

# **School Of Studies in Earth Science Choice Based Credit System Syllabus of M.Sc. Geology Vikram University Ujjain, M.P. SESSION-2018-19 (ONWARD)**

**Program Outcome:** Geology is field science, it deals with the surface and sub surface details of Earth. Surface details includes geomorphological feature, tectonic history, river valley, lake, etc. whereas subsurface details includes mineralization of minerals and metals, fossilization, structures, mining, Stratigraphic sequence, exploitation of energy minerals like of coal, petroleum and atomic minerals their exploitation and specific impact of mining on environmental with reference to their mitigation issues. Water is another important minerals found in earth at various layers of their aquifers. To know the occurrences exploitation techniques are employed; by which water crisis is managed. We know that our earth is full of saline water about 97.2% others of the whole globe; in which 2.15% is as ice cap or glaciers. Only 0.65% water is fresh water to use by mankind.

**Program Specific Outcome:** By doing M.Sc. geology, our students get opportunities in UPSC, State PSC, Atomic Mineral Division, Coal India Ltd. , ONGC, NMDC, NGRT, State DGM, Bhart Gold Mine Ltd., HZL, GSI, HCL, MECL, Indian Diamond Industries Ltd. etc.

Various private sector like:- lime stone, sand stone, all major and minor minerals along with Coal/lignite mining, Cairn Gas, Indian Oil companies, Reliance and Adani Gas and oil exploration companies, Bhart Earth rare Earth Mineral etc. various abroad sector are also giving opportunities to our students like African Diamond, Copper, Emerald, Magnese industries; USA Canada – Water health Engineering, Middle East Countries - Oil Exploration, Mud Logger etc.

Australia – Coal Mining expert for coke variety. Eurasian Country – coal mining and Oil exploration engineers.



**School Of Studies in Earth Science**  
**Choice Based Credit System Syllabus of M.Sc. Geology**  
**Vikram University Ujjain, M.P.**

**SESSION-2018-19 (ONWARD)**

**Semester – I (All courses compulsory)**

| Nature of Paper      | Paper Code | Paper Name                   | Marks Theory | Internal Marks | Total Marks | Min Marks  |           | Total Credits |
|----------------------|------------|------------------------------|--------------|----------------|-------------|------------|-----------|---------------|
|                      |            |                              |              |                |             |            |           |               |
| Core                 | T-101      | Geodynamics                  | 60           | 40             | 100         | 21         | 14        | 5             |
| Core                 | T-102      | Structural Geology           | 60           | 40             | 100         | 21         | 14        | 5             |
| Elective-I           | T-103      | Mineralogy & Geochemistry    | 60           | 40             | 100         | 21         | 14        | 5             |
| Elective-II          | T-104      | Geomorphology                | 60           | 40             | 100         | 21         | 14        | 4             |
| Elective III         | T-105      | Enterpreneurship development | 60           | 40             | 100         | 21         | 14        | 4             |
| Practical            | P-106      | Based on theory papers       | 100          | -              | 100         | 35         |           | 3             |
| Viva                 | V-107      | Comprehensive Viva           | 100          | -              | 100         | 35         |           | 4             |
| <b>Total Credits</b> |            |                              | <b>500</b>   | <b>200</b>     | <b>700</b>  | <b>175</b> | <b>70</b> | <b>30</b>     |

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**Semester – II (All courses compulsory)**

| Nature of Paper      | Paper Code | Paper Name                      | Marks Theory | Internal Marks | Credits of Theory | Credits of Internal | Total Credits |
|----------------------|------------|---------------------------------|--------------|----------------|-------------------|---------------------|---------------|
| Hard Core            | T-201      | Igneous & Metamorphic Petrology | 75           | 25             | 3                 | 1                   | 4             |
| Hard Core            | T-202      | Sedimentology                   | 75           | 25             | 3                 | 1                   | 4             |
| Hard Core            | T-203      | Stratigraphy                    | 75           | 25             | 3                 | 1                   | 4             |
| Elective             | T-204      | Palaeobiology                   | 75           | 25             | 3                 | 1                   | 4             |
| Practical/Field Work | P-201      | Based on T-201 & T-202          | 50           | -              | -                 | -                   | 2             |
| Practical            | P-202      | Based on T-203 & T-204          | 50           | -              | -                 | -                   | 2             |
| <b>Total Credits</b> |            |                                 |              |                |                   |                     | <b>20</b>     |

**SESSION- 2017-18 (ONWARD)****Semester – III (All courses compulsory)**

| Nature of Paper      | Paper Code | Paper Name                    | Marks Theory | Internal Marks | Credits of Theory | Credits of Internal | Total Credits |
|----------------------|------------|-------------------------------|--------------|----------------|-------------------|---------------------|---------------|
| Hard Core            | T-301      | Engineering Geology           | 75           | 25             | 3                 | 1                   | 4             |
| Hard Core            | T-302      | Ore Geology                   | 75           | 25             | 3                 | 1                   | 4             |
| Hard Core            | T-303      | Mineral Exploration           | 75           | 25             | 3                 | 1                   | 4             |
| Elective             | T-304      | Remote Sensing & Photogeology | 75           | 25             | 3                 | 1                   | 4             |
| Practical            | P-301      | Based on T-301 & T-302        | 50           | -              | -                 | -                   | 2             |
| Practical            | P-302      | Based on T-303 & T-304        | 50           | -              | -                 | -                   | 2             |
| <b>Total Credits</b> |            |                               |              |                |                   |                     | <b>20</b>     |

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**Semester – IV (All courses compulsory)**

| <b>Nature of Paper</b>      | <b>Paper Code</b> | <b>Paper Name</b>   | <b>Marks Theory</b> | <b>Internal Marks</b> | <b>Credits of Theory</b> | <b>Credits of Internal</b> | <b>Total Credits</b> |
|-----------------------------|-------------------|---|---------------------|-----------------------|--------------------------|----------------------------|----------------------|
| Hard Core                   | T-401             | Fuel Geology  | 75                  | 25                    | 3                        | 1                          | 4                    |
| Hard Core                   | T-402             | Mining and Mineral Dressing   | 75                  | 25                    | 3                        | 1                          | 4                    |
| Hard Core                   | T-403             | Hydrogeology  | 75                  | 25                    | 3                        | 1                          | 4                    |
| Project Based On Field Work | T-404             | Subject Based   | 25                  | -                     | -                        | -                          | 1                    |
| Practical                   | P-401             | Based on T-401 & T-402  | 50                  | -                     | -                        | -                          | 2                    |
| Practical                   | P-402             | Based on T-403 & T-404 (Comprehensive Viva Voce)  | 50                  | -                     | -                        | -                          | 2                    |
| Open Elective (Any one)     | T-405             | Environmental Geology Or Computer Applications in Geology or Mining & Minerals Rules(Major & Minor) Or Gemology Or Marine Geology | 50                  | 25                    | 2                        | 1                          | 3                    |
| <b>Total Credits</b>        |                   |   |                     |                       |                          |                            | <b>20</b>            |

