

**UNIVERSITY OF JAMMU**

**SYLLABUS AND COURSES OF STUDY IN  
GEOLOGY FOR B.Sc. SEMESTERS I-VI**

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**CHOICE BASED CREDIT SYSTEM**

# UNIVERSITY OF JAMMU

## SYLLABUS AND COURSES OF STUDY IN GEOLOGY FOR B.Sc. SEMESTERS I-VI (CBCS)

Semester	Course No	Course Title	Credits	Type of course
<b>I</b>	<b>UGETC101</b>	<b>Physical &amp; Structural Geology</b>	<b>4</b>	<b>Core</b>
	<b>UGEPC102</b>	<b>Practical - Physical &amp; Structural Geology</b>	<b>2</b>	<b>Core</b>
<b>II</b>	<b>UGETC201</b>	<b>Crystallography &amp; Mineralogy</b>	<b>4</b>	<b>Core</b>
	<b>UGEPC202</b>	<b>Practical - Crystallography &amp; Mineralogy</b>	<b>2</b>	<b>Core</b>
<b>III</b>	<b>UGETC301</b>	<b>Petrology</b>	<b>4</b>	<b>Core</b>
	<b>UGEPC302</b>	<b>Practical - Petrology</b>	<b>2</b>	<b>Core</b>
	<b>UGETS303</b>	<b>Field Geology</b>	<b>4</b>	<b>SEC</b>
<b>IV</b>	<b>UGETC401</b>	<b>Stratigraphy &amp; Palaentology</b>	<b>4</b>	<b>Core</b>
	<b>UGEPC 402</b>	<b>Practical - Stratigraphy &amp; Palaentology</b>	<b>2</b>	<b>Core</b>
	<b>UGETS403</b>	<b>Techniques in Identifying Minerals, rocks &amp; fossils</b>	<b>4</b>	<b>SEC</b>
<b>V</b>	<b>UGETE501</b>	<b>Elements of Applied Geology</b>	<b>4</b>	<b>DSE</b>
	<b>UGEPE502</b>	<b>Practical - Elements of Applied Geology</b>	<b>2</b>	<b>DSE</b>
	<b>UGETS503</b>	<b>Photo Geology and Remote Sensing</b>	<b>4</b>	<b>SEC</b>
<b>VI</b>	<b>UGETE601</b>	<b>Economic Geology and Hydrology</b>	<b>4</b>	<b>DSE</b>
	<b>UGEPE602</b>	<b>Practical - Economic Geology &amp; Hydrology</b>	<b>2</b>	<b>DSE</b>
	<b>UGETS603</b>	<b>Environmental Geology</b>	<b>4</b>	<b>SEC</b>

SEC; SKILL ENHANCEMENT COURSE;

DSE - ELECTIVE DISCIPLINE SPECIFIC

# **SYLLABY AND COURSES OF STUDY IN GEOLOGY (B.Sc. CBCS pattern)**

**For Examinations to be held in the years December 2016, 2017 and 2018.**

## **SEMESTER I**

**Course No. UGETC101**

**Credit: 04**

**Time: 2½ hours**

**Title: Physical and Structural Geology**

**Maximum Marks: 100**

External: 80 Marks

Internal: 20 Marks

### **UNIT-1**

- 1.1 Definition of Geology, its relationship with other sciences, Branches of geology, Aim and Application of Geology. Earth as a planet- its shape, size, mass, density and atmosphere.
- 1.2 Origin of Earth: Kant-Laplace, Jeans and Jeffrey's, Big Bang Theories.
- 1.3 Geochronology and its application in Geology, Radioactive dating Methods: K-Ar, C-14 and U-Pb methods.
- 1.4 Interior of earth and its composition, nature of seismic waves and their application in the study of interior of earth.
- 1.5 Definitions of Erosion and Denudation, types and prevention of soil erosion.

### **UNIT- 2**

- 2.1 Earthquakes; Causes, magnitude and intensity. Seismic zones of India, earthquake prediction.
- 2.2 Volcanoes: Classification of volcanoes, volcanic landforms and distribution of volcanoes
- 2.3 Weathering: Controlling factors of weathering, Types of weathering.
- 2.4 Karst topography: Erosional and depositional features of Karst topography.
- 2.5 Earth movements: Exogenic and endogenic movements

### **UNIT-3**

- 3.1 Fluvial Process: River profile, Stream types, Drainage pattern, erosional and depositional features produced by river.
- 3.2 Aeolian process: Processes of Aeolian erosion, erosional and depositional features produced by wind.
- 3.3 Glaciers: Their types, erosional and depositional features produced by glaciers, glaciations through geological ages.
- 3.4 Unconformities: Formation, types and their recognition in the field.
- 3.5 Identification of bedding plane, Geological uses of Clinometers, Brinton Compass.

### **UNIT-4**

- 4.1 Joints; Definitions; Genesis; Classification and Significance.
- 4.2 Lineation: Definition; Types; Origin and its relationship with major structures.
- 4.3 Mechanics of faulting, distinguishing of faults from unconformities.
- 4.4 Vertical and horizontal tectonics: Origin of grabbens, horsts, window, klippe & nappes.
- 4.5 Mechanical aspects of folding.

### **UNIT-5**

- 5.1 Recognition of the folds in the field
- 5.2 Boundin structures: geometry and types.
- 5.3 Equal area and stereographic projections, plotting of structural data.
- 5.4 Relationship between folds and foliations.

## 5.5 Response of rocks to stress change: elastic, plastic and brittle behavior of the rocks.

### Books recommended

- |                           |                                 |
|---------------------------|---------------------------------|
| 1. A. Holmes              | -Principles of Physical Geology |
| 2. Thornburry             | -Geomorphology                  |
| 3. Deer, Hawie & Zuessman | -Rock forming minerals          |
| 4. Bagley, P.C            | -Structure and Tectonics        |
| 5. Gosh, S.K              | -Structural Geology             |
| 6. A.M.Pat Wardhan:       | The Dynamics of Earth System    |
| 7. Valdiya K.S.:          | Dynamic Himalaya                |
| 8. M.P.Billings:          | Structural Geology              |

### **Note for paper setting**

**Internal Assessment test** (Total 20 marks; Time duration 1 hour): The internal assessment shall consist of one long answer type question of 10 marks and five short answer type questions of 2 marks each to be conducted after the completion of 50% syllabus from unit 1.1 to 2.2 (after 45 days).

