Syllabus
For B.Sc VIth Semester Courses in Geology
(November 2017 onwards)

Contents:
- Theory Syllabus for Courses:
  - S.Geo.6.01 – Phanerzoic Geology of India
  - S.Geo.6.02 - Sedimentary Petrology
  - S.Geo.6.03 - Engineering Geology
  - S.Geo.6.04 - Photogrammetry, Photo Interpretation & Fundamentals of GIS
  - S.Geo.6.AC-Gemmology
- Practical Course Syllabus for S.Geo.6.PR
- Practical Course Syllabus for S.Geo.6.AC.PR
- Evaluation and Assessment guidelines.
T.Y. B.Sc. Geology

Title: Phanerozoic Geology of India

Learning Objectives:
1. To bring about an understanding of the principals of stratigraphy
2. To Understand the Phanerozoic stratigraphy of India.

Unit 1: (15 lectures)

Palaeozoic History
- Tectonic History
- Precambrian Cambrian Boundary
- Marine Palaeozoic Formations of India
  - Kashmir Basin
  - Spiti Basin
- Krol Basin

Unit 2: (15 lectures)

Mesozoic History
- Tectonic History
- Permian Triassic Boundary
- Marine Mesozoic Formations of India - Spiti Basin
- Marine Transgressive Sequences of Kachchh and Tiruchirapalli.

Unit 3: (15 lectures)

Gondwana Sequence of India
- Sedimentation and Palaeoclimates
- Lower Gondwana Sequence of different basins.
- Upper Gondwana Sequence of different basins.

Unit 4: (15 lectures)

Cenozoic History
- Tectonic History
- Boundary Problems
- Indian Palaeogene - Neogene Formations:
  - Siwalik Supergroup
  - Assam –Arakan Region
  - Andaman-Nicobar Islands
- Sirmur Group

Geology and Stratigraphy of Maharashtra
- Deccan Flood Basalts.
  - Geology of Mumbai and Suburbs
Reference Books:

Practical Course:
Stratigraphy and Geology of India, Maharashtra and Mumbai
I) Study of characteristic index fossils of a particular stratigraphic horizon.
II) Diagrammatic examples of Lithostratigraphic boundaries and classification.
III) Study of Geological maps with geological history of the area in chronological order.
IV) Problems:
   a) Stratigraphic sequence from geological section.
   b) Interpretation of depositional environments for stratigraphic sequences.
   c) Stratigraphic Boundary Problem.
   d) Understanding Phanerozoic Time Scale.
T.Y B.Sc. Geology

Course: S.Geo.6.02

Title: Sedimentary Petrology

Learning Objectives:
1. To understand the various provenances of sediments.
2. To study processes of formation and environments of deposition of sedimentary rocks.

Number of Lectures - 60

Unit 1: (15 lectures)

Introduction
- Origin, transportation and deposition of sediments.
- Classification of Sedimentary rocks
- Basin, environment and facies concept.

Field techniques:
- Sedimentary structures- Basic measurements and data records
- Sketches and lithologs
- Sediment interpretation in cores

Sedimentary Texture analysis:
- Grain Size scales and laboratory methods of analysis
- Shape analysis
- Concept of maturity

Unit 2: (15 lectures)

Siliciclastic sedimentary rocks

Sandstones
- Field observations
- Petrography and classification
- Heavy minerals and other provenance indicators
- Concept of diagenesis and authigenesis

Conglomerates and breccia
- Classification and field observations
- Depositional environments for sandstones and conglomerates

Mudrocks:
- Field Observations: Textures, Structures, Colour, Nomenclature
- Laboratory Studies: Mineral composition and provenance

Unit 3: (15 lectures)

Limestones and dolomites
- Field Observations
● Components and mineralogy of limestones
● Classification of limestones and petrography
● Carbonate diagenesis
● Dolomitization and dedolomitization
● Silicification of limestone
● Carbonate depositional environments

Unit 4: Other Types of Sedimentary Rocks:

Evaporites-
● Origin of Giant Evaporite Deposits
● Palaeoclimatic interpretation from evaporites

Bedded Cherts and Phosphate Rocks- Origin, mineralogy and types

Volcaniclastic sediments- Types and field characters.