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## **CHOICE BASED CREDIT SYSTEM SYLLABUS OF M.SC. GEOLOGY**

**CLASS:** M.SC. PREVIOUS  
**SUBJECT: -** GEOLOGY  
**PAPER TITLE:** FIRST: GEODYNAMICS (T-101)  
**SEMESTER:** FIRST  
**SESSION:** 2018-19  
**Object:**

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**Objectives:** To introduce the advanced ideas of internal structure of earth. To introduce the latest concept of geomagnetism and its application. To equip with the latest knowledge on tectonic evolution of Himalaya and Indian craton.

**Outcome:** In this paper physical and tectonic activity are being discussed with emphasis to seismology. Continental drifting, Volcanism, Earthquake, Plate movements and organic history of the earth. To make aware of the Students.

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### **Unit – 1**

Earth's surface features. Seismology: seismic waves, Intensity and isoseismic lines, earthquake belts, Earthquake zone of India, Seismograph, causes of Earthquake. Internal Structure of the Earth.

### **Unit – 2**

Volcanism: types and causes of volcanic eruptions. World distribution of volcanoes, Migration of volcanoes, Palaeomagnetism and its application for determining palaeoposition of continents.

### **Unit – 3**

Isostasy: Development of the concept, Isostatic anomalies, Isostatic models, evidence.

Geosynclines: Classification and evolution of Geosyncline, causes of subsidence and upliftment. Principles of Geodesy.

### **Unit – 4**

Continental drift: development of the concept, Taylor's theories of continental drift. Evidences of continental drift and polar wandering. Sea floor spreading. topography of mid-ocean ridges, Morphological features of ocean floor.

### **Unit – 5**

Concept of plate tectonics. Types of Plate boundary, feature of convergent and divergent boundaries. Palaeoposition of India and Geodynamics of the Indian plate. Ophiolite suites, Arc – Trench system, Volcanic Mountain chain. Triple Junctions and their stability. Causes of Plate Motion. Origin of the Himalayas. Seismic belts of the earth.

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### **References:**

Holmes, Doris L and Arthur: **Holmes' principles of Physical Geology**. Wiley

Wyllie, Peter J: **The Dynamic Earth**. Wiley

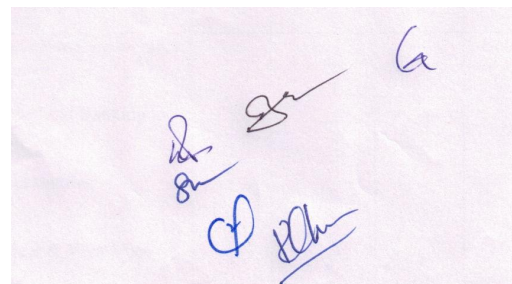
Hodgson, J H: **Earthquake and Earth Structures**. Prentice Hall

Martin H P Bott: **The interior of the Earth**. Edward Arnold

Condie K C: **Plate Tectonics and Crustal Evolution**.

Strahler: **Earth Science**.

Gutenberg Beno: **Internal Constitution of the Earth**. Dover



**CLASS: M.SC. –**  
**SUBJECT: -**  
**PAPER TITLE:**  
**SEMESTER:**  
**SESSION:**

**PREVIOUS**  
**GEOLOGY**  
**SECOND: STRUCTURAL GEOLOGY (T-102)**  
**FIRST**  
**2018-19**

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**Objectives:** In this course, you will acquire knowledge about the behavior of rocks under stress and strain, as well as the foliation-lineation fabric elements as well as the mechanics of folding and faulting.

**Outcome:** In this paper mechanics of folding and faulting, fracturing, lenition, foliation. Schistosity and joint pattern are given due important to makes aware students about the structural feather.

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**Unit – 1**

Rock failure: Mechanical principles of rock deformation, factors controlling behavior of material. Concept of stress and strain in two and three dimension, progressive deformation. Mohr circles. Symmetry concept in deformation. Unconformities: types and recognition. Progressive deformation – simple and pure shear.

**Unit – 2**

Geometry of folds surface: single and multi – layered. Super – imposed folding. Classification of folds. Types of folds. Recognition of folds. Effects of folds on outcrops.

**Unit – 3**

Geometry of faults. Classification and types of faults. Slips, separation, Recognition of faults. Causes of faulting. Mechanics of faulting.

**Unit – 4**

Origin , kind and their relation to other structures: fractures and joints, lineation, Foliation, Rock cleavages and schistosity.

**Unit – 5**

Mechanics of folding and faulting. Tectonic Fabrics. Magma Tectonics: emplacement of plutons, origin of Ring Dykes and Cone Sheets.

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**Reference:**

- Bayly B 1992: **Mechanics in Structural Geology**. Springer-Verlag  
Davis G H 1984: **Structural Geology of Rock & Region**. John Wiley  
Ghosh S K 1995: **Structural Geology of Fundamental of Modern Developments**.  
Hubert M K 1972: **Structural Geology**. Hafner Publications co. New York  
Moore E & Twiss R J 1995: **Tectonics**. Freeman Pergamon Press  
Price NJ and Cosgrove J W 1990: **Analysis of Geological Structure**. Cambriage University Press  
Hobbs, Means & Williams: **An Outline of Structural Geology**  
Fairhurst: **Rock Mechanics**. Pergamen Press, Whitten E H T: **Structural Geology of folding Rocks**  
Ramsey J.G. & Huber M.I. 1987: **Modern Structura Geology**, Academic Press  
Valdiya K.S. 1998 : **Tectonics and Sedimentation**, University Press  
Billings M.P. 2000: **Structural Geology**



**CLASS: M.Sc. –**  
**SUBJECT: -**  
**PAPER TITLE:**  
**SEMESTER:**  
**SESSION:**

**PREVIOUS**  
**GEOLOGY**  
**THIRD: Mineralogy & Geochemistry (T-103)**  
**FIRST**  
**2018-19**

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**Objectives:** In this paper be in part knowledge about the concepts and mechanism of various optical properties of crystals. To impart the knowledge about the concept of geochemistry and classification of elements.

