

K.S.K.V KACHCHH UNIVERSITY

THIRD YEAR B. Sc.

GEOLOGY

(New Course in force from Year 2009-10)

(As per U G C Model Curriculum)

THEORY

- PAPER – VI: DESCRIPTIVE MINRALOGY; PETROLOGY.
- PAPER – VII: ECONOMIC MINERAL DEPOSITS
- PAPER – VIII: GENERAL STRATIGRAPHY; PALAEONTOLOGY.
- PAPER – IX: INDIAN STRATIGRAPHY.
- PAPER – X: GENERAL GEOLOGY; STRUCTURAL GEOLOGY; APPLIED GEOLOGY; ENGINEERING GEOLOGY GEOMORPHOLOGY AND REMOTE SENSING

PRACTICALS

- PRACTICAL – I: MINRALOGY; CRYSTALLOGRAPHY.
- PRACTICAL – II: PETROLOGY; OPTICS.
- PRACTICAL – III: PALAEONTOLOGY; CRYSTAL PROJECTIONS; BLOW PIPE ANALYSIS; FIELD WORK.
- PRACTICAL – IV: STRUCTURAL GEOLOGY; APPLIED GEOLOGY; PHOTO GEOLOGY.

PAPER – VI:

UNIT - 1: DESCRIPTIVE MINERALOGY & CRYSTALLOGRAPHY

UNIT - 2: OPTICAL MINERALOGY

UNIT - 3: IGNEOUS PETROLOGY

UNIT - 4: SEDIMENTARY PETROLOGY

UNIT - 5: METAMORPHIC PETROLOGY

UNIT - 1: DESCRIPTIVE MINERALOGY AND CRYSTALLOGRAPHY:

Structure of silicate minerals,

Study of Rock forming minerals, chemical classification of minerals and study of chief mineral families – Silica, Feldspar, Feldspathoid, Mica, Amphibole, Pyroxene, Olivine, Garnet, Zeolite, Aluminosilicate, Epidote, Zoisite.

CRYSTALLOGRAPHY

Hexagonal, Monoclinic and Triclinic crystal systems – their detailed study. Twinning in crystals.

UNIT - 2: OPTICAL MINERALOGY

Detail study of optical properties - Extinction, Interference colours, Order of interference colours – their controlling factors.

Uniaxial and Biaxial interference figures and optic sign determination – microscopic accessories

UNIT - 3: IGNEOUS PETROLOGY

Magma - Types, origin and composition.

Pyrogenetic minerals – Ortho-, meta- and poly silicates.

Saturated – Undersaturated minerals.

Crystallisation of Unicomponent and bicomponent magma with influencing factors and appropriate examples.

Bowen reaction series. Textures of igneous rocks.

Classification – mineralogical, chemical, textural and Hatch scheme.

UNIT - 4: SEDIMENTARY PETROLOGY

Genesis, classification and Types of sedimentary deposits – Residual, Detrital, Chemical and organic. Sedimentary structures.

UNIT - 5: METAMORPHIC PETROLOGY

Types of metamorphism – Thermal, Dynamothermal, Cataclastic and Plutonic.

Metamorphic structures and Textures. Classification of metamorphic rocks.

Outlines of zones and facies of metamorphism.

Relationship between metamorphism and deformation.

Reference Books:

Read, H.H. (1960): Rutley's Elements of Mineralogy (26th Edition). CBS Publishers and Distributers.

Kerr, P.F. (1977): Optical Mineralogy. Mc Graw Hills Inc

Winchel, N.H.; Winchel, A.N. (1968): Elements of Optical Mineralogy. Willey Eastern Ltd. Delhi.

Bose, M.K. (1997): Igneous Petrology. World Press.

Tyrell, G.W. (1960): The Principles of Petrology. Asia Publishing House.

Blatt, H. (1982): Sedimentary Petrology. Freeman & Company.

Nichols, G. (1999): Sedimentology and Stratigraphy. Blackwell.

Reading, H.G. (1996): Sedimentary Environments. Blackwell.

Miall, A.D. (2000): Principles of Sedimentary Basin Analysis. Springer Verlag.

Pettijohn, F.J.; Potter, P.E. and Siever, R. (1990): Sand and Sandstone. Springer Verlag.

Blatt, H.; Murray, G.V. and Middleton, R.C. (1980): Origin of Sedimentary Rock.

