



**Dnyanopasak Shikshan Mandal's  
College of Arts, Commerce and Science, Parbhani**

***Pro-forma for program and course outcomes (2.6.1)***

**Name of Teacher:**

**Department: Geology**

**Program: BSc Subject:**

**Course Code: CCG**

**Paper Title:**

**B.Sc.I- Sem I. - Paper -I- Earth as a planet and Dynamic Geology**

**Paper II- Mineralogy, Crystallography**

**Sem. II- Paper -III-Physical Geology and Paleontology**

**Paper IV- Petrology**

**Paper V- Practical**

**B.Sc.II- Sem III. - Paper -VI - Optical And Descriptive Mineralogy**

**Paper -VII- Dynamics Of The Earth and Igneous Petrology**

**Skill Enhancement Course-i**

**Sem IV - Paper -VIII- -Structural Geology-**

**Paper -IX- Sedimentary And Metamorphic Petrology**

**Skill Enhancement Course-II**

**Paper -X- Practical**

**Paper -XI- Practical**

**B.Sc.III- Semi.V - Paper -XII- Geomorphology and Photogeology**

**Paper -XIII- Engineering Geology and Hydrogeology**

**Skill Enhancement Course-III**

**Sem VI - Paper -XIV- Stratigraphy of India**

**Paper -XV- Economic Geology and Prospecting**

**Skill Enhancement Course-IV**

**Paper -XVI- Practical**

**Paper -XVII- Practical**

Unit Number	Unit Name	Topics	Unit-wise Outcome
<b>B.Sc .I Sem-I Paper -I Unit-I</b>	Earth as a planet	Geology and its Perspective. Earth in the solar system: Origin, Size, Shape, Mass, density rotational and revolution of the earth. Relief features of the earth surface and interior of earth as core, mantle, crust and introduction to hydrosphere, atmosphere and biosphere and elemental abundance in each constituent. Age of the Earth.	Students are benefited by understanding the Earth as a planet and regularities of the solar system.
Unit-II	Dynamic Geology..	Earthquake, Volcanoes and their distribution	From the Dynamic Geology students will understand the hazardous nature of the earth, causes, effects and remedial measures.

<p><b>Paper -II</b> Unit – I</p>	<p>Mineralogy.</p>	<p>Chemical bonding and compound formation. Minerals: definition, classification and composition. Physical properties of mineral Introduction to common groups of rock forming minerals such as Olivine, Pyroxene, Amphibole, Mica, Silica and Feldspar. Study of Common ore minerals, industrial minerals and atomic minerals.</p>	<p>Mineralogy is the basic of geology and students understand the chemistry of minerals and rocks</p>
<p>Unit – II</p>	<p>Crystallography:</p>	<p>Elementary ideas about crystal structure. Crystal: faces, edges, solid angles. Crystallographic axes and axial angles. Parameters and indices. Crystal symmetry. Classification of crystals into six normal classes such as Cubic, Tetragonal, Hexagonal, Orthorhombic, Monoclinic and Triclinic systems and their forms, Twin and Twin laws.</p>	<p>Students are benefited by understanding crystal behavior in Crystallography. Mineralogy and crystallography are basic topics of geology interrelated to each other.</p>
<p><b>B.Sc .I Sem-II</b> <b>Paper -III</b> Unit-I</p>	<p>Physical Geology:-</p>	<p>Geological work such as erosion, transportation and deposition by river, wind, glaciers, ocean and sea.</p>	<p>Physical geology is useful to students for exploring the earth surface features by atmospheric agents.</p>
<p>Unit-II</p>	<p>Palaeontology :-</p>	<p>Definition and scope of palaeo-biology, processes of fossilization and preservation. Potential of organisms. Elementary ideas about origin of life, evolution and fossil record. Systematic classification of organisms, their characters, environmental and geological distribution of phylum Arthropoda (Trilobites), Coelentrata (Graptolites), Mollusca (Lamellibranchia, Gastropoda and Cephalopoda), Brachiopods and Echinodermata.</p>	<p>Paleontology is required for studying the palaeo-environment and ancient ecology.</p>
<p><b>Paper -IV</b> Unit – I</p>	<p>Igneous and Sedimentary Petrology</p>	<p>Igneous Petrology: Definition, composition origin of magma. Texture, structure and classification of igneous rocks and study of common igneous rocks. Sedimentary Petrology: Weathering, soil formation, soil profile, soil types and soil properties. Origin, transportation, deposition, consolidation and diagenesis of sediments. Sedimentary textures. Classification of sedimentary deposits and study of common sedimentary rock</p>	<p>Students are well acquainted with the characters and strength of the rocks like igneous and sedimentary rocks.</p>
<p>Unit – II:</p>	<p>Metamorphic Petrology</p>	<p>Agents and kinds of metamorphism, metamorphic minerals, texture and structures of metamorphic rocks, processes of formation of various metamorphic rocks such as Cataclastic, Thermal, Dynamothermal and plutonic metamorphism, study of common metamorphic rocks. Study of common rocks occurring in Maharashtra.</p>	<p>Students are familiar with the textures and structures of the metamorphic rocks.</p>

