneous and Metamorphic Petrology.
- Cox, K.G., Bell, J.D. (1979): The Interpretation of Igneous Rocks. Springer/Chapman & Hall.
- Bose, M.K. (1997): Igneous Petrology.
- Frost, B.R. & Frost, C.D. (2014): Essentials of igneous and metamorphic petrology. Cambridge University Press.
- G W Tyrrell. (1926). Principles of Petrology. Springer

Department Name: Geology

Program Name:M.Sc in Applied Geology

Program Code:311

Semester: Semester I □ Semester II ✓ Semester III □ Semester IV □

Course Name: Igneous Petrology

Course Code: GEOL-CT-202 and GEOL-CP-206 (For new course keep it blank; else enter the old course code)

Course Credit: 4

Marks Allotted: Theoretical/Practical: 50/25 Continuing Evaluation: 25

Course Type (tick the correct alternatives):

Core ✓

Department Specific Elective □

Generic Elective □

Is the course focused on employability / entrepreneurship? YES ✓ NO □

Is the course focused on imparting life skill? YES ✓ NO □

Is the course based on Activity ? YES □ NO √

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%) □

Moderate (>15% and up to 50%) □

Major (>50%) □

Summary of changes

No changes.

Course Code: GEOL-CT-202 and GEOL-CP-206

Course Name: Metamorphic Petrology

Brief Course Description:

GEOL-CT-202 and GEOL-CP-206 deal with Metamorphic grades, metamorphic facies – concept of P-T path, Metamorphic phase rule in closed and open systems, Composition and paragenesis diagram, Tectonism and metamorphism, Mineralogical geothermobarometry, phase rule
Metamorphism in crustal systems

Prerequisite(s) and/or Note(s):

(1) Good knowledge of Physics, Chemistry and Maths
(2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course

Course Objectives:

Knowledge acquired:

(1) Concept of Metamorphic grade and facies

(2) Different Metamorphic textures

(3) Thermodynamics of metamorphic reactions

Skills gained:

(1) To analyse P-T-t paths

(2) To understand Metamorphic mineral paragenesis

(3) To understand relationship of tectonics and metamorphism

Competency Developed:

(1) Ability to do thin section study of metamorphic rocks and interpret their significance
(2) Ability to understand Geothermobarometry reactions
(3) Ability to interpret Geochemical diagrams and their significance

Course Syllabus:

Metamorphic Petrology (Theoretical) Credit-2

- Index minerals, metamorphic zones; Metamorphic facies and grades, concept of metamorphic P-T-t paths.
- Mineralogical phase rule of closed and open system; Composition- paragenesis diagrams. ACF, AKF and AFM diagrams; Metamorphic products of pelitic, carbonate and mafic igneous rocks.
- Metamorphism in different tectonic settings.
- Mineralogical Geothermobarometry and its limitations; Ultrahigh temperature and pressure metamorphism - phase equilibria constraints, characterization, implications, Role of Fluids in metamorphism.
- P - T - t paths of metamorphism, their derivation and their significance, Metamorphism and crustal evolution

Continuous Emulation **credit 1**

Metamorphic Petrology Practical **Credit-1**

- Study of important metamorphic rocks in hand specimen and in thin section; Geometrical analysis of phase equilibria.

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. D. (1989). An introduction to metamorphic petrology. Longman Scientific and Technical, London.
- Spear F. S. 1993. Metamorphic phase equilibria and Pressure-Temperature-Time paths. Mineralogical Society of America. Monograph 799

Department Name: Geology

Program Name:M.Sc in Applied Geology

Program Code:311

Semester: Semester I □ Semester II ✓ Semester III □ Semester IV □

Course Name: Hydrogeology

Course Code: (For new course keep it blank; else enter the old course code)

Course Credit: 4

Marks Allotted: Theoretical/Practical: 50/25 Continuing Evaluation: 25

Course Type (tick the correct alternatives):

Core	✓
Department Specific Elective	□
Generic Elective	□

Is the course focused on employability / entrepreneurship? YES ✓ NO □

Is the course focused on imparting life skill? YES ✓ NO □

Is the course based on Activity ? YES □ NO √

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%)	□
Moderate (>15% and up to 50%)	√
Major (>50%)	□

Summary of changes

The course splits into two separate courses for better understanding and expanding the scope in the subjects. The content of the courses almost remains unchanged.

Course Code:

Course Name: Hydrogeology

Brief Course Description:

- The course deals with Groundwater fluctuation: types, controlling factors, Groundwater wells, types and methods, Groundwater chemistry: Components of groundwater; Salinity in GroundwaterSeawater intrusion and Ghyben-Herzberg RelationClassification and Indian salinity hazards,Artificial recharge of groundwater,Groundwater Exploration: Surface geophysical methodsGroundwater Management and DevelopmentGroundwater pollution: Arsenic, fluoride and Nitrate

  Prerequisite(s) and/or Note(s):

  (1) Good knowledge of Physics, Chemistry and Maths
  (2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course

Course Objectives:

Knowledge acquired:

(1) Concept of Hydrogeological cycle

(2) Concept of groundwater monitoring

(3) Groundwater recharge and pollution

Skills gained:

(1) To calculate drawdown and recharge

(2) Understanding groundwater management

(3) Indian distribution of groundwater

Competency Developed:

(1) Ability to do groundwater numericals
(2) Ability to monitor and mitigate groundwater pollution

Course Syllabus:

Hydrogeology (Theoretical) 50 marks Credit-2

- Introduction and basic concept; Hydrological cycle, Aquifer; Groundwater flow: Governing laws; flow rates and flow directions; Groundwater fluctuation: types, controlling factors; Environmental influences in groundwater.
- Groundwater Wells: Types and methods of construction; Well Performance test.
- Groundwater Quality: Components of groundwater; Salinity in Groundwater: Salinity influxes in groundwater, Seawater intrusion and Ghyben-Herzberg Relation; Prevention and control of saline water intrusion; Classification and Indian salinity hazards.
- Artificial recharge of groundwater: Concept, Methods and applications.
- Groundwater Level Monitoring: Types, well networks, Timing and frequency of water level measurements, data collection, water level mapping and significance.

- Groundwater Exploration: Surface geophysical methods — Electrical, Seismic, Magnetic, Gravity, Radiometric. Geophysical well logging.
- Groundwater pollution: Arsenic, Fluoride and Nitrate.
- Groundwater Management and Development: Methods and stages of Groundwater Investigations; Data Collection, Water level measurements, Recharge and discharge areas; Groundwater legislation.
- Indian distribution of Groundwater.