Sengupta, S. (1997): Introduction to Sedimentology. Oxford & IBH Publishing Company.

Bhattacharya, A. & Chakraborti, C. (2000): Analysis of Sedimentary Successions. Oxford & IBH Publishers. New Delhi.

Moorhouse, W.W. (1964): The Study of Rocks in Thin Sections. Harper and Row.

PAPER – VII:

**UNIT – 1: INTRODUCTION OF ECONOMIC GEOLOGY AND
CLASSIFICATION OF ORE DEPOSITS**

UNIT – 2: IGNEOUS PROCESSES

UNIT – 3: SEDIMENTARY PROCESSES

UNIT – 4: METAMORPHIC PROCESSES

UNIT – 5: MINERAL RESOURCES OF INDIA AND MINERAL FUELS

**UNIT - 1: INTRODUCTION OF ECONOMIC GEOLOGY AND
CLASSIFICATION OF ORE DEPOSITS**

Historical development of economic geology.

Definition of Mineral, Ore, Gangue, and Mineral deposits.

Various aspects of mineral exploitation. Methods of mineral exploration, exploitation and processing. Factors controlling mineral availability. Global mineral reserves and resources.

Distribution of mineral deposits in space and time.

Classification of mineral deposits – Outlines of Bateman's and Lindgren's classification.

UNIT - 2: IGNEOUS PROCESSES

Processes of mineral formations with examples from India and world - Magmatic, Pneumatolytic, Sublimates, Hydrothermal, Metasomatic replacement and cavity filling.

UNIT - 3: SEDIMENTARY PROCESSES

Weathering processes – Residual, Mechanical concentrations, Oxidation and Secondary enrichment with necessary chemical reactions involved.

Process of Sedimentation – source material, solution, transportation and deposition.

Conditions of deposition of – Iron ores, Manganese ores, Sulphur, Carbonates, Clays, Evaporation deposits – Gypsum, Sodium chloride and Potash deposits.

UNIT - 4: METAMORPHIC PROCESSES

Metamorphic deposits - Asbestos, Talc, Graphite, Kyanite – Sillimanite – Andalusite deposits with examples from India and other countries.

UNIT - 5: MINERAL RESOURCES OF INDIA AND MINERAL FUELS

Gold, Base metals, Ilmenite, Barite, Magnesite.

Pneumatolytic minerals, Minerals used for refractory; abrasives; atomic minerals; gemstones and minerals utilize in chemical industries.

Geology of fuels:

Coal -definition, origin and types of coal, stratigraphy of coal measures, fundamentals of coal petrology. Distribution and characteristics of coal deposits in India.

Oil (Petroleum and Natural Gas) origin, migration and entrapment of natural hydrocarbons, source and reservoir rocks, structural, stratigraphic and mixed oil traps.

Onshore and offshore distribution and characteristics of petroliferous basins in India.

Radioactive minerals: mineralogy, geochemistry, detection and measurement of radioactivity, prospecting techniques, distribution in India. Radioactive well logging.

Nuclear waste disposal.

Applied Aspects:

Changing pattern of mineral consumption. National mineral policy. Mineral concession rules; marine mineral resources and laws of Sea.

Reference Books:

Craig, J.M. and Vaughan, D.J. (1981): Ore Petrography and Minerology. John Willey.

Sawkins, F.J. (1984): Metal Deposits in relation to Plate Tectonics. Springer Verlag.

Klemm, D.D. and Schneider, H.J. (1977): Time and Strata Bound Ore Deposits. Springer Verlag.

Chandra, D.; Singh, R.M. and Singh, M.P. (2000): Textbook of Coal (Indian Context). Tara Book Agency. Varanasi.

Bateman, A.M. (1959): Economic Mineral Deposits. Asia Publishing House.

Gokhale, K.V.G.R. and Rao, T.C. (1972): Ore Deposits of India. Thompson Press.

Krishnaswamy, S. (1979): Indian Mineral Resources. Oxford & IBH Publishers.

Sinha, R.K. and Sharma, N.L. (1981): Mineral Economics. Oxford & IBH Publishers.

Banerjee, D.K. (1992): Mineral Resources of India. The World Press Pvt. Ltd.

PAPER -VIII.

