

Savitribai Phule Pune University, Pune
S.E. (Civil Engineering) 2015 Course

207009: Engineering Geology

Credits: 04+01

Teaching Scheme:

Theory : 04 hrs/week

Practical : 02 hrs/week

Examination Scheme:

In-Semester (Online) : 50 Marks

End-Semester : 50 Marks

Term Work : 50 Marks

Prerequisites : Fundamentals of Basic Civil Engineering, Building Technology and Materials, Geotechnical Engineering.

Course Objectives:

1. To study basic of engineering geology and introductory part of the earth science.
2. To understand the utility and application of geological principles in various phases of civil engineering activities.
3. To describe the sources, and characterization of common Building materials.
4. To learn the basic aspects occur due to structural features like folds and faults.
5. To explain various natural hazards and their implications on structures and effects on society.

Course Outcomes:

After completing this course students of civil engineering will be able to:

1. Explain the basic concepts of engineering geology.
2. Differentiate between the different rock types, their inherent characteristics and their application in civil engineering.
3. Understand physical properties, mechanical properties of the minerals and their application in civil engineering.
4. Identify favourable and unfavourable conditions for the buildings, roads, dam, tunneling etc through the rocks.
5. Explain mass wasting processes, effects of mass wasting process on the civil engineering structures and remedial measures.
6. Interpret geohydrological characters of the rocks present at the foundations of the dams, percolation tanks, tunnels.
7. Understand Seismic activities and its effect on the civil engineering construction.
8. Identify geological hazards and presence of ground water.

Course Contents

Unit I: Mineralogy, Petrology and General Geology. a) Introduction to the subject, scope and sub divisions. b) Introduction to mineralogy: Properties of Minerals, Classification of Minerals. c) Introduction to petrology: Rock Cycle, broad classification of rocks. Igneous Petrology: Plutonic, Hypabyssal and Volcanic rocks, Structure, Texture and Classification of Igneous rocks. Study of common rock types prescribed in practical work and their engineering applications.	(08 Hrs)
Sedimentary Petrology: Rock weathering, Genetic classification of secondary rocks and grain size classification and Textures, Sedimentary Structures, Diagenesis Process. Study of common rock types prescribed in practical work and their engineering applications. Metamorphic Petrology: Agents, Types of metamorphism, Texture and structures. Study of common rock types prescribed in practical work and their engineering applications.	
Unit II: Plate Tectonics and Structural Geology. a) Introduction to plate tectonics and Mountain building activity. b) Structural geology: Out crop, dip and strike, conformable series, unconformity and overlap, faults and their types, folds and their types, inliers and outlier. c) Structures: Structural features resulted due to igneous intrusions, concordant and discordant igneous Intrusions, joints and their types, stratification and lamination.	(08 Hrs)
Unit III: Geomorphology and Historical Geology. a) Geomorphology: Geological action of river, Coastal Geology. b) Historical geology: General principles of Stratigraphy, geological time scale, physiographic divisions of India, significance of their structural characters in major civil engineering activities.	(08 Hrs)
Unit IV: Preliminary Geological Studies and Remote Sensing. a) Preliminary geological explorations: reconnaissance survey, Desk Study, surface and subsurface Geological Investigation: methods, significance and limitations. b) Techniques of correlation for surface and subsurface exploration, engineering significance of geological structures and relevant case studies. c) Remote sensing (RS): Elements of remote sensing for Visual interpretation and geographical information system (GIS), application of remote sensing and geographical information system in Civil Engineering.	(08 Hrs)

Unit V: Role of Engineering Geology in Reservoirs, Dams and Tunneling. (08 Hrs)

a) Geology of dams & Reservoir: Strength, stability and water tightness of foundation rocks, influence of geological conditions on the choice and type of dam, preliminary geological work on dam and reservoir sites, precaution to be taken to counteract unsuitable conditions and their relevant treatments with case studies.

b) Tunneling: Preliminary geological investigations, important geological considerations while choosing alignment, difficulties during tunneling as encountered due to various geological conditions, role of groundwater, and suitability of common rock types for excavation and tunneling and case studies.

Unit VI: Geological Hazards, Ground Water and Building Stones. (08 Hrs)

a) Geological hazards: Volcanism, Earthquakes & Seismic zones of India, Landslides and stability of hill slopes and preventive measures

b) Groundwater: Types of ground water, water table and depth zones, influence of hydrogeological properties of rocks, geological work of groundwater, types of aquifers, fluctuations in water table levels, effects of dams and canals, effect of pumping, cone of depression, circle of influence, conservation of groundwater, artesian wells, its geological conditions, artificial recharge of groundwater.

c) Building stones: Requirements of good building stone: strength, durability, ease of dressing, appearance, mineral composition, textures and field structures, suitability of common rocks as building stone.

Books:**Text:**

1. Text Book of Engineering Geology by R.B. Gupte , 2001, P.V.G. Publications, Pune.
2. A Text Book of Engineering Geology by N. Chenna Kesavulu. 2010, Mc Millan India Ltd.
3. Principles of Engineering Geology by S.K.Garg.1999, Khanna Publ, New Delhi.
4. Principles of Engineering Geology by D. Venkat Reddy. 2010, Vikas Publishers.
5. Geology and Engineering by K. V. G. K. Gokhale and D. M. Rao, Tata McGraw-Hill.