Continuous evaluation 25 marks 1 credit

Hydrogeology Practical 25 marks 1 credit

- Hydrogeological maps: Depth to water table maps, groundwater contour maps, water table fluctuation maps.

Further reading

- Todd, D. K. 2006. Groundwater hydrology, 2nd Ed., John Wiley & Sons, N.Y.
- Davis, S. N. and De Weist, R.J.M. 1966. Hydrogeology, John Wiley & Sons Inc., N.Y.
- 3. Karanth K.R., 1987, Groundwater: Assessment, Development and management, Tata McGrawHill Pub. Co. Ltd.

Department Name: GEOLOGY

Program Name: M.SC IN APPLIED GEOLOGY

Program Code: 311

Semester: Semester I Semester II ✓ Semester III □ Semester IV □

Course Name: GEOMORPHOLOGY

Course Code: (keep it blank; else enter the old course code)

Course Credit: 2

Marks Allotted: Theoretical/Practical: 50 Continuing Evaluation:

Course Type (tick the correct alternatives):

Core □

Department Specific Elective √

Generic Elective □

Is the course focused on employability / entrepreneurship? YES √ NO □

Is the course focused on imparting life skill? YES √ NO □

Is the course based on Activity ? YES □ NO √

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%) □

Moderate (>15% and up to 50%) √

Major (>50%) □

Summary of changes

The course splits into two separate courses for better understanding and expanding the scope in the subjects. The content of the courses almost remains unchanged.

PG BOS Meeting Reference Number:

Course Code:

Course Name: Geomorphology

Brief Course Description: The coursedeals with geomorphology. The course deals with dynamic nature of earth's crust and resulting geomorphological changes through time and space.

Prerequisite(s) and/or Note(s):

(1) Earth's surface processes.
(2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:

(1) Landform: exogenic and endogenic processes
(2) Landform and tectonics
(3) Drainage pattern, sea level change and geomorphic cycle

Skills gained:

(1) analysis of earth's surface processes,

(2) correlating geomorphology with tectonics, and,

(3) landform analysis

Competency Developed:

(1) Application in river science
(2) Application in engineering planning
(3) Application in soil and agriculture.

Course Syllabus:

Geomorphology (Theory) 50 Marks (2 credit)

Landform and Earth materials; Endogenic and Exogenic processes; Major geomorphological features.

Surficial Processes and Geomorphology: Important landscapes generated by different processes Endogenic- Exogenic interference: Landform and tectonics; uplift and denudation; Hillslope.

Drainage pattern and Tectonics; Sea-level change; Geomorphic cycles

Suggested Reference Books

- Robert S. Anderson and Suzzane P. Anderson (2010): Geomorphology -The Mechanics andChemistry of Landscapes. Cambridge University Press.
- M.A. Summerfield (1991). Global Geomorphology. Wiley & Sons.
- Thornbury, W. D. (1954). Principles of Geomorphology. New York: John Wiley.

Department Name: Geology

Program Name:M.Sc in Applied Geology

Program Code:311

Semester: Semester I □ Semester II ✓ Semester III □ Semester IV □

Course Name:Geotectonics

Course Code: (For new course keep it blank; else enter the old course code)

Course Credit: 2

Marks Allotted: Theoretical/Practical: 50 Continuing Evaluation:

Course Type (tick the correct alternatives):

Core	□
Department Specific Elective	✓
Generic Elective	□

Is the course focused on employability / entrepreneurship? YES ✓ NO □

Is the course focused on imparting life skill? YES ✓ NO □

Is the course based on Activity ? YES □ NO √

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%)	□
Moderate (>15% and up to 50%)	√
Major (>50%)	□

Summary of changes

The course splits into two separate courses for better understanding and expanding the scope in the subjects. The content of the courses almost remains unchanged.

PG BOS Meeting Reference Number:

Course Code:

Course Name: Geotectonics

Brief Course Description:

- Deals withGeomagnetic fields, paleomagnetism, polar wander, geomagnetic pole reversal, sea floor spreading, Plate boundaries, plate motion and dynamics, Relative plate motion – geodetic measurement

Prerequisite(s) and/or Note(s):

(1) Good knowledge of Physics, Chemistry and Maths
(2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course

Course Objectives:

Knowledge acquired:

(1) Concept of magnetic fields

(2) Concept of polar wandering

(3) Concept of seafloor spreading

Skills gained:

(1) To understand magnetic polarity reversal

(2) Understanding tectonics

(3) Understanding plate motion

Competency Developed:

(1) Ability to understand geodetic changes
(2) Ability to measure plate motion

Course Syllabus:

Geotectonics (Theoretical) Credit-2

- Geomagnetic field, paleomagnetism, Polar wander and continental drift, geomagnetic field reversals, seafloor spreading,
- Plate motions and plate boundaries, geodynamic elements, earthquake focal mechanism, relative plate motions via seafloor spreading and earthquake focal mechanisms, satellite geodetic measurements of relative plate motions

Suggested Readings:

- Condie, K.C. Plate Tectonics and Crustal Evolution, Pargamon Press, 1989.
- Dobrin, M.B. (1984) An introduction to Geophysical Prospecting. McGraw-Hill, New Delhi.
- Lowrie, W. (2007). Fundamentals of geophysics. Cambridge University Press

Department Name: Geology

Program Name: M.Sc in Applied Geology

Program Code:311

Semester: Semester I □ Semester II ✓ Semester III □ Semester IV □

Course Name: General Fieldwork

Course Code: GEOL-CP-207 (For new course keep it blank; else enter the old course code)

Course Credit: 2

Marks Allotted: Theoretical/Practical: 50 Continuing Evaluation:

Course Type (tick the correct alternatives):

Core	□
Department Specific Elective	□
Generic Elective	□
SEC	✓

Is the course focused on employability / entrepreneurship? YES ✓ NO □

Is the course focused on imparting life skill? YES ✓ NO □

Is the course based on Activity ? YES ✓ NO □

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%)	□
Moderate (>15% and up to 50%)	□
Major (> 50%)	□

Summary of changes

PG BOS Meeting Reference Number:

Department Name: Geology

Program Name: Applied Geology

Program Code: 311

Semester: Semester I □ Semester II □ Semester III √ Semester IV □

Course Name: Palaeontology

Course Code: GEOL-CT-104 and GEOL-CP-108 blank; else enter the old course code)

Course Credit: 4

Marks Allotted: Theoretical/Practic 50/25 Continuing Eva 25

Course Type (tick the correct alternatives):

Core √

Department Specific Elective □

Generic Elective □

Is the course focused on employability / entrepreneurship? YES □ NO √

Is the course focused on imparting life skill? YES √ NO □

Is the course based on Activity ? YES □ NO √

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%) √

Moderate (>15% and up to 50%) □

Major (> 50%) □

Summary of changes

The course remains same as earlier.