UNIT – 1: LAWS OF STRATIGRAPHY AND TYPES

UNIT – 2: INVERTEBRATE PALAEOLOGY

STUDY OF PHYLUM PROTOZOA, CNIDARIANS, & BRACHIOPODA

UNIT – 3: STUDY OF PHYLUM MOLLUSCA

UNIT – 4: STUDY OF PHYLUM ARTHROPODA, ECHINODERMATA, &
HEMICHORDATA

UNIT – 5: PALAEOECOLOGY, PALAEBOTANY, ICHNOLOGY & STUDY OF
FOSSIL RICH STRATA OF KACHCHH

UNIT - 1: FUNDAMENTAL LAWS OF STRATIGRAPHY

Laws of stratigraphy, Facies concept in stratigraphy, Index fossils, Correlation, Homotaxis, Palaeogeography, Igneous and tectonic phenomena and geosynclinal developments, Rock Suites and petrographic provinces. Geological Time Scale, Geological eras and their subdivisions.

Concepts: Lithostratigraphy, Chronostratigraphy, Magnetostratigraphy, seismostratigraphy, Sequence stratigraphy.

UNIT - 2: INVERTEBRATE PALAEOLOGY

Study of phyla - Protozoa, Cnidaria, , Brachiopoda

UNIT - 3: STUDY OF PHYLUM MOLLUSCA

UNIT - 4: STUDY OF PHYLUM ARTHROPODA, ECHINODERMATA &
HEMICHORDATA

UNIT – 5 PALAEOECOLOGY, PALAEBOTANY, ICHNOLOGY & STUDY OF
FOSSIL RICH STRATA OF KACHCHH

Concepts of natural ecosystems on the earth and their mutual interrelations and interactions (atmosphere, hydrosphere, lithosphere and biosphere).

Outlines of palaeobotany, Ichnology & Study of Fossil Rich Strata of Kachchh

Reference Books:

Wood, H. (1982): An Introduction to Invertebrate Palaeontology.

Shrock and Twenhofel: Principles of Invertebrate Palaeontology.

Cambridge University Press.

Davies, A.M. (1972): An introduction to Palaeontology. Thomas Murby & Company.

- Clarkson, E.N.K. (1998): *Invertebrate Palaeontology and Evolution*. IV Edition. Blackwell.
- Benton, M.J. (1990): *Vertebrate Palaeontology and Evolution*. Unwin Hyman.
- Arnold, C.A. (1947): *An Introduction to Palaeobotany*. Mc Graw Hill.
- Haq, B.V. and Boersma, A. (1998): *Introduction to Marine Micropalaeontology*. Elsevier.

PAPER – IX:

UNIT – 1: INDIAN STRATIGRAPHY; STUDY OF ARCHAEOZOIC ERA

UNIT – 2: STUDY OF PALAEOZOIC ERA

UNIT – 3: STUDY OF MESOZOIC ERA

UNIT – 4: STUDY OF CENOZOIC ERA

UNIT – 5: STUDY OF GEOLOGY OF GUJARAT

UNIT – 1: STUDY OF ARCHAEOZOIC ERA

Detailed study of Fundamental Complex - Archaeans and Dharwars and their mineral wealth.

UNIT – 2: STUDY OF PALAEOZOIC ERA

UNIT – 3: STUDY OF MESOZOIC ERA

UNIT – 4: STUDY OF CENOZOIC ERA

UNIT – 5: STUDY OF GEOLOGY OF GUJARAT

Nature, origin and geology of Rajasthan desert and Rann of Kutch and their economic importance.

Geology of Gujarat and associated mineral wealth.

Reference Books:

Wadia, D.N. (1962): Geology of India. Tata Mc Graw Hill.

Krishnan, M.S. (1968): Geology of India and Burma. Higgin Bothams.

Ravindra Kumar (1982): Fundamentals of Historical Geology and Stratigraphy of India. Willey Eastern Ltd.

Naqvi, S.M. and Rogers, J.J.W. (1987): Precambrian Geology of India. Oxford University Press.

Pascoe, E.H. (1968): A Manual of Geology of India and Burma. Vol. I-IV. Govt. of India Press.

PAPER – X:

UNIT – 1: GENERAL GEOLOGY

UNIT – 2: STRUCTURAL GEOLOGY

UNIT – 3: APPLIED GEOLOGY

UNIT – 4: ENGINEERING GEOLOGY

UNIT – 5: GEOMORPHOLOGY AND REMOTE SENSING

UNIT – 1: GENERAL GEOLOGY

Geochemical evolution of the earth.