**Semester End Examination** (Total 80 marks; Time duration - 2½ hours). The examination is to be conducted after completion of 100% of syllabus. The question paper shall consist of sections A, B and C .

Section A will consist of **05** short answer (70-80 words) questions of 03 marks each to be set from all the 5 unit i.e. at least one question from each unit. **All questions are to be attempted** by the candidate. (Total 15 marks)

Section B will consist of **05** medium answer (250-300 words) questions of 7 marks each to be set from all the 5 units i.e. at least one question from each unit. **All questions are to be attempted** by the candidate. (Total 35 marks).

Section C will consist of 4/5 long answer (500-600 words) questions of 15 marks each and to be set from entire syllabus. **Any TWO questions are to be attempted** by the candidate. (Total 30 marks)

## **SYLLABI AND COURSES OF STUDY IN GEOLOGY** Examinations to be held in December 2016, 2017 and 2018)

### **Semester – I**

**Course No. UGEPC102**  
**Credits: 02**  
**Time: 4 hours**

**Title: Practical– Physical &Structural Geology**  
**Maximum Marks: 50**

External Examination: 25 Marks  
Internal Assessment: 25 Marks

### **Practical**

1. Determination of apparent dip from true dip
2. Determination of true dip from apparent dip
3. Drawing of geological sections, writing of geological history and completion of outcrops in the given geological maps.

Note: The practical component shall be of 50 marks comprising of continuous class assessment, practical test and attendance. The breakup of marks shall be as follows:

10 marks as continuous class assessment in practicals, 10 marks written examination (four hours duration) at the end of the semester, and 5 marks for practical attendance (to be allotted as per statutes). External Examination 15 marks for test, 5 marks for attendance and and 5 marks Viva-voce.

## **SYLLABI AND COURSES OF STUDY IN GEOLOGY**

Examinations to be held in May 2017, 2018 and 2019)

### **Semester – II**

**Course No. UGETC201**

**Credit: 04**

**Time: 2½ hours**

**Title: Crystallography and Mineralogy**

**Maximum Marks: 100**

External: 80 Marks

Internal: 20 Marks

#### **UNIT-1**

- 1.1 Crystal structure, morphology of crystals, division of different crystals into six crystal systems.
- 1.2 Crystallographic axes and axial angles, notation of faces on parameters of Weiss and Miller indices.
- 1.3 Symmetry elements
- 1.4 Crystal Symmetry and forms of Normal classes of Cubic, Tertagonal and Hexagonal Systems.
- 1.5 Crystal Symmetry and forms of Normal classes of Orthorhombic, Monoclinic and Triclinic systems.

#### **UNIT-2**

- 2.1 Definition of a mineral- classification of minerals into rock forming and ore forming minerals.
- 2.2 Twinning: Twin crystals, Twin axis, twin planes, composition planes, Twin Laws and different types of twinning.
- 2.3 Physical properties of minerals and their significance in the identification of the minerals. Moh's scale of hardness.
- 2.4 Silicate Minerals: definition and their classification based on silicate structure.
- 2.5 Silicate Structures: Isomorphism, Polymorphism, Allotrophy and Pseudomorphism.

#### **UNIT-3**

- 3.1 Feldspars: Physical properties, chemical composition and classification.
- 3.2 Micas: Physical properties, chemical composition and crystal system.
- 3.3 Amphibole Group: Physical properties, chemical composition and crystal system.
- 3.4 Pyroxene Group: Physical properties, chemical composition and crystal system.
- 3.5 Garnet Group: Physical properties, chemical composition and crystal system.

#### **UNIT-4**

- 4.1 Olivine and Epidote Groups: Physical properties, chemical composition
- 4.2 Physical properties and chemical composition: Quartz, Calcite, Aragonite, Chlorite, Andalusite, Sillimanite, Kyanite, Cordierite, Spene, Topaz and Zircon.
- 4.3 Perlogical microscope: construction and working.
- 4.4 Ordinary and Polarized light, methods to obtain polarized light.
- 4.5 Pleochroism and Birefringence: Pleochroic halos, dichroism and trichroism.

#### **UNIT-5**

- 5.1 Extinction: Definition, types and extinction angle.

- 5.2 Reflection, Refraction, Isomorphism and anisotropism.
- 5.3 Double refraction, Nicol prism- its construction and working.
- 5.4 Refractive index: methods of its determination, critical angle.
- 5.5 Interference colours and interference colour chart.

Books recommended

- |                           |                                  |
|---------------------------|----------------------------------|
| 1. H.H.Reed               | -Rutley's Mineralogy             |
| 2. Tyrrel                 | -Principles of Petrology         |
| 3. Deer, Hawie & Zuessman | -Rock forming Minerals           |
| 4. Myron,G                | -Igneous & Metamorphic Petrology |
| 5. Turner                 | -Metamorphic Petrology           |
| 6. Dana, E.S              | -A text book of mineralogy       |

**Note for paper setting:**

**Internal Assessment test** ( Total 20 Marks; Time duration I hour): the internal assessment shall consist of one long answer type question of 10 marks and five short answer type questions of 2 marks each to be conducted after the completion of 50% syllabus from unit 1.1 to 2.2 (after 45days).

**Semester End Examination** (Total 80 Marks; Time duration -2½ hour). The examination is to be conducted after completion of 100% of Syllabus. The question paper shall consist of section A,B and C.