<p>Practical-I</p> <p><b>B.Sc.II Sem-III Paper -VI Unit –I</b></p>	<p>Practical</p>	<p>1. Reading of topographical maps (SOD). 2. Study of physical properties of minerals in hand specimen. 3. Study of elements of symmetry and forms form normal classes of six crystal system.</p> <p>1. Study of megascopic characters of important rocks types of igneous, sedimentary and Metamorphic origin. 2. Study of morphological characters of phylum included in theory syllabus. 3. Geological Field Work (Three Days) Students will be required to carry out fieldwork for three days in a suitable geological area to study elementary aspects of field geology and submit report thereon.</p>	<p>Students are benefited with the understanding of Toposheet maps, characteristics of the minerals and crystals.</p> <p>Students are well acquainted with the megascopic characters of the rocks like igneous, sedimentary and metamorphic rocks. Identification and description of recent shells with fossils.</p>
<p>Unit – I</p>	<p>Optical Mineralogy</p>	<p>Unit – I Optical Mineralogy : (Periods 20, Marks,25) Introduction to petrological microscope. Nature of Light reflection, refraction, double refraction, total internal reflection and critical angle. Nicol’s prism, position of extension, and extinction angle isotropism and anisotropism, isotropic and anisotropic minerals. Birefringence, refractive index, use of accessory plates, compensation and determination of interference colour. Newton’s scale, determination of sign of elongation where ‘C’ axis is known. Vibration direction and optic orientation, anomalous colours, pleochroism and absorption. Uniaxial and biaxial interference figures and determination of optic sign of uniaxial and biaxial minerals. Methods of determination of refractive index; Central illumination method and Oblique illumination method. Study of optical properties of minerals.</p>	<p>Students are familiarised with the optical properties of the rocks and minerals.</p>
<p>Unit – II</p>	<p>Descriptive Mineralogy</p>	<p>Introduction to mineral, silicate structure, isomorphism, polymorphism and pseudomorphism. Classification of minerals. Study of structure, Chemistry, physical and optical properties, paragenesis and uses of the following mineral groups: Olivine, garnet, alumino-silicate, pyroxene, amphibole, mica, silica, feldspar, feldspathoid.</p>	<p>Students understand in detail the silicate structures and physical, optical properties of the mineral groups.</p>
<p><b>Paper -VII Unit – I-</b></p>	<p>Dynamics Of The Earth</p>	<p>Isostasy: Concept and theories of Isostasy, evidence of continental drift and sea-floor spreading. Origin and significance of Mid-oceanic ridges. Island arc and trench. Evolution of plate tectonic theories, nature and types of plate margins. Evolution of ocean and continents, Wilson cycle. Palaeomagnetism. Geosynclines.</p>	<p>Students will be familiarised with the dynamic aspects of the earth including Isostasy, evidence of continental drift and sea-floor spreading and plate tectonic theories.</p>
<p>Unit – II:</p>	<p>Igneous Petrology</p>	<p>Formation of glass and crystal. Crystallisation of unicomponent magma. Crystallisation of</p>	<p>Students are well aware with the detailed characters and strength</p>