**Outcome:** In this paper be in part the various aspects of minerals like geochemistry, atomic structure polymorphism, isomorphism etc. along with optics of the minerals. The geo chemical cycle distribution of elements of the crust mantel and core with their thermodynamic relationship and radioactive impart of given due care.

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### **Unit – 1**

Classification of Silicate structure. Polymorphism, isomorphism & Exsolution. Atomic structure & mineralogical properties of the following: Sulfides ( $AX$ ,  $A_2X$  &  $AX_2$ ), Oxides ( $XO$ ,  $X_2O$ ,  $XO_2$  &  $X_2O_3$ ) types; Sulfates (Hydrous & anhydrous); Carbonates (Calcite, aragonite & dolomite).

### **Unit – 2**

Atomic structure, chemistry, physical - optical properties & paragenesis of olivine, garnet, pyroxene, amphibole, mica, epidote & chlorite group minerals.

### **Unit – 3**

Atomic structure, chemistry, physical & optical properties of feldspar, feldspathoid, quartz, zeolite & aluminum silicate (Kyanite, sillimanite & andalucite) group minerals. Precious & semiprecious stones occurrences & distributions.

### **Unit- 4**

Principles of optics, double refraction, optical classification of minerals, optic sign, determination of refractive index, determination of interference colour & indicatrices.

### **Unit – 5**

Concept of geochemistry & geochemical cycle, geochemical classification of elements, composition of Earth, Law of thermodynamics, principle of ionic substitution in minerals & radioactivity.

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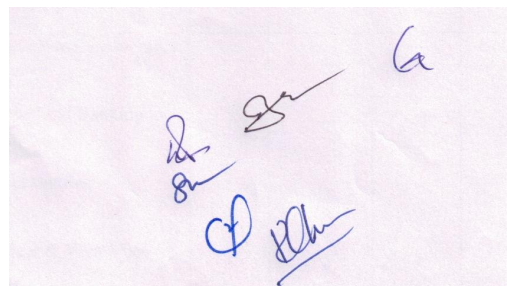
### **Reference books:**

Deer, WA; Howie, RA & Zussman J. (1996): Rock Forming Minerals.

Mason B. (1991): Principle of Geochemistry.

Dana: Text book of Mineralogy.

Phillips WR: Optical Mineralogy.



**CLASS: M.Sc. –**  
**SUBJECT: -**  
**PAPER TITLE:**  
**SEMESTER:**  
**SESSION:**

**PREVIOUS**  
**GEOLOGY**  
**FOURTH: GEOMORPHOLOGY (T-104)**  
**FIRST**  
**2018-19**

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**Objectives:** To introduce the fundamental concepts governing the landforms. Acquaintance with the concept of various geomorphological processes and landform evolution. Introduce the latest concept of chronology based on geomorphological studies in tectonic zones.

**Outcome:** In this paper surface feature of the land are being talked to students. How rivers, lakes, glaciers, deserts and various form doing with erosional features and marine impacts are highlighted.

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### **Unit – 1**

Concept of Geomorphology principles and their significance. Cycle of Erosion, Davis' and Plank' Cycle of Erosion. Slope Forming Processes: Landslides, Soil Creep and Solifluction.

### **Unit – 2**

Fluvial Agency: Types Of Rivers, Valley Development – Base Level And Its Verities, Graded Streams, Cross Profiles Of Valleys. Classification of Valleys. Drainage Patterns and Their Significance. Erosion Landforms and Depositional Landforms Of Streams.

### **Unit – 3**

Glaciers: Types of Glaciers, Regime of Glaciers, Nourishment of Glaciers, Wastage of Glaciers. Major features resulting from Glacial Erosion and Glacial Deposition. Glacio-Fluvial Features. Aeolian Agency, Topographic Effects of Wind Erosion. Landforms of Aeolian Deposition. Piedmonts and Piedmont Problems. Arid Cycle of Erosion.

### **Unit – 4**

Karst Topography: Important Areas Of Karst. Conditions Essential for Development Of Karst, Features Characteristic Of Karst Region. Origin of Limestone Caverns. Karst Geomorphic Cycle. Marine Erosion. Topographic Feature Resulting From Marine Erosion and Marine Depositions. Classification of Coasts.

### **Unit – 5**

Morphometric Analysis of Terrain and Its Significance. Morphometric Analysis Of Drainage Basin And Its Significance. Statistical Correlation Methods Fro Interpretation. The Organization of Drainage System.

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### **References:**

**Holmes, Doris Land Arthur:** Holmes' Principles of Physical Geology. Wiley

**Thornbury, W D:** Geomorphology. Wiley

Small, R J: Study of Landforms. Cambridge

Von Engelen, O D: Geomorphology Systematic and regional. MacMillan

Savinder Singh: Geomorphology,. Mathew Fontaine maury: The Physical geography of the Sea.

Harvard Univ Press,.David Lang: The Earth System. Brown Publishers





**CLASS:** M.SC. PREVIOUS  
**SUBJECT:** GEOLOGY  
**PAPER TITLE:** FIRST : IGNEOUS AND METAMORPHIC PETROLOGY(T-201)  
**SEMESTER:** SECOND  
**DATE:** 05-03-2016

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**Objectives** To acquaint the students of varied types of igneous rocks, their tectonic environment and petrogenesis. To discuss the process of metamorphic reactions and paragenesis. To study the various aspects of metamorphic facies. To acquaint the students with latest metamorphic processes. To introduce the students to concept of metamorphic convergence.

**Outcome:** by studying these papers, quality behavior and factors affecting the magma during crystallization vis-à-vis petrogenetic aspects. Their segregation deformation zoning paragenetic aspect, grade and facies analysis are highlighted to know the characters and behavior of magma in general formation of metals and minerals and also beauty of this study.

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#### **Unit-1**

Origin of magma. Factors affecting Magma composition. Evolution of magma by Differentiation and Assimilation. Phase Equilibria of Monary (Silica), Binary (Mixed and Eutectic) and Tertiary (Ab – An – Fa – Silica) Silicate Systems.

#### **Unit-2**

Classification of igneous rocks including IUGS system. Reaction principle. Reaction Series. Textures of igneous rocks and interpretation of crystallisation history. Layered igneous structures. Petrographic provinces.

#### **Unit-3**

Origin of Granite: magmatic and Granitisation Process. Petrogenesis, Petrography and Indian Occurrences of Basalt, Andesite, Carbonatite, Alkaline and Ultra Mafic rocks.

#### **Unit-4**

Agents of metamorphism. Kinds of metamorphism. Types of metamorphism. Metamorphic differentiation. Structures and textures of metamorphic rocks. Concept of metamorphic zones, metamorphic zones in contact aureoles.