Section A will consist of **05** short answer (70-80 words) questions of 03 marks each to be set from all the 5 unit i.e at least one question from each unit. **All questions are to be attempted** by the candidate (Total15 marks).

Section B will consist of **05** medium answer (250-300 words questions of 7 marks each to be set from all the 5 units i.e. at least one question from each unit. **All questions are to be attempted** by the candidate. (Total 35 Marks)

Section C will consist of 4/5 long answer (500-300 words ) questions of 15 marks each and to be set from entire Syllabus. **Any TWO questions are to be attempted** by the candidate. (Total 30 Marks)

**Course No. UGEPC202**

**Credits: 02**

**Time: 04 hours**

**Title: Practical - Crystallography and Mineralogy**

**Maximum Marks: 50**

External Examination: 25 Marks

Internal Assessment: 25 Marks

**Practical**

1. Study of physical properties and diagnostic features of the following minerals:Quartz, albite, microcline, orthoclase, muscovite, biotite, tourmaline, hornblende, augite, olivine, epidote, garnet, andalusite, kyanite sillimanite, beryl,apatite, corundum, talc gypsum, calcite, fluorite, actinolite, tremolite, asbestos and zircon.
2. Study of optical properties of the following minerals:Quartz, albite, microcline, orthoclase, muscovite, biotite, tourmaline, hornblende, augite, olivine, epidote, garnet
3. Study of Crystal models of Normal Classes of 6 crystal systems

Note: The practical component shall be of 50 marks comprising of continuous class assessment, practical test and attendance. The breakup of marks shall be as follows:

10 marks as continuous class assessment in practicals, 10 marks written examination (four hours duration) at the end of the semester, and 5 marks for practical attendance (to be allotted as per statutes). External Examination 15 marks for test, 5 marks for attendance and and 5 marks Viva-voce.

## SYLLABY AND COURSES OF STUDY IN GEOLOGY

For Examinations to be held in the years December 2017, 2018, 2019.

### SEMESTER III

**Course No. UGETC301**

**Credit: 04**

**Time: 2½ hours**

**Title: Petrology**

**Maximum Marks: 100**

External: 80 Marks

Internal: 20 Marks

#### Unit 1

- 1.1 Magma: definition, types and composition. Magma crystallization, Bowen reaction Principle
- 1.2 Magma diversification: Magmatic differentiation and Assimilation
- 1.3 Forms of the Igneous rocks: Concordant & discordant bodies.
- 1.4 Classification of Igneous rocks.
- 1.5 Textures of Igneous rocks

#### Unit 2

- 2.1 Structure of Igneous rocks
- 2.2 Minerals of Igneous rock: Felsic, Mafic, Femic, Salic and colour index of rocks.
- 2.3 Mineralogical characteristics of basic rocks and acidic rocks
- 2.4 Phase rule; Bi-component crystallization of Albite-Anorthite system and Tri-component crystallization of Ab-Di-An system.
- 2.5 Detailed petrographic description of Granite, Granodiorite, Rhyolite, Syenite, Phonolite, Diorite, Gabbro and Basalt.

#### Unit 3

- 3.1. Processes of formation of sedimentary rock.
- 3.2 Diagenesis and Lithification..
- 3.3 Texture of sedimentary rocks
- 3.4 Structure of sedimentary rocks
- 3.5 Description of important siliciclastic and carbonate rocks such as – Conglomerate, Breccia, Sandstone, Greywacke, Shale and Limestone.

#### Unit 4

- 4.1 Classification of clastic rocks
- 4.2 Classification of non-clastic rocks.
- 4.3 Process and products of metamorphism; types of metamorphism
- 4.4 Factors, zones and grade of metamorphism.
- 4.5 Textures & structure of metamorphic rocks

#### UNIT-5

- 5.1 Classification of Metamorphic rocks.
- 5.2 Concept of metamorphic grade, zones and facies.
- 5.3 Green schist and blue schist facies
- 5.4 Metasomatism definition and types of metasomatism

5.5 Petrographic details of some important metamorphic rocks such as – Slate, Schists, Gneiss, Amphibolite, Marble and Quartzite.

### Books recommended:

1. Winter, J. D.- Principles of igneous and metamorphic petrology. Pearson.
2. McBirney, A. R.-- Igneous Petrology. San Francisco (Freeman, Cooper & Company) and Oxford (Oxford Univ. Press),
3. Myron G. Best-- Igneous and Metamorphic Petrology,
4. Bose M.K. ----. Igneous Petrology. World Press Kolkata
- 5 G W Tyrrell. ----- Principles of Petrology. Springer
6. Tucker, M. E. -- Sedimentary Petrology, Blackwell Publishing.
7. Collinson, J. D. & Thompson, D. B. -- Sedimentary structures, Unwin- Hyman, London
8. Pettjohn, :----- Sedimentary rocks, CBS Publishers.

### Note for paper setting

**Internal Assessment test** (Total 20 marks; Time duration 1 hour): The internal assessment shall consist of one long answer type question of 10 marks and five short answer type questions of 2 marks each to be conducted after the completion of 50% syllabus from unit 1.1 to 2.2 (after 45 days).

**Semester End Examination** (Total 80 marks; Time duration - 2½ hours). The examination is to be conducted after completion of 100% of syllabus. The question paper shall consist of sections A, B and C .

Section A will consist of **05** short answer (70-80 words) questions of 03 marks each to be set from all the 5 unit i.e. at least one question from each unit. **All questions are to be attempted** by the candidate. (Total 15 marks)

Section B will consist of **05** medium answer (250-300 words) questions of 7 marks each to be set from all the 5 units i.e. at least one question from each unit. **All questions are to be attempted** by the candidate. (Total 35 marks).