List Of Recommended Books:


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Practical Course

Megascopic and Microscopic Identification of Sedimentary Rocks.

Sedimentary Textures. (Clastic)

Rudaceous (Conglomeratic/ Brecciatic), Arenaceous (Gritty/ Sandy), Argillaceous

Sedimentary Structures

1. Parallel bedding
2. Current Bedding
3. Graded Bedding
4. Ripple Marks
5. Rain Imprints
6. Concretions/Secretions

Grain size and shape analysis

Preparation of lithologs and sections

Paleocurrent analysis

Identification and description of heavy minerals
T.Y.B.Sc. Geology

Course: S.Geo.6.03

Title: Engineering Geology

Learning Objectives:
1. To understand the engineering properties of rocks and their use as construction material.
2. Detailed study of various geological and geotechnical investigations for various civil engineering projects.
3. To understand the impact of Geological activities on the environment.

Number of lectures: 60

**Unit 1:** (15 lectures)

**Engineering Properties of Rocks:**
- Specific Gravity
- Porosity
- Sorption
- Compressive Strength
- Tensile Strength
- Elasticity of Rocks
- Residual Stress and Shear Stress in Rocks.

**Engineering properties of soil**
- Soil classification
- Soil gradation
- Compressive and shear strength
- Atterberg limits
- Consolidation and swelling of clays

**Unit 2:** (15 lectures)

**Rocks as Construction Materials:**

**Types of Rocks used in construction:**
- How are they obtained in nature? Use of Rocks as facing stone.
- Factors influencing Engineering usefulness of Rocks.

**Use of Rocks as aggregates:**
- Use of rock as an aggregate in different types of constructions
- Sources of different grades of aggregates.
- Properties of aggregates (Shape, Size, Surface Texture, Roundness, Coating).
- Cement aggregate reaction, Thermal effects on aggregate.
- Highway aggregate, Rail – road ballast, Runway aggregate.

**Source of Rock aggregate:**
- Types of quarries,
● Exploration for quarries,
● processing of aggregates.

Source of sand and gravel

Unit 3: (15 lectures)
Geological and Geotechnical investigations for Civil Engineering Projects:
● Tunnels:
  ➢ Terminology, Geological conditions for tunnel sites,
  ➢ Tunnels in folded rocks and bedded rocks.
  ➢ Influence of divisional planes, Effects of faults, Crushed zones,
  ➢ Tunnels near slopes, Role of Groundwater in tunneling.
● Landslides:
  ➢ Causes, types and prevention of landslides.
  ➢ Influence of divisional planes, effects of faults, Crushed zones.
● Bridges: Classification, abutments, foundations, investigations for site selection

Unit 4 (15 lectures)
Geological and Geotechnical investigations for Civil Engineering Projects:
● Dams and Reservoirs:
  ➢ conditions for the selection of dam and reservoir sites.
  ➢ Terminology associated with dams.
  ➢ Types of dams: Masonary Dams (Gravity Buttress and Arch types), Earthen dams. Types of spillways.
  ➢ Locations of all the important dams and Hydro – electric projects in India.
● Dam failures-causes and case studies.

List Of Recommended Reference Books


Practical Course:

Engineering Geology

- Geological maps to demarcate and evaluate the suitability of sites for engineering projects such as Tunnels, Dams and Reservoir construction.
- Determining uniaxial compressive strength of rocks.
- Equal-area net
  a) Locus of rotating line
  b) Determining core-pole angle and orientation of plane in recovered core
  c) Determining slope stability
  d) Determining orientation of bed in rotational fault
T.Y. B.Sc. Geology  
Course: S.Geo.6.04  
Title: Photogrammetry, Aerial Photo Interpretation and Fundamentals of Geographical Information Systems

Learning Objectives:
1. To bring about an understanding of the principles of Photogrammetry and about the various analytical techniques used.
2. To understand the construction and working of various instruments used in the process of aerial photo interpretation.
3. Understand the principles of GIS and study its application in Earth Sciences.