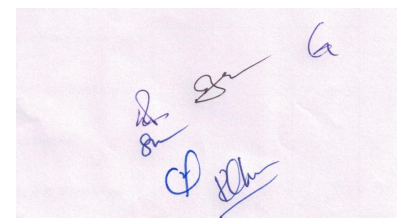
#### **Unit-5**

Metamorphic grades, facies and facies series. Facies classification. Metasomatism and their types. Origin and types of migmatites. Metamorphism of carbonates, Pelites, mafic rocks. Charnokites and Khondalites.

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#### **Suggested Readings:**

- Best, M.G. 1986:** Igneous and Metamorphic Petrology, CBS Publ.  
**Bose, M.K. 1997:** Igneous Petrology, World Press, **Huang, V J:** Petrology.  
**Butcher, K & Frey, M. 1994:** Petrogenesis of Metamorphic Rocks, Springer – Verlag  
**Kretz, R. 1994:** Metamorphic Crystallisation, John Wiley  
**Mc Birney, A.R. 1993:** Igneous Petrology, Jones and Bartlet Publ.  
**Phillipots, A. 1992:** Igneous and Metamorphic Petrology, Prentice Hall.  
**Turner, F.J. 1980:** Metamorphic Petrology, Mc Graw Hills  
**Yardley, B.W. 1989:** An Introduction to Metamorphic Petrology, Longman  
**Winkler, HGF:** Petrogenesis of Metamorphic Rocks, Springer Verlag  
**Miyashiro, A:** Metamorphism and Metamorphic rocks. George Allen and Unwin



Wyllie, PJ: Ultramafic Rocks. P J Heffer, **Chatterjee S.C.** Petrology  
**CLASS: M.SC. PREVIOUS**  
**SUBJECT: GEOLOGY**  
**PAPER TITLE: SECOND: SEDIMENTOLOGY (T-202)**  
**SEMESTER: SECOND**  
**DATE: 05-03-2016**

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**Objectives:** To impart knowledge about the processes operating in clastic sedimentology. To impart knowledge about the genesis of carbonate rocks. To study the sedimentary structures in carbonate rocks. To discuss the microfacies concept and techniques used for staining the carbonate minerals.

**Outcome:** Here the primary rocks affected by weathering and erosion leads to minerals deposition in the various forms like placers, strata bond deposit, and other mineral concentration are highlighted seems, sedimentary rocks content about 90% world mineral with them.

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### **Unit-1**

Process of sedimentation, Fluid Flow, Origin of Sediments. Modes of Transport of Sediments. Stoke's Law of Sediments. Classification and Nomenclature of the Common Sediments (rudites, arenites and argillites). Classification of Sedimentary Rocks.

### **Unit-2**

Origin, Classification and Significance of Primary, Secondary and Organic Sedimentary Structures. Paleocurrent Significance in Quality Assessment. Classification of Sandstone, Limestone and Dolomite.

### **Unit-3**

Textures of Sedimentary Rocks and Their Genetic Significance. Granulometric Analysis of Clastic Particles, Statistical Measure and Interpretation of Nature of Sediments. Diagenesis

### **Unit-4**

**Elements** and Types of Depositional Environments: Continental (Fluvial, Lacustrine, Aeolian and Glacial), Transitional and Marine Environments, Evaporites and Volcano- Clastic Sediments.

### **Unit-5**

Provenance and Mineral Stability. Concept and Types of Sedimentary Provenance. Heavy minerals: Their separation and Utility in the Provenance Analysis. Tectonic Framework of Sedimentation (Kay's Classification of Tectonic Elements). Cyclotherm.

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### **Suggested Readings:**

Allen, P. 1997: **Earth Surface Processes**. Blackwell  
Davis, R A, 1992: **Depositional Systems**. Prentice Hall  
Einsels, G 1992: **Sedimentary Basins**. Springer Verlag  
Miall AD, 2000: **Sedimentology and Stratigraphy**. Blackwell  
Reading H G. 1996: **Sedimentary Environments**. Blackwell  
Sengupta, S. 1997: **Introduction to Sedimentology**. Oxford IBH  
Pettijohn, F J: **Sedimentary Petrology**.  
Thompson and Collision: **Sedimentary Structures**.  
Pettijohn, Potter and Seiver: **Sand and Sand stones**.  
Sukhtankar RK (2004): Applied Sedimentology.



**CLASS:** M.Sc. – PREVIOUS  
**SUBJECT: -** GEOLOGY  
**PAPER TITLE:** Third: Stratigraphy (T-203)  
**SEMESTER:** Second  
**DATE:** 05.03.2016

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**Objectives** To impart knowledge about litho. bio. and chronostratigraphic classification, code of stratigraphic nomenclature, facies variations, Precambrian shield areas, Palaeozoic, Mesozoic and Cenozoic strata with faunal and floral elements and the Gondwana successions.

**Outcome:** It is one of the lucid branch of geology where principle of information uniformity is low of super position tectonic form work, magnetic litho, geo and chrono stratigraphy. Criteria are being discussed with students in the light of time scale. As we know mineral have no political boundary.

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### **Unit – 1**

Criteria for the Stratigraphic classification and correlation. Litho-, Bio- and Chrono- stratigraphic units. Magneto-stratigraphy. Sequence Stratigraphy. Geological time-Scale. Orogenic cycles in the Indian Stratigraphy. Tectonic framework of India. Geological column of Indian Stratigraphy.

### **Unit – 2**

Ice-ages in the Indian Stratigraphy: Precambrian, Permo-Carboniferous and Pleistocene ice ages, their evidences. Archaean (Azoic) History of India: Distributions and stratigraphy of the Archeans of South India, Madhya Pradesh, Rajasthan, Jharkhand and Orissa.

### **Unit – 3**

Precambrian (Proterozoic) History of India: Distribution and stratigraphy of the Cuddapah and Vindhyan Super Groups. Palaeozoic history: Distributions and stratigraphy of Salt Range and Spiti. Origin and age of Saline Formation. Precambrian – Cambrian Boundary problem.

### **Unit- 4**

Mesozoic history : Distributions and Triassic of Spiti, Jurassic of Cutch (Kachchh) and Cretaceous of South India. Bagh beds. Lameta beds. Deccan Traps. Permo- Triassic Boundary problem.

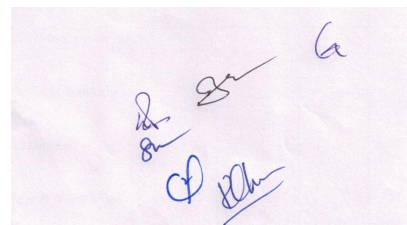
### **Unit – 5**

Palaeoclimate, classification, distribution and stratigraphy of the Gondwana Super Group. Cenozoic history : Tertiary of Assam, its economic importance. Siwaliks and its vertebrate fossil record. K-T Boundary.