Course Code: GEOL-CT-104 and GEOL-CP-108

Course Name: Palaeontology

Brief Course Description:

Ancient life on earth will be explored via the principles and concepts of invertebrate paleontology, paleoecology, paleobiology and evolution.

Prerequisite(s) and/or Note(s):

1) Basic understanding of biology and ecology.
2) Some information about fossil.

Course Objectives:

Knowledge acquired:

- Origin of life, Precambrian life, evolution of life
- Numerical taxonomy, Cladistic taxonomy
- Mass extinction, rate and evolution
- Microfossils and its application in petroleum basins
- Palynology: spores and pollen

Skills gained:

Students achieve skills goals through four in-depth projects, three field-based and one literature-based.

Competency Developed:

The basic morphology and systematics of the main fossil invertebrate groups.

Course Syllabus Theory **credit 2**

Origin of life, Precambrian life, Adaptation and Functional Morphology; Organic Evolution – theories, modes, patterns and trends.
Evolutionary Systematics: Numerical Taxonomy, Cladistic Taxonomy.
Organic Evolution: theories, modes, patterns and trends, Ontogeny: patterns and its role in organic evolution.
Mass extinctions: Causes; rate of extinction and evolution.
Biostratigraphy: Application of fossils in age determination and correlation.
Microfossils: Types, environmental significance; Application to exploration geology and palaeoclimatic studies.
Palynology: Introduction, palynomorphs, morphology of spores and pollens, Wall Stratification of Spore and Pollen.
Siwalik Fauna: their origin and occurrences; Trace Fossil: Classification and its application
Origin and major steps in vertebrate evolution.

Continuous Evaluation credit 1

Practical credit 1

Study offossils withvariousmodesofpreservation; Study of hard part and functional morphology of different invertebrate groups; Identificationoffeedinghabitsfromvertebrateteeth; Study of ontogenetic growth patterns through biometric analysis; Numerical techniques to study populations; Study of microfossils.

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.

Department Name: Geology

Program Name: Applied Geology

Program Code: 311

Semester: Semester I ☐ Semester II ☐ Semester III √ Semester IV ☐

Course Name: Sedimentary Basin Analysis

Course Code: GEOL-ET-305 new course keep it blank; else enter the old course code)

Course Credit: 2

Marks Allotted: Theoretical/Practical: 50 Continuing Evaluation:

Course Type (tick the correct alternatives):

Core ☐

Department Specific Elective √

Generic Elective ☐

Is the course focused on employability / entrepreneurship? YES √ NO ☐

Is the course focused on imparting life skill? YES ☐ NO √

Is the course based on Activity ? YES ☐ NO √

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%) √

Moderate (>15% and up to 50%) ☐

Major (> 50%) ☐

Summary of changes

This course remains same.

Course Name: Sedimentary Basin Analysis

Brief Course Description:

. Prerequisite(s) and/or Note(s):

(1) Good knowledge of Physics, Chemistry and Maths
(2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course

Course Objectives:

Knowledge acquired:

- Mechanism of basin formation, basin formation and plate tectonics
- Palaeocurrent analysis: methods and application
- Sediment routing system; Erosion and regolith; Terrestrial sediment and solute yield
- BQART equation; Chemical weathering and global biogeochemical cycles; measurement of erosion rate
- Basin stratigraphy: Accommodation, sediment supply and sea level
- Stratigraphic cycles: definition and recognition;
- Subsidence history and back stripping; Signatures of Tectonic subsidence
- Measurements of thermal maturity in sedimentary basins
  Application to petroleum Geology

Skills gained:

(1) analysis of sedimentary basin,
(2) analysis of basin tectonics and palaeoenvironmental analysis, and,
(3) palaeoclimatic information

Competency Developed:

(1) Application in basin modelling
(2) Application in petroleum geology
(3) Application in exploration industry.

Course Syllabus:

Mechanism of sedimentary basin formation: Rheological characteristics of the earth; basin formation and plate tectonics; Palaeocurrent analysis: Methods and use in basin analysis.
Sedimentary basin fills: Sediment routing system; Erosion and regolith; Terrestrial sediment and solute yield; BQART equation; Chemical weathering and global biogeochemical cycles; measurement of erosion rate.
Basin stratigraphy: Introduction; Accommodation, sediment supply and sea level; Stratigraphic cycles: definition and recognition; Hierarchy; Mechanism.
Subsidence: Introduction; compaction of porous sediments: fundamentals; Porosity and permeability of sediments and sedimentary rocks; Subsidence history and backstripping; Signatures of Tectonic subsidence.

Thermal history: Introduction; Arrhenius equation and maturation indices; Factors influencing temperatures and paleotemperatures in sedimentary basins; Measurements of thermal maturity in sedimentary basins.
Application to petroleum Geology: Petroleum system and concept of play; Source rock and source rock prediction; Reservoir rocks: Introduction, Reservoir properties: porosity and permeability; Factors controlling reservoir quality; diagenetic changes in reservoir rocks; Classic and unconventional plays.

Suggested Readings:

- Bastia,R.,&Radhakrishna,M.(2012).Basin evolutionand petroleumprospectivelyof the continentalmarginsofIndia(Vol.59).Newness.
- Allen, J.R.L., 1985b. Principles of Physical Sedimentology. Allen and Unwin, London, 272pp
- A.D. Miall, 2000. Principles of Sedimentary Basin Analysis. Springer publ.
- Facies model revisited, H.W. Posamentier, 2006. SEPM

Department Name: Geology

Program Name:M.Sc in Applied Geology

Program Code:311

Semester: Semester I □ Semester II □ Semester III √ Semester IV □

Course Name:Engineering Geology

Course Code: (For new course keep it blank; else enter the old course code)

Course Credit: 2

Marks Allotted: Theoretical/Practical: 50 Continuing Evaluation:

Course Type (tick the correct alternatives):

Core	□
Department Specific Elective	√
Generic Elective	□

Is the course focused on employability / entrepreneurship? YES √ NO □

Is the course focused on imparting life skill? YES √ NO □

Is the course based on Activity ? YES □ NO √

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%)	□
Moderate (>15% and up to 50%)	√
Major (>50%)	□

Summary of changes

The course splits into two courses. The content of the course remains unchanged.