Reference:

1. Physical Geology by P. K. Mukarjee, World Press, 2013.
2. Physical Geology by Arthur Holmes, ELBS Publication.
3. Principles of Engineering Geology and Geotechniques by D. P. Krynine & W. R. Judd. CBS Publishers, New Delhi.
4. Engineering Geology by F. G. H Blyth and De Frietus, 2006, Reed Elsevier India Ltd.

IS Codes:

Sr. No	No. of the IS code	Title of the IS Code
1	IS 1123:1998	Method of identification of Natural building stone.
2	IS 4078:1967	Code of Practice for Indexing and Storage of drill cores
3	IS 4453: 1967	Code of Practice for exploration by Pits, Trenches, Shafts and Drafts
4	IS 5313: 1969	Guide lines for core drilling observations
5	IS 6926: 1973	Code of Practice for diamond core drilling for site investigations for river valley projects
6	Handbook	PWD Handbook Ch No. 6 Part II: 1980 published By Govt. of Maharashtra
7	IS 7779 (Part II 1,2,3):1979	Schedule of properties and availability of stones for construction purposes
8	IS 13030:1991	Method of test for lab determination of Water Content, Porosity, Density and related properties of rock material
9	IS 9143:1996	Method of determination of Unconfined Compressive Strength of rock material
10	IS 1124: 1998	Method of test for determination of Water absorption, Apparent Sp. Gravity and porosity of natural building stone
11	IS1122: 1998	Method of test for determination of Sp. Gravity of natural building stone
12	IS 2386 Part VIII	Methods of test for Petrographic Examination
13	Code No. 653	An Introduction to Earthquake Hazards: AICTE handbook
14	IRC Sec. 2400	Surface and Subsurface Geotechnical Explorations

List of Laboratory Assignments

Following experiments are to be compulsorily performed. Term work shall consist of journal giving details of the experiments performed.

1. Megascopic identification of following mineral specimens (around 50).

Rock Forming Minerals, Economic Minerals and Ore Minerals such as:

Rock Crystal, Rosy Quartz, Transparant Quartz, Milky Quartz, Smoky Quartz, Amethyst, Chalcedoney, different varieties of Agate, Jasper Banded Hematite Jasper, Orthoclase, Microcline, Plagioclase, Muscovite, Biotite, Olivine, Apophyllite, Stilbite, different varieties of Calcite, Gypsum Tourmaline, Chromite, Limonite, Asbestos, Laterite, Kyanite, Graphite, Haematite, Pyrite, Hornblende, Diopside, Hypersthene, Micaceous Haematite, Garnet,

2. Megascopic identification of following different rock specimens (around 50).

- a) **Igneous Petrology: Plutonic, Hypabyssal, Volcanic Rock** Muscovite Granite, Granite porphyry, Hornblende Granite, Syenite, Syenite porphyry, Diorite, Epidiorite, Gabbro, Pegmatite, Picrite, Graphic Granite, Tourmaline Pegmatite, Dolerite, Rhyolite, Andesite, Pumice, Trachyte, Compact Basalt, HT. altered A.B, Giant Phenocryst Basalt (GPB), Amygdaloidal Basalt, Pipe A.B, Volcanic Breccia, Tuff breccia,
- b) **Sedimentary Rock: Rudaceous, Arcaceous, Argillaceous, Chemical and Organic Deposits:** Laterite, Bauxite, Conglomerate, Secondary Breccia, Sandstone (Red), Sandstone with Ripple marks, Sandstone (White), Sandstone (weathered), Sandstone (Micaceous), Sandstone (Mottled), Sandstone (Current Bedding), Shahabad Limestone, Red Limestone, Black Limestone, Stalactite Limestone, Oolitic limestone, Shelly Limestone, Chert Breccia, Secondary Quartzite, Mudstone, Grit, Arkose sandstone, Shale (White), Shale (Yellow), Shale (Black)
- c) **Metamorphic Petrology: Contact Metamorphic rocks, Dynamothermal Metamorphic rocks:** Kyanite Quartzite Marble, Serpentine Marble, Phyllite, Slate, Augen Gneisse, Hornblende Biotite Gneisse, Hornblende Gneisse, Mica Schist, Biotite Schist With Garnet, Muscovite Schist, Chlorite Schist With Magnetite, Hornblende Schist, Chlorite Schist, Talc Schist, Talc Chlorite Schist, Talc Mica Schist, Talc Actinolite Schist, Quartz Sericite, Schist, Graphite Schist, Khondalite, Charnockite, Amphibolite,

3. Interpretation and construction of geological sections from contoured geological maps (Total 8).

4. Solution of engineering geological problems such as alignment of dams, tunnels, roads, canals, bridges, etc. based on geological maps (Total 3). # (From A. G. Series 8 maps and 2 maps constructed by the faculty members)

5. Logging of drill core and interpretation of drilling data with graphical representation of bore log.

6. Two site visits are desirable to study various geological features And their application, covering details from sections I and II.

7. GRAM++ software and ARC GIS software may be optional to perform.