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### **Reference books:**

Boggs Sam Jr 1995: Principles of Sedimentary and Stratigraphy. Prentice Hall  
Krishnan, M S: Geology of India and Burma. Higginbothams, Madras  
Ravindra Kumar: Historical Geology and Stratigraphy of India. John Wiley  
Wadia, D N : Geology of India. MacMillan & Co  
Doyle and Brennet MR 1996: Unlocking the Stratigraphy: Concepts and Application. Prentice Hall.



**CLASS:** M.Sc. – PREVIOUS  
**SUBJECT: -** GEOLOGY  
**PAPER TITLE:** Fourth : Palaeobiology (T-204)  
**SEMESTER:** Second  
**DATE:** 05.03.2016

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**Objectives:** To understand the basic principles of organic evolution and their application in palaeontology. To have an extensive knowledge of evolution and distribution of the important invertebrate fossil organisms. Application of international code of nomenclature for taxonomic studies. To provide conceptual knowledge of the evolutionary processes of vertebrates as evidenced from the fossil record. To have detailed knowledge of the evolution of saurischian and ornithischian reptiles, proboscideans, perissodactyls, and primates with an emphasis on fossil distribution of these groups in India. To have a working knowledge of plant fossils with special reference to those of Gondwana Group and their geological significance.

**Outcome:** Here Evolutionary history of human, horse and elephant are the key point of paper. Micropalantological, paleontological and palaeobotanical aspects with time and space are discuses in details to know how animal Kingdome and plant Kingdome evolved.

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#### **UNIT – 1**

Modes of fossilization, uses of fossils, Classification, evolution, geological history of: Trilobites, Graptolites, Echinoids and Corals.

#### **UNIT – 2**

Classification, evolution, geological history of the following : Brachiopoda, Gastropoda, Lamellibranchia and Cephalopoda.

#### **UNIT - 3**

Succession of the Vertebrate Life through the geologic time. Evolutionary history of Human, Elephant and Horse.

#### **UNIT – 4**

Micropaleontology : Classification, separation of microfossils. Applications of microfossils in fossil fuel exploration, Morphology and geological history of foraminifera.

#### **UNIT – 5**

Concept of Palaeobotany and Palynology. Plant life through ages. Characteristic features of Lower Gondwana flora. Characteristic features of Upper Gondwana flora.

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#### **Referenes:**

Moore, Lalicher and Fischer: **Invertebrate Paleontology**. Woods, Henry: **Invertebrate Paleontology**.

Clarkeson ENK 1998 : **Invertebrate Paleontology and Evolution**. Blackwell

Stearn CW and Carrol RL 1989: **Paleontology – the Record of Life**. John Wiley

Smith AB 1994: **Systematics and the Fossils Record- Documenting Evolutionary Patterns**.

Blackwell,.Prothero DR 1998: **Bringing Fossils to Life: An Introduction to Palaeobiology**. McGraw

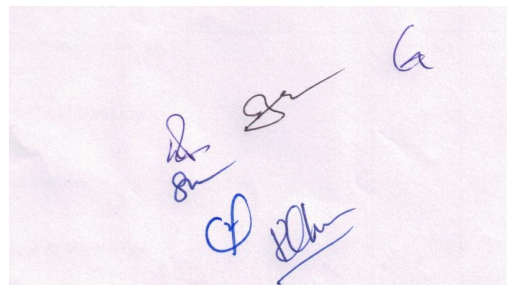
Anantharaman and Jain: **Textbook of Paleontology**.

Banner F T and Lord A R: **Aspects of Micropalaeontology**.

Roger A S: **Vertebrate Palaeontology**.

Jones D J: **Microfossils**.

Glassner M P: **Principles of Micropalaeontology**.



**CLASS:** M.Sc. – FINAL  
**SUBJECT: -** GEOLOGY  
**PAPER TITLE:** Fourth: MINERAL EXPLORATION (T-303)  
**SEMESTER:** Third  
**DATE:** 05.03.2016

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**Objectives:** It is intended to familiarize the post graduate students with the principles, methodology and application of important geophysical/mineral exploration methods adopted to investigate the surface and subsurface.

**Outcome:** In the preceding paper origin occurrence and there distributions was the key point of the study. Here how to explore and exploits those deposit there historical remain and modern technique are main topic of study.

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#### **UNIT – 1**

Geological criteria (ore-guides) for mineral prospecting, Methods of geological exploration : exploratory grids pits, trenches, well logging in evaluation of deposits.

#### **UNIT - 2**

Sampling types and methods. Assaying by channel sampling and placer sampling underground mining sampling. Calculation of ore reserves.

#### **UNIT – 3**

Classification and principles of geophysical methods: - Electrical methods and Magnetic methods.

#### **UNIT – 4**

Gravity methods : Earth's gravity fields, regional and local gravity anomalies, Interpretation of gravity anomalies for mineral deposits. Seismic methods; Elastic properties of rocks, types of elastic waves (P, S, L waves), Refraction and reflection methods, Time-distance relation for horizontal interface.

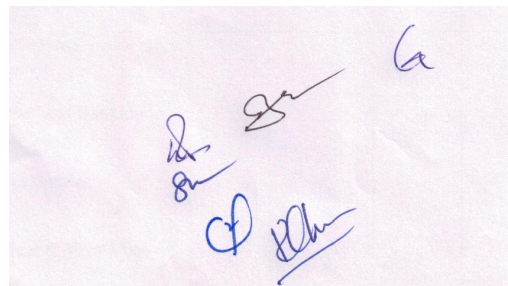
#### **UNIT - 5**

Geochemical Exploration: Geochemical cycle, Mobility of elements, Path finder elements, Mode of occurrence of trace elements, Primary dispersion patterns, Syngenetic and Epigenetic diffusion. Sampling technique for geochemical exploration.

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#### **References:**

Arogyaswamy RNP, 1996: **Courses in Mining Geology**. 4<sup>th</sup> Oxford IBH  
Dobrin MB. 1976: **Introduction to Geophysical Prospecting**. Mc Graw Hills  
Ginzburg i.I : **Principles of Geochemical Prospecting**. Pergamon London  
Hawkes H and Wobb JS : **Geochemistry in mineral Exploration**. Harper NY  
Holson GD and Tiratsoo EN, 1985: **Introduction to petroleum Geology**. Gulf Pubi



**CLASS:** M.Sc. – FINAL  
**SUBJECT: -** GEOLOGY  
**PAPER TITLE:** Third : Ore Geology (T-302)  
**SEMESTER:** Third  
**DATE:** 05.03.2016

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**Objectives** To impart the knowledge and understanding about the various processes of the ore formations. To introduce the modern concepts of the ore genesis. To understand the formation, mode of occurrences and types of various petrological ore associations. To understand the concepts used in the ore mineralogy. To understand the advance techniques used in ore genesis.