Section C will consist of 4/5 long answer (500-600 words) questions of 15 marks each and to be set from entire syllabus. **Any TWO questions are to be attempted** by the candidate. (Total 30 marks)

**Examination to be held in December, 2017, 2018, 2019.**

### SEMESTER III

**Course No. UGEPC302**

**Credit: 02**

**Time: 04 hours**

**Title: Practical - Petrology**

**Maximum Marks: 50**

External: 25 marks

Internal : 25 marks

1. Identification of important Igneous rocks in hand specimen and thin sections,
2. Identification of important Sedimentary rocks in hand specimen and thin sections and
3. Identification of important Metamorphic rocks both in hand specimen and thin sections.

Note: The practical component shall be of 50 marks comprising of continuous class assessment, practical test and attendance. The breakup of marks shall be as follows:



10 marks as continuous class assessment in practicals, 10 marks written examination (four hours duration) at the end of the semester, and 5 marks for practical attendance (to be allotted as per statutes). External Examination 15 marks for test, 5 marks for attendance and and 5 marks Viva-voce.

**SKILL ENHANCEMENT COURSE**

**Examination to be held in December, 2017, 2018, 2019.**

**SEMESTER III**

**Course No UGETS303**

**Credit: 04**

**Time: 2½ hours**

**Title: FIELD GEOLOGY**

**Maximum Marks: 100**

External: -- 80 Marks

Internal:-- 20 Marks

**Unit 1**

- 1.1 Scope of Geological field work; Uses of geological survey; diversity of survey.
- 1.2 Orientation of Topographic sheet in field, marking location in toposheet, Bearing (Front and back)
- 1.3 Compass and clinometer method of field mapping.
- 1.4 Essential of Field survey: Compass-clinometer, haversack hammer Chisel, measuring tape; topographic sheet, field diary,
- 1.5. Field observations, collecting of specimens; field photographs; degree of accuracy in field work.

**Unit 2**

- 2.1 Geological maps, topographic Maps: Classifications of the features, contours, scale; directions; Nature of profile section and its construction.
- 2.2 Method of field work: survey, mapping laboratory work, writing of reports
- 2.3 Relation of Topography to geological mapping; uses of profile section in geological mappings
- 2.4 Procedure in Geological mappings; description of Geological maps.
- 2.5 Nature of Legend, requisite data of the completed geological map.

**Unit 3**

- 3.1 Types of dip (true and apparent dip) Measurement of dip and strike of the rock bed in the field.
- 3.2 Field relations of Igneous rocks: flow structure, Pyroclastic rocks, shape of contacts, sharpness of contact.
- 3.3 Principal Phenomenon of the contact, Marginal texture Schliers and segregations; contact zones of country rocks, mineralogical and chemical alteration.
- 3.4 Distortion of original structures, fossils, pebbles etc by the metamorphism discrimination between primary and secondary gneiss.
- 3.5 Field study of structure of Igneous rocks,, topographic expression of igneous rock; difference between vesicular structure vs. weathering Pits; amygdaloidal vs. porphyritic structure.

**Unit-4**

- 4.1 Field interpretation of sedimentary material: nature of parent rock; physiographic condition at the time of deposition; age relation of sedimentary material
- 4.2 Bedding; causes of tilting and folding of beds; distinction between primary and secondary dip; amount of tilting and direction of force.
- 4.3 Topographic expression of folds; effect of topography on beneath of outcrop, correlation of outcrops.
- 4.4 Evidence of faulting; faults in relation to their time of origin
- 4.5 Age of joints; Relation of joints to erosion and topography Interpretation of joints.

**Unit-5**

- 5.1 Identification of environmental problems of a project site and remedial measures to be taken.

- 5.2 Prospecting methods: Airborne and ground prospecting methods.
- 5.3 Seismic geophysical prospecting methods.
- 5.4 Magnetic and gravity prospecting methods
- 5.5 Geophysical logging methods.

**Books recommended:**

1. Billings, M.P, (1984), Structural Geology, Prentice Hall of India
2. Lahee, FH (1961) Field Geology. Mc Graw Hills
3. Robert R.Compton, (1962), John Wiley & sons, Manual of field geology, INC, Newyork, London
4. Mathur S M (2001) Guide to field Geology, PHI Learning New Delhii.
5. Dayal, P. (1990). A Text Book of Geomorphology, Shukla Book Depot, Patna.
6. Sharma, H.S. (1990), Indian Geomorphology, concept Publ.Co., New Delhi
7. Duff.P.Mcl.D. (1992), Holmes, Principles of Physical Geology, Chapman and Hall, London
8. Phillips E. F.C. (1994). The use of Stereographic projection in Structural Geology, Arnold Publishers.

**Note for paper setting**

**Internal Assessment test** (Total 20 marks; Time duration 1 hour): The internal assessment shall consist of one long answer type question of 10 marks and five short answer type questions of 2 marks each to be conducted after the completion of 50% syllabus from unit 1.1 to 2.2 (after 45 days).

**Semester End Examination** (Total 80 marks; Time duration - 2½ hours). The examination is to be conducted after completion of 100% of syllabus. The question paper shall consist of sections A, B and C .

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Section B will consist of **05** medium answer (250-300 words) questions of 7 marks each to be set from all the 5 units i.e. at least one question from each unit. **All questions are to be attempted** by the candidate. (Total 35 marks).

Section C will consist of 4/5 long answer (500-600 words) questions of 15 marks each and to bet set from entire syllabus. **Any TWO questions are to be attempted** by the candidate. (Total 30 marks)

## **SYLLABY AND COURSES OF STUDY IN GEOLOGY**

**For Examinations to be held in the years March 2018, 2019, 2020**

### **SEMESTER IV**

**Course No. UGETC401**

**Credit: 04**

**Time: 2½ hours**

**Titles; Stratigraphy & Palaeontology**

**Maximum Marks: 100**

External: -- 80 Marks

Internal:-- 20 Marks

#### **Unit 1**

- 1.1 Definition, Principle of stratigraphy; Geological Time Scale.
- 1.2 Stratigraphic correlation: Paleontological and Non-Paleontological
- 1.3 Stratigraphic classification.
- 1.4 Physiographic and tectonic division of India.
- 1.5 Code of stratigraphic nomenclature.