Geophysical conditions of the earth – gravity, magnetism and heat flow.

Origin of oceans and continents.

Age of the earth, Isostasy, Mountain building process, Glaciation, Glacio-eustasy, Continental drift, Outlines of Plate tectonics.

Convection in the earth and production of its magnetic field.

UNIT – 2: STRUCTURAL GEOLOGY

Causes and Mechanism of Folding, Faulting.

Structural concepts of main mountain ranges – Himalaya and Aravalli.

Order of superposition in the field

UNIT – 3 APPLIED GEOLOGY

Toposheets , Geological maps and reports.

Methods of Prospecting. Methods of geological and geophysical prospecting and their applications – Magnetic, Gravity, Seismic and Electrical methods.

Prospecting for economic minerals - drilling, sampling and assaying.

Elements of surveying – use of prismatic compass, altimeter and plane table.

Field techniques – Use of Clinometer Compass, Brunton Compass, Methods of Sampling.

Introduction to geological mapping and report writing.

UNIT – 4: ENGINEERING GEOLOGY

Geology in relation to engineering. Properties on rocks to be used as building stones.

Important building stones of India. Foundations. Dam sites.

Use of computers in geological studies.

Concept and definition of environmental geology.

UNIT – 5: GEOMORPHOLOGY AND REMOTE SENSING

A general outline of geomorphology – topography and its relation to structures and lithology.

Major landforms. Drainage systems. Geomorphic features of India.

REMOTE SENSING

Introduction to aerial photographs, satellite imageries and preparation of photogeological maps.

ELEMENTS OF RELATED DISCIPLINES

Elements of related disciplines - Geochemistry, Geophysics, Nuclear geology and mining geology.

Fieldwork in geologically important areas is compulsory.

Reference Books:

Holmes, A. (1978): Principles of Physical Geology. The English Language Book Society.

Patwardhan, A.M. (1999): The Dynamic Earth System. Prentice Hall.

Billings, M.P. (1977): Structural Geology. Prentice Hall.

Hobbs, B.E.; Means, W.E. and Williams, P.F. (1957): An Outline of Structural Geology.

Schultz, J.R. and Cleaves, A.B. (1955): Geology in Engineering. John Willey.

Singh, P. (1985): Principles of Engineering Geology.

Sharma, P.V. (1986): Geophysical Methods in Geology. Elsevier.

Dobrin, M.B. (1976): Introduction to Geophysical Prospecting. Mc Graw Hill.

Ramchandra Rao, M.B. (1993): Outlines of Geophysical Prospecting – A Manual for Geologists. EBD Educational Pvt. Ltd. Dehradun.

Lahee, F.H. (1961): Field Geology. Mc Graw Hill.

Compton, R.R. (1962): Manual of Field Geology.

Sabbins, F.F. (1985): Remote Sensing – Principles and Applications. Freeman.

Pandey, S.N. (1987): Principles and Applications of Photogeology. John Willey.

Thornbury, W.D. (1969): Principles of Geomorphology. John Willey Inc.

Mason, B. and Moore, C.B. (1991): Introduction to Geochemistry. Wiley Eastern.

Mason, B. & Moore, C.B. (1991): Introduction to Geochemistry. Wiley Eastern Ltd.

Wood, B.J. and Fraser, D.G. (1976): Elementary Thermodynamics for Geologists. Oxford University Press.

McKinstry, H.E. (1962): Mining Geology. II Edition. Asia Publishing House.

Clark, G.B. (1967): Elements of Mining. III Edition. John Wiley.

Arogyaswami, R.P.N. (1996): Courses in Mining Geology. IV Edition. Oxford & IBH Publishers.

Umathay, R.M. (2001): Text Book of Mining Geology. Dattsons.

K.S.K.V KACHCHH UNIVERSITY

THIRD YEAR B. Sc.