<p><b>B.Sc.II Sem-IV Paper -VIII Unit -I</b></p>	<p>Structural Geology</p>	<p>binary magma, eutectics, mixed crystals. Crystallization of Ternary magma. Reaction relation and Bowen's reaction series. Textural characters such as granularity, shape of the crystal, mutual relation of crystals, textures and their types. Microstructures and structures of igneous rocks. Classification of igneous Rocks. Theories of differentiation and assimilation. Crystallisation of Granitic and Basaltic magma. Study of common igneous rocks.</p> <p>Introduction, Attitude of beds, strike and dip, study of clinometers compass, Brunton compass and its application in the field survey. Fold: Parts of fold, nomenclature of folds, plunge of folds, types of fold field study of folds, determination of top of beds by primary features. Fault: General characteristic of fault, types of movement, classification of fault Based on genetic, net slip, attitude of faults relative to attitude of beds, fault pattern and value of dip of fault. Criteria for reorganization of fault such as discontinuity of strata, repetition and omission of beds, feature characteristic of fault plane and physiographic criteria.</p> <p>Joint: Introduction, Genetic and geometric classification of joints. Unconformity: Introduction, general significance of unconformity. Types of unconformities such as disconformities, angular unconformity, non-conformity, local unconformity, overlap, off lap, overstep, outlier and inliers. . Lineation and Foliation: Introduction, descriptive terminology, kinds origin and relation to major structures.</p>	<p>of the igneous rocks. The processes of formation of various types of rocks is also discussed in detail.</p> <p>Students learn the structures of the earth surface including the bedding, stratification, folding and faults.</p>
<p>Unit II</p>	<p>Sedimentary Petrology :-</p>	<p>Formation of sediments and different types of depositional environment Such as eolian, fluvial and sea environment. Mineral composition of sedimentary rocks. Textural characters such as grain size, sphericity, roundness, shape. Mechanical, chemical and organic structures. Maturity of sediments Heavy Minerals. Mineralogy, Texture, Structure and Classification of conglomerate, sand stones and lime stones. Study of common sedimentary rocks.</p> <p>Kinds if metamorphism. Concept of depth zones, Facies and grades of Metamorphism. Eskola's concept of metamorphic facies pressure-Temperature Diagram. Metamorphic minerals (stress and antistress minerals) Texture and structure of metamorphic rocks. Process of formation of metamorphic rocks such as cataclastic, thermal, dynamothermal and plutonic Metamorphism and their products.</p>	<p>Other structural features like jointing and unconformity are discussed in detailed in this section.</p> <p>Students are well acquainted with the characters, strength and process formation of the sedimentary rocks.</p> <p>Students are well aware of the megascopic and microscopic characters of the metamorphic rocks in detail.</p>
<p><b>B.Sc.II Sem-IV Paper -IX Unit-I</b></p>	<p>Metamorphic Petrology</p>		

<p>Practical -Paper X (Based on Paper VI and VI)</p>	<p>Practical</p>	<p>Metasomatism, pneumatolytic metamorphism, injection metamorphism and Auto-metamorphism. Lit-per-lit gneiss, composite gneiss. Anatexis and palingenesis. Study of common metamorphic rocks.</p> <p>Study of Optical Properties of Following Minerals: Quartz, Orthoclase, Microcline, Plagioclase, Augite, Hypersthene, Hornblende, Actinolite, Olivine, Muscovite, Biotite, Garnet, Calcite, Chlorite, Kyanite, Sillimanite and Andalusite. 2) Newton's scale of interference colours, 3) Determination of sign of elongation. 4) Determination of optic sign of uniaxial/biaxial minerals. 5) Calculation of Hess Metasilicate of Pyroxene Minerals. 6) Identification and description of Plate Margins in the given diagram/Map 7) Study of Following Igneous Rocks in Hand Specimen. Porphyritic Granite, Granite, Nephilian syenite, Norite Felsite, Peridotite Graphic granite Obsidian Granodiorite ,Gabbro, Dunite Rhyolite, Trachyte, Andesite, 8) Identification of various Basalts . 9) Study of the Optical Properties of Following Rocks: Granite, Syenite, Diorite, Gabbro, , Rhyolite, Trachyte, Andesite and Basalt 10) Study of structures of Igneous Rocks in hand specimen</p>	<p>Students are well acquainted with the megascopic and microscopic characters of the rocks like igneous, sedimentary rocks. Identification and description of megascopic and microscopic characters of minerals.</p>
<p>Practical -Paper XI (Based on Paper VIII and IX)</p>	<p>Practical</p>	<p>1) Study of Structural Geological Maps Covering Faults, Unconformity, Folds and Dykes. 2) Orthographic Methods of Solving Structural Problems. 3) Stereographic Methods of Solving Structural Problems 4) Study of Following Sedimentary Rocks in Hand Specimen: Sandstone and its types, Grit, Carbonaceous Shale, Fossiliferous Limestone, Shelly Limestone, Breccia, Marl, Mudstone, Greywacke, Conglomerate, Arkose, Quartzite, 5) Study of Following Metamorphic Rocks: Marble, Mica-Garnet schist, Actinolite schist, Sillimanite Schist, Gneisses, Granulite Eclogite, Schorl, Amphebolite. 6) Study of the Optical Properties of Following Sedimentary Rocks: Sandstone, Limestone, Breccia, Conglomerate, Oolitic limestone, Fossiliferous limestone, Quartzite, Shale. Quartzite, 7) Study of the Optical Properties of Following metamorphic Rocks Marble, Mica-Garnet schist, Actinolite schist, Sillimanite Schist, Trimolite Schist, Augen Gneiss, Granulite. Schorl, Eclogite 8) Study of structures of Sedimentary Rocks in hand specimen. 9) Study of structures of Metamorphic Rocks 10) Preparation of Geological report based on field tour of four days duration. A) Water quality analysis Introduction, sampling methods, materials and methods of</p>	<p>Students will understand the earths structures through geological maps.</p> <p>Students are well acquainted with the megascopic and microscopic characters of the metamorphic rocks.</p>