#### **Unit 2**

- 2.1 Dharwar Super group: Lithology, Structure and Classification.
- 2.2 Geological succession of Cudappah Supergroup
- 2.3 Geological succession of Delhi Super group and Geology of Singbhum.
- 2.4 Salkhala rocks of Kashmir, Dogra slates, Simla slates
- 2.5 Geological succession of Vindhya rocks in India

#### **Unit-3**

- 3.1 Palaeozoic Succession of Kashmir, Spiti and Zaskar area
- 3.2 Classification distribution and economic importance of Gondwana rocks in India
- 3.3 Triassic succession of Spiti, Jurassic rocks of Kutch and Cretaceous of Trichinopoly.
- 3.4 Distribution and Classification of Deccan Basalt.
- 3.5 Palaeogene-Neogene sequences of northwest Himalaya and Assam.

#### **Unit-4**

- 4.1 Palaeontology: definition; Fossils: definition, characters, binomial nomenclature in taxonomy, significance of fossils.
- 4.2 Condition of fossilization, mode of preservation of fossils.
- 4.3 Morphology and geological distribution of Trilobite.
- 4.4 Morphology and geological distribution of Brachiopods.
- 4.5 Morphology and geological distribution of Pelecypods.

#### **Unit-5**

- 5.1 Morphology and geological distribution of Cephalopds and Gastropods.
- 5.2 Morphology and geological distribution of Echinoida.
- 5.3 Morphology and geological distribution of Gastropods.

- 5.4 Evolutionary history of Horse.  
5.5 Morphology, distribution and significance of Gondwana Flora.

**Books Recommended:**

1. Wadia, D.N -----Geology of India. Mc Graw Hill Book co.
2. Krishnan, M.S. ----- Geology of India and Burma, 6th Edition. CBS Publ.
3. Ravindra Kumar,. ----- Fundamentals of Historical Geology & Stratigraphy of India. Wiley Eastern.
4. Shrock, R.R. & Twenhoffel, W.H.,----- Principles of Invertebrate Paleontology
5. Swinerton, HH., ----- Outlines of Paleontology. Edward Arnold Publishers
6. Jain, P.C. & Anantharaman, M.S., ---Palaeontology: Evolution & Animal Distribution.

**Note for paper setting**

**Internal Assessment test** (Total 20 marks; Time duration 1 hour): The internal assessment shall consist of one long answer type question of 10 marks and five short answer type questions of 2 marks each to be conducted after the completion of 50% syllabus from unit 1.1 to 2.2 (after 45 days).

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Section B will consist of **05** medium answer (250-300 words) questions of 7 marks each to be set from all the 5 units i.e. at least one question from each unit. **All questions are to be attempted** by the candidate. (Total 35 marks).

Section C will consist of 4/5 long answer (500-600 words) questions of 15 marks each and to be set from entire syllabus. **Any TWO questions are to be attempted** by the candidate. (Total 30 marks)

**For Examinations to be held in the years March 2018, 2019, 2020**

**SEMESTER IV**

**Course No. UGEPC402**

**Credit: 02**

**Time: 04 hours**

**Titles: Practical - Stratigraphy & Palaeontology**

**Maximum Marks: 50**

External: -- 25 Marks

Internal:-- 25 Marks

**PRACTICALS: -**

1. Morphological characters, systematic position and age of fossil genera pertaining to Brachiopods, Pelecypods, Cephalopods, Trilobite and Echinacea.
2. Preparation of lithostratigraphic maps of India showing distribution of important geological formations.

Note: The practical component shall be of 50 marks comprising of continuous class assessment, practical test and attendance. The breakup of marks shall be as follows:

10 marks as continuous class assessment in practicals, 10 marks written examination (four hours duration) at the end of the semester, and 5 marks for practical attendance (to be allotted as per statutes). External Examination 15 marks for test, 5 marks for attendance and and 5 marks Viva-voce.

**SKILL ENHANCEMENT COURSE**

**For Examinations to be held in the years March 2018, 2019, 2020**

**SEMESTER IV**

**Course No. UGETS403**

**Title: Techniques in the identification of minerals, rocks and fossils.**

**Credit: 04**

**Maximum Marks: 100**

**Time: 2½ hours**

External: --- 80 Marks

Internal:-- 20Marks

**Unit 1**

- 1.1 Crystalline and amorphous substances; Physical, Electrical, Magnetic and Thermal Properties of minerals and their identification.
- 1.2 Properties of precious and semi-precious minerals.
- 1.3 Mineral separation techniques: magnetic separation, density separation, separation. Reasons for separation.
- 1.4 Determination of specific gravity of minerals- principles and methods
- 1.5 Techniques for thin section preparation: Cutting, mounting, sawing and grinding and polishing.

**Unit-2**

- 2.1 Concept and use of transmitted and reflected light microscopy.
- 2.2 Rotational method for the polarising microscope: Universal stage; nomenclature of axes of rotation. Equipment for conoscopic light.
- 2.3 Determination of refractive index using becke line; oblique illumination, wave length dispersion.
- 2.4 Staining techniques: methods for rock slab and method for uncovered thin section.
- 2.5 Staining of K-feldspars and plagioclase feldspars and carbonate minerals

**Unit-3**

- 3.1 Field identification of the rocks: mineralogical composition, colour index, textural features.
- 3.2 Principle of Modal analysis by point counter, Modal analysis of the rock slab;
- 3.3 Concept of geochemical analysis of the rocks. Different types of geochemical analysis.
- 3.4 Normative calculation rules for calculating the CIPW Norm.
- 3.5 Concept of Grain Size analysis in sedimentary rocks.