GEOLOGY

(New Course in force from 2009-10)

(As per U G C Model Curriculum)

PRACTICALS

PRACTICAL - I:

- *MINERALOGY*
- *CRYSTALLOGRAPHY*

MINERALOGY:

Megascopic study of metallic and non-metallic minerals representing important mineral families-: Quartz, amethyst, chalcedony, agate, bloodstone, flint, jasper, opal, orthoclase, microcline, plagioclase, muscovite, biotite, beryl, fluorite, garnet, apatite, halite, hornblende, augite, tourmaline, olivine, Leucite, Nepheline, Sodalite, Scapolite, Enstatite, Hypersthene, Bronzite, Wollastonite, Tremolite, Actinolite, Glaucophane, Serpentine, Andalusite, Sillimanite, Kyanite, Topaz, Staurolite, Sphene, Epidote, Analcime, Stilbite, Apophyllite, Kaolin, Aragonite.

ORES: Magnetite, Hematite, limonite, siderite. Ilmenite, chromite, pyrolusite, pyrite, chalcopryrite, malachite, galena, sphalerite, chlorite, bauxite. Stibnite, Rutile, Psilomelane, Cassiterite, Corundum, Franklinite, Willemite, wolframite, Azurite.

Study of the following minerals in thin sections

Quartz, orthoclase, microcline, plagioclase, muscovite, biotite, hornblende, hypersthene, augite, olivine, tourmaline, calcite, sphene, garnet, apatite.

Chlorite, Staurolite, Kyanite, Sillimanite, Andalusite, Enstatite, Bronzite, Tremolite, Diopside, Nepheline, Leucite, Hauyne, Nosean.

CRYSTALLOGRAPHY:

Study of crystal models representing Eleven types of six systems with diagrams. Study of twin crystals with diagrams.

PRACTICAL - II:

- *PETROLOGY*
- *OPTICS*

PETROLOGY:

Megascopic identification of the following rock specimens

Granite, Graphic granite, Porphyritic granite, Syenite, Gabbro, Pegmatite, Rhyolite, Trachyte, Basalt, Obsidian, Pumice, Conglomerate, Sandstone, Shale, Limestone, Slate, Schist, Quartzite, Marble.

Anorthosite, Pyroxenite, Dunite, Eclogite, Dolerite, Pitchstone, Andesite, Breccia, Grit, Oolitic and Pisolitic limestone, Phyllite, Schist-different varieties, Granulite, Peat, Lignite, Bituminous, Anthracite, China clay, Fire clay, Laterite.

Identification of typical rocks in thin sections

Granite, Syenite, Gabbro, Dolerite, Rhyolite, Trachyte, Basalt, Conglomerate, Sandstone, Limestone – fossiliferous, Quartzite, Marble, Mica-schist, Hornblende, Gneiss. Tourmaline granite, Hypersthene granite, Diorite, Picrite, Andesite, Limburgite, Sillimanite garnet gneiss, Andalusite schist, Actinolite schist.

OPTICS:

Uniaxial and Biaxial interference figures, Optic sign determination, Pleochroic scheme- Uniaxial, Biaxial.

PRACTICAL - III:

- PALAEOLOGY
- CRYSTAL PROJECTIONS
- BLOW PIPE ANALYSIS

PALAEOLOGY:

Study of invertebrate and plant fossil specimen representing important phyla belonging to different geological eras - with diagrams.

CRYSTAL PROJECTIONS

Clinographic and stereographic (by geometric method) projections of simple crystals of Cubic, Tetragonal and Orthorhombic systems. Representation of elements of symmetry of eleven types of symmetry with stereographic projections.

BLOW PIPE ANALYSIS:

Blow pipe analysis of 20 mineral powders-Carbonates, Sulphates, Sulphides and Oxides of Calcium, Strontium, Barium, Zinc, Lead, Magnesium, Iron, Copper, Manganese, Chromium, Antimony.

PRACTICAL - IV:

- STRUCTURAL GEOLOGY
- APPLIED GEOLOGY
- PHOTOGEOLOGY
- FIELD WORK

STRUCTURAL GEOLOGY:

Section and description of geological maps with structural features such as unconformity, overlap, faulting, folding, inliers, outliers and igneous intrusions. Outcrop problems with one series of strata with inlier, outlier and faulting. Graphic solutions of structural problems.

APPLIED GEOLOGY:

Orientation and reading of toposheets. Uses of clinometer compass and Brunton compass. Elementary plane table survey.

PHOTOGEOLOGY:

Study of stereo pair photos depicting typical landforms with the help of pocket stereoscope.

FIELD WORK

Viva voce and fieldwork. Examination of journals.

Field work in geologically important areas is compulsory.

NOTE: Report of geological fieldwork and keeping of systematic journals are compulsory.