Number of lectures: 60

Unit 1  
(15 lectures)
Principles of Aerial Photography
- Early history of aerial photography;
- Aerial cameras, Film resolution.
- Electronic Imaging, Aerial Videography.
- Basic Geometric Characteristics of Aerial Photographs: Geometric types of Aerial Photographs, Taking Vertical Aerial Photographs, Geometric Elements of Vertical Photograph.
- Photographic Scale.
- Ground Coverage of Aerial Photographs.
- Area Measurement on aerial photographs.

Unit 2  
(15 lectures)
Principles of Photogrammetry:
- Relief Displacement of Vertical Features in aerial photographs.
- Characteristics of Relief Displacement,
- Object height determination from Relief Displacement Measurement.
- Correction for Relief Displacement.
- Image Parallax: Characteristics of Image Parallax, Parallax Measurement.
- Ground Control for Aerial Photography.
- Mapping with Aerial Photographs: Stereoscopic Plotting Instruments, Orthophotos, Photogrammetric Work Stations.
- Flight Planning.

Unit 3  
(15 lectures)
Aerial Photo Interpretation:
- Fundamentals of Visual Image Interpretation.
- Basic Visual Image Interpretation Equipment- Construction and Working.
- Land-use/Land cover mapping.
- Geologic and Soil mapping.
- Water Resource Applications.
- Archaeological Applications.
- Environmental Assessment
- Principles of Landform Identification.

Unit 4 (15 lectures)
Basics of Geographical Information Systems
- Definitions of GIS
- The components of a geographical information system.
- Basic requirements for a GIS.
- Data Models: Conceptual models of real world geographical phenomena.
- Conceptual models of space.
- Geographical Data models: Vector models of Entities – Simple points, lines and polygons.
- Raster Data Structures-The grid Cell Data Types: Boolean, Nominal, Ordinal, Integer, Real, Topological Data Input: Sources of Geographical Data, Geographical data Collectors and providers.
- Geo-referencing.

Reference Books:
Practical Course:
- Test and Exercise for Stereoscopic vision
- Determination of Photo Scale and numerical problems on photo scale.
- Orientation of Stereographic pair of aerial photographs under a mirror stereoscope and point transfer. Plotting of principal point, flight line and match line.
- Construction of stereogram
- Handling of a parallax bar and height calculation
- Numerical problems on height calculation using measured relief displacement on a single aerial photograph.
- Flight Planning: Calculations necessary to develop a flight plan and draw a flight map.
Evaluation and Assessment: S.Geo. 6.01, 6.02, 6.03, 6.04 courses

Evaluation (Theory): Total marks per course - 100.
   
   CIA- 40 marks
      
   CIA 1: Written test - 20 marks
   CIA 2: Field work (12 days, and Field report, Viva on Fieldwork, This will be for all the four courses, that is 20 marks outside Mumbai City)

   End Semester Examination – 60 marks
   One question from each Unit for 15 marks, with internal choice. Total marks per question with choice -21 to 22 marks.

Evaluation of S.Geo.6.PR (Practicals)Total marks - 200.

   *For the purpose of workload – fieldwork is to be considered as 4 hours per week per batch.

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Template for S.Geo courses End Semester examination in Semester 6

<table>
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<th>KNOWLEDGE</th>
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St. Xavier’s College - Autonomous, Mumbai

Department of Geology

Roll Number:__________

UID Number:__________

MARKS:_____/20

Assessment Grid for S.Geo.6.PR CIA 2 (Field Work)

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<th>Parameters</th>
<th>Marks</th>
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<th>60 – 80% Good</th>
<th>40 – 60% Satisfactory</th>
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Evaluators Names Signature and date

Name

Signature & date