**Unit-4**

- 4.1 Statistical analysis of data; Frequency distribution, mean
- 4.2 Variance, standard deviation..
- 4.3 QAP classification of igneous rocks
- 4.4 Concept of the Graphical representation of the metamorphic rock:
- 4.5 The ACF and ACF diagram for representing metamorphic paragenesis

## Unit-5

- 5.1 Study of fossils showing various modes of fossilization.
- 5.2 Techniques of identification of fossils.
- 5.3 Application of zoological code of nomenclature for taxonomic studies.
- 5.4 Techniques of separation of microfossils from matrix.
- 5.5 Moulding and casting

### Books Recommended:

1. W.A.Deer, R.A.Howie and J.Zussman, 1966, An Introduction to the Rock Forming minerals, Longmans.
2. Alexander N.Winchell, 1968, Elements of Optical Mineralogy, Parts I and II, Wiley Eastern (P) Ltd.,
3. Ernest, E.Walhstrom, 1960, Optical Crystallography, John Wiley and Sons.
4. E.S.Dana, 1935, A Text Book of Mineralogy, John Wiley & Sons.
5. L.G.Berry Mason, 1961, Mineralogy, W.H.Freeman & Co.,
6. Kerr,B.F., 1995, Optical Mineralogy 5th Ed. Mc Graw Hill, New York.
7. S.Mitra, 1994, Fundamentals of Optical, Spectroscopic and X-ray Mineralogy, S.R.Technico Book House, Ashok Raj Path, Patna
8. Swinerton, HH., ---- Outlines of Paleontology. Edward Arnold Publishers
9. P.C. Jain, & M S Anantharaman ---Palaeontology: Evolution & Animal Distribution
10. Hutchison, C. S. 1974 . Laboratory handbook of petrographic techniques.Wiley-Interscience.

### Note for paper setting

**Internal Assessment test** (Total 20 marks; Time duration 1 hour): The internal assessment shall consist of one long answer type question of 10 marks and five short answer type questions of 2 marks each to be conducted after the completion of 50% syllabus from unit 1.1 to 2.2 (after 45 days).

**Semester End Examination** (Total 80 marks; Time duration - 2½ hours). The examination is to be conducted after completion of 100% of syllabus. The question paper shall consist of sections A, B and C .

Section A will consist of **05** short answer (70-80 words) questions of 03 marks each to be set from all the 5 unit i.e. at least one question from each unit. **All questions are to be attempted** by the candidate. (Total 15 marks)

Section B will consist of **05** medium answer (250-300 words) questions of 7 marks each to be set from all the 5 units i.e. at least one question from each unit. **All questions are to be attempted** by the candidate. (Total 35 marks).

Section C will consist of 4/5 long answer (500-600 words) questions of 15 marks each and to be set from entire syllabus. **Any TWO questions are to be attempted** by the candidate. (Total 30 marks)

# SYLLABY AND COURSES OF STUDY IN GEOLOGY

## DISCIPLINE SPECIFIC ELECTIVE

For Examinations to be held in the years December 2018, 2019, 2020.

### SEMESTER V

**Course No UGETE501**

**Credit: 04**

**Time: 2½ hours**

**Title: Elements of Applied Geology**

**Maximum Marks: 100**

External: --- 80 Marks

Internal: -- 20 Marks

#### Unit 1

- 1.1 Role of Engineering geologists in planning, design and construction of major man-made structural features
- 1.2 Rock aggregates; Significance as Construction Material
- 1.3 Soil and Soil groups of India.
- 1.4 Highways; constructions in Hilly area, marsh area, desert.
- 1.5 Environmental considerations for mining,

#### Unit 2:

- 2.1 Types of dams, Geology of dam sites
- 2.2 Forces acting on the Dams, problems associated with dam sites.
- 2.3 Geotechnical and environmental implications in the Dam construction.
- 2.4 Geology of reservoirs, Geological investigation of reservoir sites.
- 2.5 Problem associated with reservoirs and their remedial measures.

#### Unit-3

- 3.1 Constructions of the tunnels in the soft and hard rocks, problems and remedial measures.
- 3.2 Tunnels: Geological investigation of tunnels sites.
- 3.3 Bridges: Terminology, stability of bridges, foundation of the bridges.
- 3.4 Landslides: Classification of landslides., Causes of landslides and prevention of landslides.
- 3.5 Case histories related to Indian Civil Engineering Projects

#### Unit 4

- 4.1 Foundation treatment; Grouting, Rock Bolting and other support mechanisms
- 4.2 Intact Rock and Rock Mass properties
- 4.3 Concept, Mechanism and Significance of Rock Quality Designation (RQD).
- 4.4 Concept, Mechanism and Significance of Rock Structure Rating (RSR)
- 4.5 Concept, Mechanism of Rock Mass Rating (RMR)

#### Unit.5

- 5.1 Concept, Mechanism of Tunnelling Quality Index (Q)
- 5.2 Earthquakes cause corrective/Preventive measures.

- 5.3 Physical and engineering properties of soil.
- 5.4 Surface Methods of Geological investigations for civil engineering.
- 5.5 Surveying by Plane Table/Theodolite; Preparation of engineering geological maps; Engineering.

### **Books Recommended:**

1. Krynin, D.P. and Judd W.R. Principles of Engineering Geology and Geotechnique, McGraw Hill.
2. Johnson, R.B. and De Graf, J.V. . Principles of Engineering Geology, John Wiley.
3. Valdiya, K.S.----- Environmental Geology – Indian Context. Tata McGraw Hill.
4. Krynine D.P. and Judd W.R.,----- Principles of Engineering Geology & Geotechnics. McGraw-Hill Book
5. Crozier. M.J.. ----Landslides: causes, consequences and environment. Academic Press.

### **Note for paper setting**

**Internal Assessment test** (Total 20 marks; Time duration 1 hour): The internal assessment shall consist of one long answer type question of 10 marks and five short answer type questions of 2 marks each to be conducted after the completion of 50% syllabus from unit 1.1 to 2.2 (after 45 days).

**Semester End Examination** (Total 80 marks; Time duration - 2½ hours). The examination is to be conducted after completion of 100% of syllabus. The question paper shall consist of sections A, B and C .