**Outcome:** here the paper is confined to the origin occurrences and geological distribution of various ore minerals are the main point of study. How it is form and were to look for is the main subject matter students.

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#### **UNIT – 1**

Relation of magma to mineral deposits. Geological thermometers. Ore genesis. Control of ore deposits. Paragenesis and zoning in mineral deposits.

#### **UNIT – 2**

Processes of Mineral Deposits: Magmatic concentration, Contact Metasomatism, Hydrothermal and Volcano-genetic deposits.

#### **UNIT – 3**

Processes of Mineral Deposits: Sedimentary, Placer, Residual and Oxidation and Supergene Enrichment. Ore Microscopy : Textures and Structures of Ores.

#### **UNIT – 4**

Origin, mode of occurrence, association. Uses and Indian occurrences of the ores of Iron, Manganese, Chromium, Nickel, Copper, Lead, Zinc, Aluminium, Tin, Tungsten and Gold.

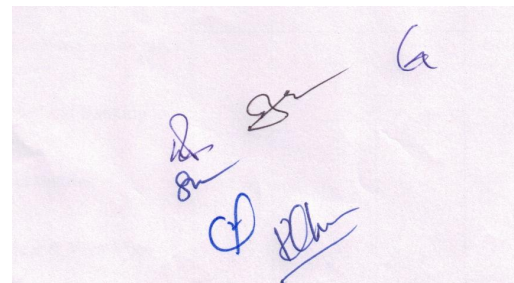
#### **UNIT – 5**

Origin, Mode of Occurrence, Association, Specification and grades for uses in Industries and Indian occurrences of the non-metallic minerals – Mica. Asbestos, Barite, Graphite, Gypsum. Minerals used in Fertilizers and Cement Industries.

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#### **References:**

Bateman, 1981: **Economic Mineral Deposits.** Wiley  
Deb. S. : **Industrial Minerals**  
Evans.JM 1993: **Ore Geology and industrial Minerals.** Blackwell  
Krishnaswamy: Mineral Resources of India  
Stanton R.L. 1972: Ore Petrology. Mc Graw Hill  
Srivastava J.P. & Rani N. Ore Geology



**CLASS:** M.Sc. – FINAL  
**SUBJECT: -** GEOLOGY  
**PAPER TITLE:** Second: ENGINEERING GEOLOGY (T- 301)  
**SEMESTER:** Third  
**DATE:** 05.03.2016

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**Objectives:** To impart knowledge about the materials of construction and their physical properties. To understand the impact of geologic conditions on foundation and design of buildings. To impart knowledge about the engineering consideration of seismicity and geological consideration for the construction of dams, bridges, tunnels and roads.

**Outcome:** This paper is back bone of modernization of any nation wide civil engineering project likes construction of dam, bridges, tunnels and there impacts on civilization with to know its geological. Where about with landslide. Features or geo hazards are the skeleton of the civilization are imported to the students.

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#### **UNIT - 1**

Importance of geology in civil engineering Projects. Merits and demerits of civil engineering in folds, faults and joints affected area. Engineering properties of rocks.

#### **UNIT - 2**

Tunnel: Terminology and Types, Geological Considerations for Tunneling in different Grounds. Lining of Tunnels. Highways- Geological considerations for construction of highways.

#### **UNIT – 3**

Dam and its parts: Types of dam. Geological considerations for the selection of a dam site and reservoir. Problems related to failure of Dams. Grouting.

#### **UNIT – 4**

Bridge : Types and Geological considerations. Canals : Geological considerations and lining.

#### **UNIT – 5**

Landslide : causes, effects and prevention. Consideration of civil engineering in seismic areas. Geo-hazards : mitigation and management.

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#### **References :**

Bell F G, 1999 : **Geological Hazards**. Rout ledge  
Blyth FCH : **Geology for Engineers**. Arnold Ltd.  
Kesavulu NC : **Textbook of Engineering Geology**. Mc Millan  
Khurmi RS : **Fundamental of Engineering Geology**. Dhanpat Rai and sons  
Krynine & Judd, Principles of Engineering Geology



**CLASS:** M.Sc. – FINAL  
**SUBJECT: -** GEOLOGY  
**PAPER TITLE:** First: Photogeology and Remote Sensing (T-304)  
**SEMESTER:** Third  
**DATE:** 05.03.2016

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**Objectives:** Remote Sensing Technology has emerged as an important tool for scientifically managing resources and environment. The technology enhanced our capability of resources exploration, mapping and monitoring on local and global scale. This course has been designed with the objectives to acquaint the students with basic principles of remote sensing, concepts and their application in various fields.

**Outcome;** this paper deals the modern techniques help and locate to mineral deposit where photo geology and remote sensing as an a tool in the remote area where human accesses is difficult.

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#### **UNIT – 1**

Introduction to aerial photography. Types of aerial photos. Geometric principles of photographs – relief and tilt displacement, Vertical Exaggeration and distortions. Measurements from Aerial Photographs. Scale, Distance, Area and Height.

#### **UNIT – 2**

Preparation of Photo-geologic Maps. Mosaic controlling factors of aerial photograph. Flight plan, area, purpose time and season of photography. Introduction to overlap, sidelap, drift, crab, fiducial marks. Elements of Interpretation of aerial photographs.

#### **UNIT – 3**

Electro-Magnetic spectrum. Space platforms. Reflectance of minerals. Vegetation, rocks and water. Elementary idea about active and passive sensors. Introduction to IRS mission.

#### **UNIT – 4**

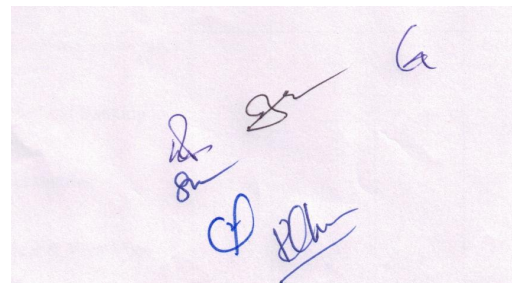
Multispectral scanners (MSS). Thematic Mappers (TM). Linear imaging self scanning (LISS). Elementary idea about image processing concept of Geographic Information System (GIS).