SEC-I	Skill enhancement Course in Geology-I	Water quality analysis, permissible limits of water quality, health hazards in relation to surface or groundwater. Or B) Soil Analysis Introduction, formation of soil, types of soils, sampling methods, materials and methods of soil analysis, physical and chemical characteristics of soil, problems and potentials of soil.	Students Skill enhancement in water quality analysis in relation with health hazards.
SEC-II	Skill enhancement Course in Geology-II	A) Roof water harvesting Introduction to Roof Water Harvesting, basics of hydrology, Water Harvesting, Conservation, tools and techniques of Roof Water Harvesting, utility and awareness. Or B) Sieve Analysis of Soil /Sediments Introduction, sampling methods, materials and methods of sieve analysis, grain size analysis of soil/sediments, scientific significance and practical application	Students Skill enhancement in soil analysis in relation with problems and potential of soil.  Students Skill enhancement in roof water harvesting systems in relation with health hazards.
<b>B.Sc. III Sem-V Paper -XII</b> Unit I:	Geomorphology	Geomorphology -Introduction and concepts of geomorphology, study of geomorphic surface features (land forms) of fluvial, Aeolian, glacial and marine origin	Students are acquainted with the earths various landforms and its process of formation.
Unit II:	Photogeology	-Introduction to aerial photography, satellite imageries and preparation of photogeological maps. Elements of aerial photo interpretation. Stereoscopic vision, orientation of stereoscope, stereo-pairs and stereo viewing of air photos, types of aerial photographs and photo index. Scale of aerial photographs. Application of Aerial photographs in the study of lithology, structure and geomorphology. Introduction to remote sensing and applications in Geology.	Students are gaining the basics of the remote sensing through the understanding of the Photogeological study.
<b>Paper -XIII</b> Unit -I	Engineering Geology	Concept and definition of engineering geology and environmental geology. Environmental and geological hazards such as earthquake volcano and mass movement. Environment and geological consideration in the location and construction of engineering structures such as dams, reservoirs and tunnels. Drilling and its application in Engineering geology.	Students are very much familiarised with the engineering aspects like causes and prevention during geological hazards, construction and maintenance of Tunnels, dams, reservoirs etc.
Unit -II	Hydrogeology	Introduction, hydrologic cycle, water table, aquifer and its classification. Aquifer properties such as porosity, permeability, specific yield, specific retention, storativity, hydraulic conductivity. Darcy's law, occurrence of groundwater in igneous, sedimentary and metamorphic rocks. Hydrological prospecting. Concept of watershed. Methods of soil and water conservation.	Students are benefited by understanding the various characteristics of groundwater in relation with the rocks and different concept of watershed.