Section A will consist of **05** short answer (70-80 words) questions of 03 marks each to be set from all the 5 unit i.e. at least one question from each unit. **All questions are to be attempted** by the candidate. (Total 15 marks)

Section B will consist of **05** medium answer (250-300 words) questions of 7 marks each to be set from all the 5 units i.e. at least one question from each unit. **All questions are to be attempted** by the candidate. (Total 35 marks).

Section C will consist of 4/5 long answer (500-600 words) questions of 15 marks each and to be set from entire syllabus. **Any TWO questions are to be attempted** by the candidate. (Total 30 marks)

**For Examinations to be held in the years December 2018, 2019, 2020.**

### **SEMESTER V**

**Course No UGEPE502**

**Credit: 04**

**Time: 04 hours**

**Title: Practical -Elements of Applied Geology**

**Maximum Marks: 50**

External: --- 25 Marks

Internal: -- 25 Marks

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'



Note: The practical component shall be of 50 marks comprising of continuous class assessment, practical test and attendance. The breakup of marks shall be as follows:

10 marks as continuous class assessment in practicals, 10 marks written examination (four hours duration) at the end of the semester, and 5 marks for practical attendance (to be allotted as per statutes). External Examination 15 marks for test, 5 marks for attendance and and 5 marks Viva-voce.

#### SKILL ENHANCEMENT COURSE

**For Examinations to be held in the years December 2018, 2019, 2020.**

### SEMESTER V

**Course No - UGETS503**

**Credit: 04**

**Time: 2½ hours**

**Title: Photo Geology and Remote Sensing**

**Maximum Marks: 100**

External: --- 80 Marks

Internal: -- 20 Marks

#### **Unit 1:**

- 1.1 Photogeology. Types of Aerial photographs and information records on aerial photographs.
- 1.2 Geometry of aerial photographs stereoscopic vision and stereoscope.
- 1.3 Elements of air photo interpretation
- 1.4 Identification of sedimentary, igneous and metamorphic rocks.

#### **Unit 2**

- 2.1 Introduction and scope of Remote Sensing in assessment and evaluation of natural resources.
- 2.2 Define the basic principles of satellite Remote Sensing: Electromagnetic Radiation
- 2.3 Advantages and limitations of Remote Sensing
- 2.4 Satellites and satellite imageries their interpretation.

#### **Unit 3**

- 3.1 Interpretation and advantages of Thermal imagery
- 3.2 Introduction, TIR region of electromagnetic spectrum, thermal properties of material.
- 3.3 Introduction of Electromagnetic Spectrum.
- 3.4 Application of Microwave Remote Sensing.

#### **Unit 4**

- 4.1 Introduction and components of GIS(geographical information system)
- 4.2 Applications of GIS, (Geographical information system)
- 4.3 Data formats- Raster and Vector
- 4.4 Spatial data models and data editing

#### **Unit 5**

- 5.1 Concept of Global positioning System (GPS) and its segments
- 5.2 Applications of Global positioning System(GPS)
- 5.3 Integrating GPS data with GIS
- 5.4 Applications in earth system sciences

**Books recommended:**

1. Demers, M.N. *Fundamentals of Geographic Information System*, John Wiley & sons. Inc.
2. Hoffmann-Wellenhof, B., Lichtenegger, H. and Collins, J.: *GPS: Theory & Practice*,
3. George J. *Fundamentals of Remote Sensing* Universal Press
4. Campbell J B and Randolph H W *Introduction to remote sensing*. Guilford press.

### **Note for paper setting**

**Internal Assessment test** (Total 20 marks; Time duration 1 hour): The internal assessment shall consist of one long answer type question of 10 marks and five short answer type questions of 2 marks each to be conducted after the completion of 50% syllabus from unit 1.1 to 2.2 (after 45 days).

**Semester End Examination** (Total 80 marks; Time duration - 2½ hours). The examination is to be conducted after completion of 100% of syllabus. The question paper shall consist of sections A, B and C .

Section A will consist of **05** short answer (70-80 words) questions of 03 marks each to be set from all the 5 unit i.e. at least one question from each unit. **All questions are to be attempted** by the candidate. (Total 15 marks)

Section B will consist of **05** medium answer (250-300 words) questions of 7 marks each to be set from all the 5 units i.e. at least one question from each unit. **All questions are to be attempted** by the candidate. (Total 35 marks).

Section C will consist of 4/5 long answer (500-600 words) questions of 15 marks each and to be set from entire syllabus. **Any TWO questions are to be attempted** by the candidate. (Total 30 marks)

**SYLLABY AND COURSES OF STUDY IN GEOLOGY**

**For Examinations to be held in the years March 2019, 2020, 2021**

**SEMESTER VI**

**Course No.: UGETE601**

**Credit: 04**

**Time: 2½ hours**

**Title: Economic Geology and Hydrology**

**Maximum Marks: 100**

External: -- 80 Marks

Internal: -- 20 marks

**Unit 1**

- 1.1 Ores, gangue minerals, tenor grade and lodes.
- 1.2 Resources and reserves- classification of reserves
- 1.3 Mineral conservation and substitution
- 1.4 National Mineral policy

**Unit-2**

- 2.1 Magmatic process of ore formation: Early and Late magmatic.
- 2.2 Hydrothermal process of the formation of ore deposits, Type of hydrothermal deposits: cavity filling and replacement deposits.
- 2.3 Metamorphic and metamorphosed ore deposits.
- 2.4 Mechanical process of ore formation: Place deposits.