#### **UNIT – 5**

Applications of photo Geology and Remote sensing in the study of Geomorphology, Lithology and Structural Features and Hydrogeologic studies.

#### **References :**

Curran P J, 1985 : **Principles of Remote Sensing**. ELBS/Longman  
Drury SA, 1987 : **Image Interpretation in Geology**. Allen and Unwin  
Miller V.C. 1961 Photogeology  
Pandey S.N. 2001 Principles and Applications of Photogeology.  
Tripathi & Bajpai 2000. Remote Sensing In Geosciences.





**Class:** M.Sc. - Final  
**Subject:** GEOLOGY  
**Paper Title:** FIRST: FUEL GEOLOGY (T-401)  
**Semester:** FOURTH  
**DATE:** 05.03.2016

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**Objectives** To impart knowledge about the genesis and distribution of coal in space and time.

**Outcome;** necessity mother of invention. When the use of fuel minerals were the have up to the society then it was felt to know more about the quality parameter and its social impacts was imported among students. Because energy and power is the need of third world. So here we no each and every aspect of the fuel mineral pros and cons.

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### **Unit-1**

Origin of Coal. Physico-Chemical Characterization: Proximate and Ultimate Analysis Rank and Varieties of coal. Macroscopic Ingredients and Microscopic Constituents (Lithotypes, Maceral, and Microlithotypes).

### **Unit-2**

Indian and International Classification of Coal. Preparation of Coal for Industrial Purpose (Washing), Carbonization (Coke Manufacturing), Gasification and Hydrogenation, Briquetting of Coal.

### **Unit-3**

Geological Features of Coal Seams. Geology of the productive coal fields of India. Methods of Coal Prospecting. Estimation of Coal Reserve. Elementary idea about Coal Mining Methods. Coal Bed Methane.

### **Unit-4**

Origin, Migration and Accumulation (oil-traps) of Petroleum and Natural Gas. Kerogene. Geology of the Productive Oil Fields of India. Position of Oil and Natural Gas in India.

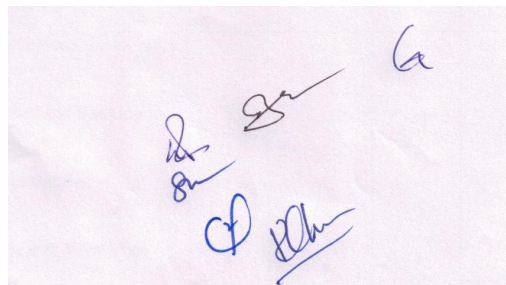
### **Unit-5**

Atomic minerals: mode of occurrence, association and distribution in India. Methods of Prospecting, Productive Horizons in India, Nuclear Power Stations of the Country and Future Prospects.

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### **Suggested Readings :**

Durance EM, 1986: Radioactivity in Geology: Principles and Applications. Ellis H  
Holson GD and Tiratsoo E N, 1985: Introduction of petroleum Geology. Gulf Pub  
Nettleton L L: Geophysical Prospecting for Oil  
North FK 1985: Petroleum Geology. Allen and Unwin  
Selley RC, 1998: Elements of Petroleum Geology. Academic Press  
Singh MP 1998: Coal and Organic Petrology. Hindustan Publications ND  
Tissot BP and Welt DH 1984: Petroleum Formation and Occurrence. Springer Verlag  
Stach et. al 1982. Textbook of Coal Petrology



**Class** M.Sc.- FINAL  
**Semester** IV  
**Subject** GEOLOGY  
**Paper Title** SECOND: MINING AND MINERAL DRESSING (T-402)  
**DATE:** 05.03.2016

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**Objectives** To impart the basic knowledge about the methods and techniques involved in mining, evaluation and exploration of the economic deposits.

**Outcome;** in this paper method of mining and metallurgy mineral ore and mineral or the main theme of the paper where modern practices used them worldwide are taught to the student with the help of flow sheet flow chart.

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### **Unit-1**

Mining terminology, mine supports, subsidence, shaft and shaft sinking. Breaking of rocks. Percussion and Rotary drilling methods. Classification of mining methods.

### **Unit-2**

Alluvial mining, Open-cast mining & Underground mining (other than coal mining): Stopping methods- open stopes, timbered stopes, shrinkage stopes, slicing system and caving. Mine atmosphere: mine ventilation, pumping of mine water.

### **Unit-3**

Coal mining methods: Board and Pillar methods, Long Wall methods. Strip mining. Haulage and winding.

### **Unit-4**

Mineral Dressing: Physical properties of minerals utilized in mineral dressing. Crushers: Primary and secondary crushers. Grinding mills. Rod mills, ball mills, autogenous mills.

### **Unit-5**

Industrial screening: Types of screens. Gravity separation. Heavy – medium separation. Magnetic separation. Froth Flootation technique of separation of sulfide ores.

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### **Suggested Readings:**

Arogyaswamy RNP: Courses of Mining Geology. Oxford & IBH

Gaudin: Principles of Mineral Dressing. McGraw Hill

Lewis: Elements of Mining.

Mc Kinstry HE: Mining Geology. Prentice Hall

Richards and Looke: Text Book of Ore Dressing. McGraw Hill

Roberts: Elements of Ore Dressing.

Taggart: Mineral Dressing.

Young: Elements of Mining Geology.



**Class:** M.Sc. Final  
**Semester:** IV  
**Subject:** Geology  
**Paper Title:** Third: Hydrogeology (T-403)

**Objectives:** To study the origin and causative factors, occurrence, distribution, quality and general behavior of groundwater under varying geological and geographical conditions. To acquaint the students with various methods employed in the groundwater exploration, water well conduction, development and completion, well hydraulics and varying problems being faced in the field under different climatological conditions.