<p><b>B.Sc.III Sem-VI Paper -XIV</b> Unit – I:</p>	<p>Stratigraphy- I</p>	<p>Principles of stratigraphy, units of stratigraphy, principles of correlation. Occurrence, distribution, classification, lithology and economic importance of following supergroups/groups: Archean of central province, Singhbhum, Eastern Ghats, Delhi, Dharwar, Cuddupah, Vindhyan, Gondwana and Deccan Traps.</p>	<p>Students understand the occurrence, distribution, classification, lithology and economic importance of rocks of Peninsular India.</p>
<p>Unit –II:</p>	<p>Stratigraphy-II</p>	<p>Occurrence, distribution, classification, lithology and economic importance of supergroups/groups : Geology of Kashmir, Spiti valley and Siwalik, Marine formations of Jurassic of Kutch, Cretaceous of Tiruchirapalli and Tertiary rocks of Assam.</p>	<p>Students get benefited by recognising the occurrence, distribution, classification, lithology and economic importance of rocks of Peninsular and extra- Peninsular India.</p>
<p><b>Paper -XV</b> unit –I:</p>	<p>Economic Geology</p>	<p>Introduction of economic geology, magma and mineral deposits. Metallic and non-metallic ore deposits. Processes of formation of mineral deposits such as: Magmatic concentration, sublimation, metasomatism, metamorphism, hydrothermal process, supergene sulphide enrichment, sedimentation, residual and mechanical concentration. Occurrence, geological and geographical distribution and uses of following mineral deposits of India: Iron, chromites, copper, manganese, lead &amp; zinc, gold, bauxite, gypsum, asbestos, mica, uranium, precious and semiprecious stones.</p>	<p>Students are well acquainted with the Processes of formation of mineral deposits and also the occurrence, geological and geographical distribution and uses of economic minerals in India.</p>
<p>UNIT–II</p>	<p>Prospecting</p>	<p>Geological method of prospecting. Geochemical method of prospecting including leakage anomalies and pathfinder elements. Geophysical prospecting (Instrument, field procedure and interpretation) based on magnetic, gravity, electrical, seismic studies.</p>	<p>Students have got the understanding of the method of the geological, geochemical and geophysical prospecting. By handling the equipment students can be self-employable</p>
<p>Practical-XVI</p>	<p>Practical</p>	<p>A) Morphometric Analysis of the given Watershed/toposheet. B) Identification and description of the Geomorphological models/geological maps C) Identification of the Structures from aerial photographs D) Merits and demerits of the Engineering site from given Geological Structural Contour Map on the basis of Draw section along given section line. E) Hydrological Problems.</p>	<p>Students acquire the techniques of Morphometric Analysis, Identification of the geomorphological models and Structures from aerial photographs. Understanding of Merits and demerits of the Engineering site from Geological Maps.</p>
<p>Practical-XVII</p>	<p>Practical</p>	<p>A) Sub-surface information of the area with the help of Resistivity Meter. B) Identify and locate the Geological Formations on a given map of India. C) Identification and description of the Physical Properties of Ore Minerals. D) Describe and locate the occurrence of Ore Minerals in the given map of India. E) Field work (minimum of three days) and viva. Record Book</p>	<p>Students are handling the equipment and are well acquainted with the economic mineral deposits of India.</p>

SEC-III	Skill Enhancement Course-III	<p>1) Preparation of Geological maps from contour data Definition of Contour, structural geology. Geography of area in maps (high ground, hills, valleys saddles etc), terminologies like Dip, strike, outcrop, horizontal and inclined beds. Technique and procedure for Preparation of geological maps from contour maps of the given data at least 5 maps containing dipping strata, fold, fault, joint, unconformity etc.</p> <p style="text-align: center;">OR</p> <p>2) Properties of Soil Scope of Course, Soil Composition. Geological survey of subsoil - the method and extent of exploration activities. Genesis of soils, mineralogical composition of soil. Physical properties of soils. The characteristics of the physical state of fine-grained and coarse-grained soils. Soil Structure. Chemical properties of soil samples. Problem Soils (Sensitive, Organic, Expansive, Collapsing, Varved, etc.)</p>	<p>Students Skill enhancement in Preparation of Geological maps from contour data.</p> <p>Students Skill enhancement in Genesis of soils, mineralogical composition of soil.</p>
SEC-IV	Skill Enhancement Course-IV	<p>1) Preparation of Litho log. Definition, measurement and interpretation of lithologs: Field and laboratory techniques in sedimentology: recording of sedimentary structures. Preparation of lithologs from field data. Laboratory study of oriented samples of river sediments. Preparation of litholog from visible vertical section. Detection of ideal cycle from vertical litholog and analysis of palaeo-current data Interpretation and correlation of lithology from lithologs.</p> <p style="text-align: center;">OR</p> <p>2) Water table fluctuation Introduction: Groundwater hydrology, utilization and historical background, Occurrence and movement of groundwater, origin of groundwater. Rock properties affecting the movement of groundwater. Groundwater in hydrological cycle, measurement of groundwater level. Influence of water level fluctuation on environment.</p>	<p>Students Skill enhancement in the techniques of preparation of lithologs from field data.</p> <p>Students Skill enhancement in the techniques of Water table fluctuation in the groundwater.</p>

**Specify Course Outcome:**

Paper I: Both the Earth as a planet and Dynamic Geology are basics of the Earth and to understand the regularities of the solar system and dynamicity of the Earth.

Paper II: Both Mineralogy and crystallography are basic geology topics interrelated to each other and are useful before the study of rocks.

Paper II: Physical geology is useful for exploring the earth surface features by atmospheric agents and paleontology is required for studying the palaeo-environment and ecology.



**Specify Program Outcome:**

**Signature of Teacher**