**Unit-3**

- 3.1 Distribution and occurrence of Copper and Pb-Zn deposits in India
- 3.2 Distribution and occurrence of iron ore deposits in India
- 3.3 Formation and distribution of Coal in India
- 3.4 Distribution of Oil; and Gas in India

**Unit 3:**

- 4.1 Definition of hydrogeology, Hydrological cycle.
- 4.2 Hydrological parameters - Precipitation, evaporation,
- 4.3 Transpiration and infiltration
- 4.4 Origin of groundwater; Vertical distribution of groundwater

**Unit-V**

- 5.1 Aquifers: Definition and types of aquifers, coastal aquifers
- 5.2 Water bearing properties of rocks - Porosity and Permeability; specific yield, specific
- 5.3 Springs: Definition and types of springs, gysers
- 5.4 Groundwater provinces of India

**Books recommended**

1. Sinha & Rai-----Mineral economics
2. N.L Sharma-----Geology of Coal & Indian coal fields
3. Krishnaswamy-----Mineral deposits of India
4. Gokhle & Rao-----Ore Deposits of India
5. U. Prasad-----Economic geology

6. Todd, D. K-----Groundwater hydrology, 2nd Ed., John Wiley & Sons, N.Y.
7. Davis, S. N. and De Weist, R.J.M.----- Hydrogeology, John Wiley & Sons Inc., N.Y.
8. Karanth K.R.-Groundwater assessment, Development and management, Tata McGraw-Hill Pub.Co. Ltd.

### Note for paper setting

**Internal Assessment test** (Total 20 marks; Time duration 1 hour): The internal assessment shall consist of one long answer type question of 10 marks and five short answer type questions of 2 marks each to be conducted after the completion of 50% syllabus from unit 1.1 to 2.2 (after 45 days).

**Semester End Examination** (Total 80 marks; Time duration - 2½ hours). The examination is to be conducted after completion of 100% of syllabus. The question paper shall consist of sections A, B and C .

Section A will consist of **05** short answer (70-80 words) questions of 03 marks each to be set from all the 5 unit i.e. at least one question from each unit. **All questions are to be attempted** by the candidate. (Total 15 marks)

Section B will consist of **05** medium answer (250-300 words) questions of 7 marks each to be set from all the 5 units i.e. at least one question from each unit. **All questions are to be attempted** by the candidate. (Total 35 marks).

Section C will consist of 4/5 long answer (500-600 words) questions of 15 marks each and to be set from entire syllabus. **Any TWO questions are to be attempted** by the candidate. (Total 30 marks)

**For Examinations to be held in the years March 2019, 2020, 2021**

### SEMESTER VI

**Course No. : UGEPE602**  
**Credit: 02**  
**Time: 04 hours**

**Titles: Practical - Economic Geology & Hydrology**  
**Maximum Marks: 50**

External: -- 25 Marks  
Internal:-- 25 Marks

**1. Economic Geology:**

Study of ore and economic minerals in hand specimen;  
Preparation of maps showing distribution of important metallic and non-metallic deposits and important coal and oil fields of India.

**2. Hydrology:**

Estimation of porosity and permeability from the given data;  
Preparation and interpretation of water table maps.

Note: The practical component shall be of 50 marks comprising of continuous class assessment, practical test and attendance. The breakup of marks shall be as follows:

10 marks as continuous class assessment in practicals, 10 marks written examination (four hours duration) at the end of the semester, and 5 marks for practical attendance (to be allotted as per statutes). External Examination 15 marks for test, 5 marks for attendance and and 5 marks Viva-voce.

## Skill Enhancement Course

For Examinations to be held in the years March 2019, 2020, 2021

### SEMESTER VI

**Course No :- UGETS603**

**Credit: 04**

**Time: 2½ hours**

**Title: Environmental Geology**

**Maximum Marks: 100**

External: --- 80 Marks

Internal:-- 20Marks

#### Unit-1

- 1.1 Environmental geology; Definition, scope, application
- 1.2 Radioactivity in the atmosphere and air pollution chemistry.
- 1.3 Water: Sources, consequences, control of water pollution. Soil: Sources and nature of Soil pollution and its harmful effects.
- 1.4 Fresh water and marine chemistry, biochemical aspects f water pollutants, role of water in the environment.

#### Unit-2

- 2.1 Some significant chemical processes such as photosynthesis, fermentation and biodegradation
- 2.2 Application of meteorological principles to transport and diffusion of pollutants.
- 2.3 Effects of meteorological parameters on pollutants and vice versa.
- 2.4 Preliminary concepts of climate change. Seasons in India, Monsoons, El Nino, ENSO

#### Unit-3

- 3.1 Photosynthesis, food-chains. Energy resources and their exploitation
- 3.2 Resources of energy, energy use pattern in different parts' of the world and its impact on the environment.
- 3.3 Radioactivity from nuclear reactors, fuel processing and radioactive waste, hazards related to hydropower.
- 3.4 Types, sources and consequences, of water pollution, ecological and biochemical aspects of water pollution.

#### Unit-4

- 4.1 Types and characteristics of domestic, industrial agricultural wastes – their effects on water bodies.
- 4.2 Sewage and waste water treatment. Water pollution control, case studies.
- 4.3 The division of the marine environment – benthonic, pelagic, bathyal, littoral. Ocean waters as a biological environment
- 4.4 Effects of pollution on marine life.

#### Unit-5

- 5.1 Definition of pollution. Different types of pollution – Air, Water and soil and their local, regional and global aspects.
- 5.2 Air: Sources of air pollutants, their sources and behaviour in the atmosphere. Effects of air pollutants on humans, animals, plants and properties.
- 5.3 Solid waste management principles. Environmental problems associated with noise pollution.
- 5.4 Radioactive pollution, management.

## **Books recommended.**

1. Verma, V.K.----- Geomorphology Earth surface processes and form. McGraw Hill.
2. Thornbury W. D.--Principles of Geomorphology Wiley Eastern Ltd., New Delhi.
3. Valdiya, K. S.,-----Environmental Geology - Indian Context. Tata McGraw Hill New Delhi.
4. Keller, E. A.----- Environmental Geology. Shales E. Merrill Publishing Co., Columbus, Ohio.
5. Bird, Eric, ----- Coastal Geomorphology: An Introduction. John Wiley & Sons, Ltd. Singapore.

## **Note for paper setting**

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