Course Code:

Course Name: Software training

Brief Course Description:

- The course deals with engineering Geology. The geological investigation related to dam and reservoir site selection and use of building materials.

Prerequisite(s) and/or Note(s):

(1) Good knowledge of Physics, Chemistry and Maths
(2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course

Course Objectives:

Knowledge acquired:

- Concept of geological investigation in engineering projects
- Concept of building materials and source
- Reservoir and dam: type, stability
- Criteria for dam site selection
- Tunnels: stability of tunnels, criteria for selecting tunnel site

Skills gained:

(1) knowledge of building materials

(2) knowledge of slope stability treatment

(3) knowledge in engineering planning

Competency Developed:

(1) Application in remote sensing mapping
(2) Application in groundwater exploration
(3) Application in land use mapping

Course Syllabus:

Engineering Geology (50 marks) Credit 2

Stages of geological investigation for engineering projects.

Slope stability and mass movements: classifications, landslides, controlling factors of mass movements and their remedial measures.

Building materials and dimension stones: Concept, Properties; Indian Occurrence.

Dams and reservoir: Types, Parts of dams and reservoirs, stability of dams and reservoir, seepage and leakage.
Dam and reservoir failure: Causes and their remedial measures; Criteria for selecting sites for construction of dams and reservoirs.

Tunnels: Types, Parts of a tunnel, stability of tunnel.

Tunnel Failure: Causes and their remedial measures; criteria for selecting sites for construction of tunnels

SUGGESTED READINGS:

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

Department Name: Geology

Program Name: Applied Geology

Program Code: 311

Semester: Semester I □ Semester II □ Semester III √ Semester IV □

Course Name: Field Training Program

Course Code: (For new course keep it blank; else enter the old course code)

Course Credit: 2

Marks Allotted: Theoretical/Practic 50 Continuing Eva

Course Type (tick the correct alternatives):

Core □

Department Specific Elective √

Generic Elective □

Is the course focused on employability / entrepreneurship? YES √ NO □

Is the course focused on imparting life skill? YES √ NO □

Is the course based on Activity ? YES □ NO √

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%) □

Moderate (>15% and up to 50%) √

Major (> 50%) □

Summary of changes

Course Code:

Course Name: Field training program

Brief Course Description:

Deals with field geology.

- This course deals with Geological Fieldwork for structural mapping, lithological mapping, sedimentological, palaeontological, Economic geology, or any other selected problems of any age (Precambrian to Recent) in India.

  Prerequisite(s) and/or Note(s):

  (1) Good knowledge of Physics, Chemistry and Maths
  (2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course

Course Objectives:

Knowledge acquired:

(1) Use of clinometer and brunton compass
(2) Measuring dip and strike of beds

Skills gained:

(1) Identifying different types of rocks

(2) Understanding structural features

Competency Developed:

(1) Ability to interpret various terrains
(2) Identifying exposures

Department Name: Geology

Program Name: Applied Geology

Program Code:

Semester: Semester I □ Semester II □ Semester III √ Semester IV □

Course Name: Fuel Geology

Course Code: (For new course keep it blank; else enter the old course code)

Course Credit: 2

Marks Allotted: Theoretical/Practic 50 Continuing Ev

Course Type (tick the correct alternatives):

Core □

Department Specific Elective √

Generic Elective □

Is the course focused on employability / entrepreneurship? YES √ NO □

Is the course focused on imparting life skill? YES √ NO □

Is the course based on Activity ? YES □ NO √

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%) □

Moderate (>15% and up to 50%) √

Major (>50%) □

Summary of changes

The course has been modified. Previously it was part of Economic Geology and now it has been fragmented as Ore Geology and Fuel Geology.

Course Code:

Course Name: Fuel Geology

Brief Course Description:

Fuel Geology deals with coal and petroleum geology.

Prerequisite(s) and/or Note(s):

(1) Good knowledge of Physics, Chemistry and Maths
(2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course

Course Objectives:

Knowledge acquired:

1) Source of energy
2) Origin of coal, macerals – types and composition
3) Grade and rank of coal, classification, Indian occurrence
4) Petroleum: physical and chemical properties, origin
5) Migration and reservoir, traps
6) Nuclear fuels: mineralogy and geochemistry
7) Indian distribution of radiogenic minerals
8) Nuclear waste disposal – geological criteria.

Skills gained:

Knowledge about the origin, formation, distribution, resources, as well as the chemical and physical characteristics of coal and coal-bearing strata.

Competency Developed:

(1) An understanding of coal formation, coal extraction and utilization, coal quality and environmental considerations
(2) To use of physics, mathematics and geological knowledge in exploration for oil, gas or minerals.

Course Syllabus:

- Introduction: Sources of energy, Indian scenario.
- Coal Geology: Introduction, Origin of coal, Biochemical and dynamo-chemical changes in coal formation, Macroscopic and Microscopic constituents, Macerals and micro-lithotypes, Physical and chemical properties.
- Grade and Rank of coal, Indian classification, Spatial and temporal distribution of coal, Indian scenario.
- Petroleum Geology: Composition and physical properties of petroleum, Origin of Petroleum; Kerogen and their types.
- Migration of natural hydrocarbon.

- Petroleum Reservoir: source rock, reservoir rock, cap rocks.
- Traps : Structural, stratigraphic and combination traps.
- Petroliferous basins of India.
- Nuclear Fuel: Minerology, Geochemistry, mode of occurrence; Distribution of radioactive minerals in India; Radiogenic waste disposal — geological constrains.
- Gas-hydrates.Others

Suggested Readings:

Bastia, R., &Radhakrishna, M. (2012). Basin evolution and petroleum prospectivity of the continental margins of India (Vol. 59). Newnes.

Bjorlykke, K. (1989). Sedimentology and petroleum geology. Springer-Verlag.