**Outcome:** we are know that without water life is not possible either plant or animal and we also aware that our metabolic process required a specific type of water looking in to these various aspects of hydrogeology is given due importance in this paper. The various modern techniques to explore is also key point of study. All though life without water is not possible but about second and third of the world nation all also facing water as an havoc.

|               |   |
|---------------|---|
| <b>Unit-1</b> | Distribution of water: surface and subsurface, importance of ground water. Introductory idea to type of water. Hydrological cycle, Evaporation, Condensation, Precipitation and its types. Ground water: Origin, importance, occurrences. Infiltration and percolation, Groundwater provinces of India.                               |
| <b>Unit-2</b> | Geological factors governing the occurrence of ground water. Porosity, permeability, specific yield, specific retention, hydraulic conductivity, storage coefficient, aquifers and their classification.  |
| <b>Unit-3</b> | Groundwater flow: confined, unconfined, steady, unsteady, and radial flow. Forces causing flow. Darcy's Law. Water level fluctuation: causative factors and their measurements. Elementary idea about pumping test.   |
| <b>Unit-4</b> | Ground water quality: Physical characteristics: Turbidity, colour, taste, odour, temperature and specific conductivity. Chemical characters: TDS and suspended solids, pH value, hardness, heavy metals and dissolved gases. Biological characteristics. Water contaminants and pollutants. Radioisotopes In Hydrogeological Studies. |
| <b>Unit-5</b> | Geophysical methods of groundwater exploration- Wenner and Schlumberger methods, Salt water intrusion in coastal aquifers, remedial measures. Water harvesting & artificial recharge methods, elementary idea about groundwater development & conservation, conjunctive use of surface and ground water.                              |

**Suggested readings:**

- Davis S.N. and Dewiest R.J.M.**, 1966: Hydrogeology. John Wiley  
**Fetter CW**, 1990: Applied Hydrogeology. Merrill  
**Freeze RA & Cherry JA**, 1979: Ground water. Prentice Hall  
**Karanth, K.R.**, 1994 Groundwater Assessment, Development and Management.  
**Todd, D.K.** 1980: Groundwater Hydrology. John Wiley and Sons.  
**Raghunath H.M.** – Hydrology and **Karanth**- Hydrogeology; **C.F. Tolman**- Groundwater  
**Herman Bouver**- Groundwater Hydrology  
**R.H. Brown and others** – Groundwater Studies  
**Van te Chew**- Hand book of Applied Hydrology  
**Gautham Mahajan**- Groundwater Survey and Investigation



**Class:** M.Sc. - FINAL  
**Semester:** IV  
**Subject:** GEOLOGY  
**Title** FIFTH: ENVIRONMENTAL GEOLOGY (T-405)  
**DATE:** 05.03.2016

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**Objectives** To introduce the concept and role of geology in the study of environment. To study the various aspects of Geo-hazards and their mitigation. To impart knowledge about pollution and their remedial measures. To introduce the awareness and legislative measures in the mitigation of environmental problems. To impart knowledge about the atmospheric system i.e. climate, air pressure, temperature and weather changes.

**Outcome:** This paper conclude the all geological phenomena either aesthetic of the land surface are there degradation age desertification logion or wet line issues flat earthquake, seismic hazard, volcanoes, Tsunamis etc. are the key point of study were there ecological prospective global warming costal hazards and anthropological subject metal are taught in details to the students.

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### **Unit-1**

Concept of Environmental geology. Classification of environment. Ecological perspectives of the environment. Global warming.

### **Unit-2**

Impact assessment of degradation and contamination of surface water and ground water quality due to industrialization and urbanization. Soil profiles, soil types and soil quality degradation due to irrigation, use of fertilizer and pesticides.

### **Unit-3**

Wetlands: Classification, natural and artificial wetlands, problems of reclamation of wetlands, use of wetlands. Water logging problems. Desertification and Degradation of land. Anti-desertification measures.

### **Unit-4**

Causes of floods, flood hazards and management. Impacts of mining activities on the environment. Environmental management in mining. Effects of earthquakes, Seismic hazards and management. Environmental pollution due to industries, energy resources, urbanization.

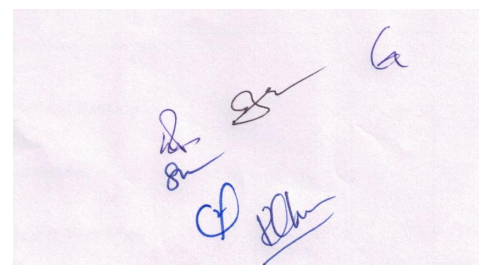
### **Unit-5**

Earth's natural hazardous processes and its impact on environment: volcanic activity, landslides and coastal hazards. Environmental problems related to dams and reservoirs.

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### **Suggested Readings :**

Bell F G. 1999: Geological hazards. Rout ledge London  
Hsai-Yang Fang 1997: Introduction to Environmental Geotechnology, CRC Press  
Patwardhan A M. 1999: The Dynamic Earth System. Prentice Hall  
Smith K. 1992: Geological Hazards. Rout ledge London  
Subramaniam V. 2001: Textbook in Environmental Science. Narosa international  
T.E. Graedel & P.J. Crutzen, 1993: Atmospheric Change, Freeman and Co  
Valdiya K S 1987: Environmental Geology- Indian context. Tata-McGraw



(OPEN ELECTIVE – 2)

**Class:** M.Sc. Final

**Semester** IV

**Subject** GEOLOGY

**Paper Title** FIFTH: COMPUTER APPLICATIONS IN GEOLOGY (T-405)

**DATE:** 05.03.2016

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**Objectives** Introduce the students of geology to the basics of computer and its application in solving the geology related problems.

**Outcome:** Here the technology reduces the main power and computer is one of them but we also train our students fight against an employments issues offcourse computer has made every things to be imagines by their soft ware and their various programs to visualized even geological deposit to help the planner.

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**Unit-1**

Introduction to computers. Structure of computer. Hardware and software components. Classification and types of computers. Capabilities and limitations of computer. Computer organization

**Unit-2**

General working of computer. Input and output devices, magnetic media devices, optical devices. Printer. Keyboard device. VDU, Scanner and digitizer, plotter. Types of Software.

**Unit-3**

Computer languages. Number system. ASCII. Machine language, high level language. Assembler. Interpreter. Compilers. Flowchart. Decision Table. Algorithms. MS-DOS, Windows, MS- Office.

**Unit-4**

Basic programming concept. Variable constants, procedures, conditional statements and loops. Visual Basic, C++, DBMS and Oracle.

**Unit-5**

Computer applications for various geological studies. Preparation of contour maps by Surfer. Graphical interpretations. GIS overview.



**Class:** M.Sc. - FINAL  
**Semester:** IV  
**Subject:** GEOLOGY  
**Title** FOURTH: PROJECT BASED ON FIELD WORK (T-404)  
**DATE:** 05.03.2016

**THE FIELD WORK INCLUDES**

- SURVEYING
- MAPPING- STRUCTURAL  
STRATIGRAPHY  
ECONOMIC GEOLOGY  
MINING
- SAMPLING
- SAMPLE ANALYSIS
- INTERPRITATION OF DATA

**BASED ON ABOVE FIELD OBSERVATIONS A PROJECT REPORT WILL BE SUBMITTED FOLLOWED BY COMPREHENSIVE VIVA VOCE EXAMINATION.**

**(OPEN ELECTIVE - ANY ONE)**  
**(OPEN ELECTIVE -1)**