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

Department Name: Geology

Program Name: Applied Geology

Program Code: 311

Semester: Semester I □ Semester II □ Semester III √ Semester IV □

Course Name: Industry/ Research related training / Seminar

Course Code: (For new course keep it blank; else enter the old course code)

Course Credit: 2

Marks Allotted: Theoretical/Practic 50 Continuing Ev

Course Type (tick the correct alternatives):

Core □

Department Specific Elective √

Generic Elective □

Is the course focused on employability / entrepreneurship? YES √ NO □

Is the course focused on imparting life skill? YES √ NO □

Is the course based on Activity ? YES □ NO √

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%) √

Moderate (>15% and up to 50%) □

Major (> 50%) □

Summary of changes

Course Code:

Course Name: Industry/ Research related training / Seminar

Brief Course Description:

- deals with Geological Fieldwork for structural mapping, lithological mapping, sedimentological, palaeontological, Economic geology, or any other selected problems of any age (Precambrian to Recent) in India.

Prerequisite(s) and/or Note(s):

(1) Good knowledge of Physics, Chemistry and Maths
(2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course

Course Objectives:

Knowledge acquired:

(1) Industraial experience
(2) Mineral exploration techniques

Skills gained:

(1) Basics of Industrial applications

(2) Understanding structural features

Competency Developed:

(1) Ability to interpret various terrains
(2) Identifying exposures

Syllabus

The students will choose and organize their own Industrial training

Department Name: Geology

Program Name: M.Sc in Applied Geology

Program Code: 311

Semester: Semester I ☐ Semester II Semester III ✓ Semester IV ☐

Course Name: Climatology

Course Code: (For new course keep it blank; else enter the old course code)

Course Credit: 2

Marks Allotted: Theoretical/Practical: 50 Continuing Evaluation:

Course Type (tick the correct alternatives):

Core ☐

Department Specific Elective ✓

Generic Elective ☐

Is the course focused on employability / entrepreneurship? YES ✓ NO ☐

Is the course focused on imparting life skill? YES ✓ NO ☐

Is the course based on Activity ? YES ✓ NO ☐

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%) ☐

Moderate (>15% and up to 50%) ✓

Major (> 50%) ☐

Summary of changes

The course splits into two separate courses for better understanding and expanding the scope in the subjects. The content of the courses almost remains unchanged.

Course Code:

Course Name: Climatology

Brief Course Description:

- deals with Climate: Classification; Koppen's and Thornthwaite's classification; Composition and structure of the atmosphere; Energy Balance: Solar Radiation; Temperature and Moisture; Distribution of temperature

  Prerequisite(s) and/or Note(s):

  (1) Good knowledge of Physics, Chemistry and Maths
  (2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course

Course Objectives:

Knowledge acquired:

(1) Concept of Climate classification

(2) Concept of Energy Balance

(3) Types of precipitation

Skills gained:

(1) To understand global warming

(2) Understanding wind pattern

(3) Understanding cyclones

Competency Developed:

(1) Ability to understand climate changes
(2) Ability to understand Milankovitch Cycle

Course Syllabus:

Climatology (Theoretical) Credit-2

- Introduction, Climate: Classification; Koppen's and Thornthwaite's classification; Composition and structure of the atmosphere; Energy Balance: Solar Radiation; Temperature and Moisture; Distribution of temperature.
- General circulation of winds; Monsoons and Jet Streams; Air Masses; Fronts, Cyclones: temperate and tropical.
- Precipitation: Types and distribution; Global warming; Changes in Atmospheric Chemistry; Climate changes: Past, present and future.

Suggested Readings

- Rudiman, W.F., 2001. Earth's climate: past and future. Edition
- 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

Department Name: Geology

Program Name: M.Sc in Applied Geology

Program Code: 311

Semester: Semester I ☐ Semester II ☐ Semester III ✓ Semester IV

Course Name: Geochemistry

Course Code: (For new course keep it blank; else enter the old course code)

Course Credit: 4

Marks Allotted: Theoretical/Practical: 50/25 Continuing Evaluation: 25

Course Type (tick the correct alternatives):

Core ☐

Department Specific Elective ☐

Generic Elective ✓

Is the course focused on employability / entrepreneurship? YES ✓ NO ☐

Is the course focused on imparting life skill? YES ✓ NO ☐

Is the course based on Activity ? YES ✓ NO ☐

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%) ☐

Moderate (>15% and up to 50%) ✓

Major (> 50%) ☐

Summary of changes

The course splits into two separate courses for better understanding and expanding the scope in the subjects. The content of the courses almost remains unchanged.

Course Code:

Course Name: Geochemistry

Brief Course Description:

Deals in Earth in relation to solar system and universe. Cosmic abundance of elements, Comparisons of planets and meteorites. Isotope geochemistry: Geochronology - methods and limitations, Evolution of the Earth's isotopic reservoir, Application to petrogenesis

- Prerequisite(s) and/or Note(s):
  (1) Good knowledge of Physics, Chemistry and Maths
  (2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course

Course Objectives:

Knowledge acquired:

(1) Basic concept f Geochemistry

(2) Different types of geochemical principles

- (3) Cosmic abundance of elements, comparison of composition of earth with other planets and meteorites

Skills gained:

- Isotope geochemistry, geochronology,
- role of Eh-pH in natural systems
- Earth-ocean-atmospheric interaction

Competency Developed:

(1) Ability to interpret geochemical data
(2) Ability to do make proper geochemical interpretation

Course Syllabus:

Geochemistry (Theoretical) Credit-2

- Earth in relation to solar system and universe. Cosmic abundance of elements, Comparisons of planets and meteorites.
- Isotope geochemistry: Geochronology - methods and limitations, Evolution of the Earth's isotopic reservoir, Application to petrogenesis. Stable isotopes - Nature, Abundance, Fractionation, Evolution, Fluid interactions. Applications in environmental problems.
- General chemical characteristics of sedimentary rocks; role of ionic potential, H-ion concentration and oxidation-reduction potential in sedimentation. Eh-pH diagrams of Mn-H_2O systems and Fe- H_2O systems with/without CO_2.
- Geochemical cycle, Biogeochemical cycle, Ocean-atmosphere interactions, the evolution of Atmosphere

Continuous Evolution Credit-1

Geochemistry Practical Credit-1

- Geochemical numericals and application of geochemical instruments

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.

Department Name: Geology

Program Name: M.Sc in Applied Geology

Program Code: 311

Semester: Semester I □ Semester II □ Semester III √ Semester IV □

Course Name: Isotope Geology

Course Code: GEOL-EP-404D (For new course keep it blank; else enter the old course code)

Course Credit: 4

Marks Allotted: Theoretical/Practical: 50+25 Continuing Evaluation: 25

Course Type (tick the correct alternatives):

Core □

Department Specific Elective □

Generic Elective √

Is the course focused on employability / entrepreneurship? YES √ NO □

Is the course focused on imparting life skill? YES √ NO □

Is the course based on Activity ? YES □ NO √

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%) □

Moderate (>15% and up to 50%) □

Major (> 50%) □

Summary of changes

No changes.

Course Code: GEOL-EP-404D

Course Name: Isotope Geology

Brief Course Description:

- The course deals with Isotope Geology. The course deals with chemical characteristics of soft and hard rock systems. .

Prerequisite(s) and/or Note(s):

(1) Good knowledge of Physics, Chemistry and Maths
(2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course

Course Objectives:

Knowledge acquired:

- General characteristics of Isotopes, Isotope effects, Isotope fractionation process
- Mass Spectrometry: Basic principles; Equations of motion of ions; Ion Microprobe and Electrostatic Tandem Accelerators; Isotope Dilution Analysis
- Radioactivity, Decay mechanism of radioactive atoms; Radioactive decay and growth, Radiogenic isotope in Geochronology and Petrogenesis, Fission-track dating
- Stable isotope geochemistry: Variations of Stable Isotope ratios
- Isotope Geothermometry, Isotope Fractionation in the Hydrologic and Biological System

Skills gained:

(1) knowledge in radio and stable isotopes

(2) knowledge in geochronology

(3) knowledge in decay of radioactive isotopes

Competency Developed:

(1) Application in rock melt systems
(2) Application in sediments
(3) Application in chemical industries

Course Syllabus:

Isotope Geochemistry (Theoretical) 50 marks Credit 2

Introduction: General characteristics of Isotopes, Isotope effects, Isotope fractionation process of some important elements.

Mass Spectrometry: Basic principles; Equations of motion of ions; Ion Microprobe and Electrostatic Tandem Accelerators; Isotope Dilution Analysis.

Principles of Radioactivity, Decay mechanism of radioactive atoms; Radioactive decay and growth, Radiogenic isotope in Geochronology and Petrogenesis, Fission-track dating.

Stable isotope geochemistry: Scope of Stable Isotope Geochemistry, Variations of Stable Isotope Ratios in Nature, Isotope Geothermometry, Isotope Fractionation in the Hydrologic and Biological System.

Continuous Evaluation **1 credit**

Practical **1 credit**

SUGGESTED READINGS:

- Albarède, F. (2003). Geochemistry: an introduction. Cambridge University Press.
- Faure, Gunter and Teresa M. Mensing (2004). Isotopes: Principles and Applications,Wiley India Pvt. Ltd

Department Name: Geology

Program Name: M.Sc in Applied Geology

Program Code: 311

Semester: Semester I ☐ Semester II ☐ Semester III ☐ Semester IV ✓

Course Name: Ore Geology

Course Code: (For new course keep it blank; else enter the old course code)

Course Credit: 4

Marks Allotted: Theoretical/Practical: 50/25 Continuing Evaluation: 25

Course Type (tick the correct alternatives):

Core	✓
Department Specific Elective	☐
Generic Elective	☐

Is the course focused on employability / entrepreneurship? YES ✓ NO ☐

Is the course focused on imparting life skill? YES ✓ NO ☐

Is the course based on Activity ? YES ✓ NO ☐

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%)	☐
Moderate (>15% and up to 50%)	✓
Major (> 50%)	☐

Summary of changes

The course splits into two separate courses for better understanding and expanding the scope in the subjects. The content of the courses almost remains unchanged.

Course Code:

Course Name: Ore Geology

Brief Course Description:

- deals with Ore forming processes, Tectonics and ore formation, Ore texture and genesis. Phase equilibria of sulphide and oxide, Ore in igneous rocks, metamorphic rocks, sedimentary placer deposits

  Prerequisite(s) and/or Note(s):

  (1) Good knowledge of Economic geology
  (2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:

(1) Ore deposits and their formation
(2) Extraction of ore
(3) Ore texture and genesis

Skills gained:

(1) Ore estimation
(2) Indian occurrences of Ore
(3) Environmental impact of Ore geology

Competency Developed:

(1) Ore genesis processes
(2) Mineral deposits exploration

Course Syllabus:

Ore Geology (Theory) Credit: 2

- Ore-Forming Processes, Mode of Occurrence, Role of fluids in ore genesis.
- Plate tectonics and mineral deposits.
- Ore textures and their genesis: sulphide and oxide phase equilibria and its significance.
- Ores of silicic igneous rock association, Ores of basic and ultrabasic plutonic rocks, Ores of sedimentary association: Sedimentary deposits, placer deposits, Ores of volcanic- Volcano-sedimentary association, Ores of metamorphic association, Ores associated with weathering surfaces; Metamorphism of ores.

- Indian Occurrence of Fe, Mn, Cu, Pb, Zn, Cr, Ni, Sn and W deposits
- Mode of Occurrence and origin of important non-metallic minerals: diamond, graphite, barite, gypsum, phosphorite, mica and asbestos.
- Raw materials (with specifications) used in the following industry: Iron and Steel, Glass and ceramic, Cement and Fertilizer.

Continuous Evaluation Credit-1

Ore Geology Practical Credit:1

- Study of hand specimen of important ore mineral; Study of important ore minerals under microscope.
- Study of hand specimen of coal, Reserve estimation of coal

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

Department Name: Geology

Program Name: M.Sc in Applied Geology

Program Code:311

Semester: Semester I ☐ Semester II ☐ Semester III ☐ Semester IV ✓

Course Name: M.Sc. Dissertation

Course Code: GEOL-CP-405 (For new course keep it blank; else enter the old course code)

Course Credit: 4

Marks Allotted: Theoretical/Practical: 50 Continuing Evaluation:

Course Type (tick the correct alternatives):

Core ✓

Department Specific Elective ☐

Generic Elective ☐

Is the course focused on employability / entrepreneurship? YES ✓ NO ☐

Is the course focused on imparting life skill? YES ✓ NO ☐

Is the course based on Activity ? YES ✓ NO ☐

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%) ☐

Moderate (>15% and up to 50%) ☐

Major (> 50%) ☐

Summary of changes

Course Code: GEOL-CP-405 Course

Name: M.Sc. Dissertation

Brief Course Description:

- GEOL-CP-405 deals with Geological Fieldwork for structural mapping, lithological mapping, sedimentological, palaeontological, Economic geology, or any other selected problems of any age (Precambrian to Recent) in India.

  Prerequisite(s) and/or Note(s):

  (1) Good knowledge of Physics, Chemistry and Maths
  (2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course

Course Objectives:

Knowledge acquired:

(1) Research methodology
(2) Research techniques

Skills gained:

(1) Development of critical thinking to carry out scientific investigation objectively without being biased with preconceived notions.
(2) to analyze problems, formulate a hypothesis, evaluate and validate results, and draw reasonable conclusions thereof.

Competency Developed:

(1) Ability to interpret various terrains
(2) Identifying exposures

Syllabus

The students will choose their dissertation topic and guide on their own.

Department Name: Geology

Program Name: M.Sc in Applied Geology

Program Code: 311

Semester: Semester I ☐ Semester II ☐ Semester III ☐ Semester IV ✓

Course Name:Stratigraphy

Course Code: GEOL-CT-203 (For new course keep it blank; else enter the old course code)

Course Credit: 2

Marks Allotted: Theoretical/Practical: 50 Continuing Evaluation:

Course Type (tick the correct alternatives):

Core ☐

Department Specific Elective ✓

Generic Elective ☐

Is the course focused on employability / entrepreneurship? YES ✓ NO ☐

Is the course focused on imparting life skill? YES ✓ NO ☐

Is the course based on Activity ? YES ✓ NO ☐

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%) ☐

Moderate (>15% and up to 50%) ☐

Major (> 50%) ☐

Summary of changes

Course Code: GEOL-CT-203

Course Name: Stratigraphy

Brief Course Description:

- GEOL-CT-203Deals with the study of Precambrian and Phanerozoic basins of India
-

Prerequisite(s) and/or Note(s):

(1) Good knowledge of Sedimentation and tectonics
(2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course

Course Objectives:

Knowledge acquired:

(1) Concept of Stratigraphic units

(2) Concept of Cratons and mobile belts

Skills gained:

(1) To understand Precambrian lithology

(2) Understanding Phanerozoic sedimentation

Competency Developed:

(1) Ability to understand Precambrian and Phanerozoic tectonics
(2) Ability to understand Sedimentation history and evolution of life

Course Syllabus:

Stratigraphy (Theoretical) Credit-2

- Archaean cratons – lithology, tectonics and igneous activity
- Concept of supercontinent
- Proterozoic mobile belts
- Proterozoic basins and their evolution
- Phanerozoic stratigraphy of india
- Boundary problems

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

Department Name: Geology

Program Name: M.Sc in Applied Geology

Program Code: 311

Semester: Semester I ☐ Semester II ☐ Semester III ☐ Semester IV ✓

Course Name: Ocean Science

Course Code: GEOL-ET-304 (For new course keep it blank; else enter the old course code)

Course Credit: 2

Marks Allotted: Theoretical/Practical: 50 Continuing Evaluation:

Course Type (tick the correct alternatives):

Core ☐

Department Specific Elective ✓

Generic Elective ☐

Is the course focused on employability / entrepreneurship? YES ✓ NO ☐

Is the course focused on imparting life skill? YES ✓ NO ☐

Is the course based on Activity ? YES ✓ NO ☐

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%) ☐

Moderate (>15% and up to 50%) ☐

Major (> 50%) ☐

Summary of changes

Course Code: GEOL-ET-304

Course Name: Ocean Science

Brief Course Description:

- GEOL-ET-304Deals with thePhysical oceanography, coastal processes, wave propagation, reflection and refraction, tsunami, Tides: causes and magnitude, Estuaries: Classification, coastal population, coastal management, Global Wind system; Ekman‟s theory; Sverdrup, Stommel and Munk‟s theories,Ocean currents, geostrophic motion; barotropic and baroclinic conditions

  Prerequisite(s) and/or Note(s):

  (1) Good knowledge ofOceanography and marine biology
  (2) Note(s): Syllabus changes yearly and may be modified during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course

Course Objectives:

Knowledge acquired:

(1) Concept of Ocean currents

(2) Concept of Ocean sediments and basins

(3) Biological oceanography

Skills gained:

(1) To understand Ocean chemistry

(2) Understanding Waves and Tides

Competency Developed:

(1) Ability to understand Ekman transport and upwelling
(2) Ability to understand marine life

Course Syllabus:

Oceanography (Theoretical) Credit-2

- Physical oceanography, coastal processes, wave propagation, reflection and refraction, tsunami
- Tides: causes and magnitude
- Estuaries: Classification, coastal population, coastal management
- Global Wind system; Ekman‟s theory; Sverdrup, Stommel and Munk‟s theories
- Ocean currents, geostrophic motion; barotropic and baroclinic conditions
- El Nino; monsoonal winds and currents: North Indian Ocean; Arabian Sea: Upwelling processes.
- Chemical Oceanography: Seawater Composition; Elements: Types, Classification and

distribution; Chemistry of Element: pore fluid and anthropogenic inputs

- Ionic interactions; nutrients cycle, trace metals and organic

matter. Atmosphere-Ocean Interaction: biological pump

- Biological Oceanography: Marine environment and marine organisms; Production of marine life
- Abundance and diversity; coastal communities; Ecology and community: food webs
- Anthropogenic impacts on marine biota; climate change and marine biodiversity
- Pollution and marine environments including fisheries

Suggested Readings

Introductory Oceanography by Harold V. Thurman, Mt. San Antonio College, Charles E. Merrill Publishing Company.

Oceanography for Beginners, by Pranab K. Banerjee, Allied Publishers Pvt. Limited

Coastal Hydraulics, by A. M. Muir and C. A. Fleming 1981, The MacMillan Press Ltd, London.

Department Name: Geology

Program Name: Applied Geology

Program Code:

Semester: Semester I □ Semester II □ Semester III □ Semester IV √

Course Name: Geophysics

Course Code: (For new course keep it blank; else enter the old course code)

Course Credit: 4

Marks Allotted: Theoretical/Practic 50+25 Continuing Eva 25

Course Type (tick the correct alternatives):

Core □

Department Specific Elective □

Generic Elective √

Is the course focused on employability / entrepreneurship? YES √ NO □

Is the course focused on imparting life skill? YES √ NO □

Is the course based on Activity ? YES √ NO □

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%) □

Moderate (>15% and up to 50%) √

Major (> 50%) □

Summary of changes

Changes have been made to the course. The last course has been broken up into two different ones: geophysics and geotectonics.

Course Code:

Course Name: Geophysics

Brief Course Description:

Geophysics provides tools and methods which can image the subsurface through measurements which are mostly made remotely from the Earth's surface.

Prerequisite(s) and/or Note(s):

1) Basic understanding of physics.
2) Some information about field based survey procedure.

Course Objectives:

Knowledge acquired:

- Gravity and gravity anomalies, gravity survey, gravity map preparation
- Magnetic fields, magnetic behavior of rocks, magnetic methods – anomalies, preparation of magtnetic anomaly maps
- Thermal and electrical properties of rocks, resistivity method
- Application of electrical method in groundwater exploration
  Seismic method, wave propagation principles, seismic data interpretation

Skills gained:

Prepare students for a career in the petroleum industry and in the associated seismic processing companies, in geophysical prospecting.

Competency Developed:

The master programme assists with understands how geophysical results are obtained, analyzed and used to improve knowledge of structure of dynamics of the Earth on various scales.

Course Syllabus: Theory credit 2

- Seismology and Interior structure of the Earth: Elastic wave theory, Snell's Law, the ray parameter and theory of seismic waves, Earthquake seismology, Internal structure of the earth.
- Gravity: Gravitational fields of the earth and anomalies, Geoid and figures of the Earth, Isostasy and structure of the crust; Gravity method: Gravity field Survey, Corrections Applied to gravity data, Preparation of gravity maps.
- Geomagnetism: Earth's magnetic field, Magnetic behavior of rocks, Palaeomagnetism and its applications; Magnetic method: Principles, Preparation of Magnetic anomaly maps and interpretation.
- Thermal and Electrical properties of the solid Earth: Source of heat. Heat flow mechanism in crust, mantle and core, Electric method: Principles, Resistively methods: basic properties, field procedures, electrode arrays and equipment; Interpretation of electrical profile and sounding curves Application of electrical methods in groundwater prospecting and civil engineering problems.
- Seismic Method: Principles of wave propagation; Refraction and Reflection seismic surveys for single interface both horizontal and dipping cases; Seismic velocity and interpretation of seismic data.

Continuous Evaluation **1 credit**

Practical Syllabus 1 credit

Application of geological instrument in geophysics, geophysical numerical, Geophysical subsurface studies using various instruments.

Suggested Readings:

Dobrin, M.B. (1984) An introduction to Geophysical Prospecting. McGraw-Hill, New Delhi.

Exploration Geophysics - An Outline by Bhimasarikaram V.L.S., Association of Exploration Geophysicists, Osmania University, Hyderabad, 1990.

Lowrie, W. (2007). Fundamentals of geophysics. Cambridge University Press

Outlines of Geophysical Prospecting - A manual for geologists by Ramachandra Rao, M.B., Prasaranga, University of Mysore, Mysore, 1975.

Telford, W. M., Geldart, L. P., & Sheriff, R. E. (1990). *Applied geophysics* (Vol. 1). Cambridge university press.

Department Name: Geology

Program Name: Applied Geology

Program Code: 311

Semester: Semester I □ Semester II □ Semester III □ Semester IV √

Course Name: Remote Sensing

Course Code: (For new course keep it blank; else enter the old course code)

Course Credit: 4

Marks Allotted: Theoretical/Practic 50/25 Continuing Eva 25

Course Type (tick the correct alternatives):

Core □

Department Specific Elective □

Generic Elective √

Is the course focused on employability / entrepreneurship? YES √ NO □

Is the course focused on imparting life skill? YES √ NO □

Is the course based on Activity ? YES □ NO √

Percentage of change in syllabus (applicable in case of change in syllabus only)

Minor (up to 15%) □

Moderate (>15% and up to 50%) √

Major (>50%) □

Summary of changes

The course splits into two courses. The content of course remains same as earlier.

Course Code:

Course Name: Remote Sensing

Brief Course Description:

This course is designed to educate students to the fundamental ideas and principles of different remote sensing components.

Prerequisite(s) and/or Note(s):

1) Basic understanding of photo imagery.
2) Some information about optical characteristics of light waves.

Course Objectives:

Knowledge acquired:

- Basic concept of remote sensing
- Photogeology: digital and conventional
- Electromagnetic radiation: concept and theories, interaction with atmosphere and application of remote sensing
- Remote sensing data: source and sensors
- Data acquisition, satellite imagery
- Arial photography: types and interpretation
  GIS and GPS

Skills gained:

- Concept about different types of satellite and sensors.
- Interpretation of satellite and top sheet maps.

Competency Developed:

- Apply the concepts of Photogrametry and its applications such as determination of heights of objects on terrain.
- Illustrate Energy interactions with atmosphere and with earth surface features,
- Understand different components of GIS and Learning about map projection and coordinate system
- Develop knowledge on conversion of data from analogue to digital and working with GIS software.

Course Syllabus theory **credit 2**

Definition, concept, Types scope and purpose;Photogeology: Digital and conventional. Electromagnetic Radiation: Concepts and theories; Electromagnetic spectrum: Types, Common wavelength band in Remote sensing; Interaction with atmosphere and application in remote sensing; atmosphere windows.
Remote Sensing: data source, platforms and sensors; data products, geometric and radiometric corrections; Acquisition of data; Thermal and microwave remote sensing; Satellite Imagery; Indian Remote Sensing Satellites and Space Missions.
Photogeology: Aerial photography, definition, characteristics, Types and geometry; Aerial Photo

Interpretation and Elements of photogrammetry.
Digital Image Processing: Image structure, Processing system, Restoration, enhancement, classification and application in geological exploration, landuse and natural hazards zonation.
Geographical Information System (GIS) and Global Positioning System (GPS)

Continuous evaluation **credit 1**

Practical **credit 1**

Stereoscopic study of air-photos, parallax, vertical exaggeration and Interpretations; Elementary practical exercises on photogeological mapping.
Application of Software in Remote Sensing

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.