

अंतरी पेटवू ज्ञानज्योत



(NAAC Re-Accredited)

**KAVAYITRI BAHINABAI CHAUDHARI  
NORTH MAHARASHTRA UNIVERSITY,  
JALGAON.**

**FACULTY OF SCIENCE AND TECHNOLOGY  
Choice Based Credit System (CBCS) Pattern  
Syllabus for S.Y.B.Sc.GEOLOGY**

**Semester III and IV**

**With Effect from June, 2019**

**Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon.**

**Faculty of Science and Technology**

Choice Based Credit System (CBCS) Pattern

**S.Y.B.Sc. Geology Syllabus**

**(With Effect from June, 2019)**

**SEMESTER –III**

GL: 301 – Igneous Petrology

GL: 302 – Sedimentary Petrology

GL: 303 – Geology Practical

GL: 304 – Hydrogeology (SEC - I)

**SEMESTER –IV**

GL: 401 – Metamorphic petrology

GL: 402—Stratigraphic Principles and Indian Stratigraphy

GL: 403 – Geology Practical

GL: 404 – Watershed Development (SEC-II)

**Semester –III; Paper – I; Paper –GL: 301**

**Title - IGNEOUS PETROLOGY(CREDITS: 2)**

**Unit 1: Concepts of Igneous petrology**

- a. Introduction to Petrology: Heat flow, geothermal gradients through time,
- b. Origin and Types of magma (Acidic, Felsic, Salic, Intermediate, Basic, Mafic, Femic, and Ultramafic.)

**Unit 2: Forms, textures and structures**

- a. Mode of occurrence of Igneous rocks: Concordant (Sills, Lopolith, Laccolith, Phaccolith) and Discordant (Dykes, Batholith)

- b. Textures and structures of igneous rocks:

Definition of terms: Texture, Holocrystalline, Mero-, Hypo- and Hemi-crystalline, Holohyaline, Euhedral, Idiomorphic, Subhedral, Hypidiomorphic, Anhedral, Allotriomorphic, Phaneritic, Aphanitic.

Textures: Equigranular, Inequigranular, Poikilitic, Ophitic, Sub-ophitic, Porphyritic, Glassy, Graphic.

Structures: Columnar, Flow, Ropy, Vesicular, Amygdaloidal.

- c. Classification of igneous rocks: Tabular and IUGS.

**Unit 3: Phase diagrams and Petrogenesis**

- a. Definition and types of Pyrogenetic minerals.
- b. Crystallization of Unicomponent magma,
- c. Crystallisation of Binary Magma :
  1. Eutectic (Orthoclase - Quartz,)
  2. Solid Solution (Albite – Anorthite).
- d. Magma generation in source region, their emplacement and evolution.
- e. Petrogenesis of Basalt, Gabbro, Granite and Kimberlites.

**Unit 4: Magmatism in different tectonic settings**

- a. Magmatism in the oceanic domains (MORB, OIB)
- b. Magmatism along the plate margins (Island arcs/Continental arcs).

### **SUGGESTED READINGS:**

1. Anthony Hall, Igneous Petrology
2. Best, Myron G. Igneous and Metamorphic Petrology, Blackwell Science
3. Bose M.K. 1997 Igneous Petrology.
4. Cox, K G, J. D. Bell. (1979).The Interpretation of Igneous Rocks,Springer.
5. Ehlers E. G. & Blatt H.Igneous, Sedimentary and Metamorphic Petrology CBS Publication
6. Elthers and Blatt, Igneous and Metamorphic petrology
7. Huang Petrology, McGraw Hill Book Co.
8. McBirney, A. R. (1984).Igneous Petrology, Oxford Univ. Press,
9. Myron G. Best (2001). Igneous and Metamorphic Petrology
10. Nockold, Knox and Chinner, Petrology for Students,Cambridge University Press
11. Philpotts, A., & Ague, J. (2009). Principles of igneous and metamorphic petrology. CambridgeUniv Press
12. Raymond, L. A. (2002). Petrology: the study of igneous, sedimentary, and metamorphic rocks McGraw-Hill
13. Turner and Verhoogen, Igneous and Metamorphic Petrology
14. Tyrell G W, Principles of Petrology
15. Williams, Turner, Gilbert, Petrography
16. Winter J D An Introduction to Igneous and Metamorphic Petrology, Prentice Hall
17. Winter, J. D. (2014). Principles of igneous and metamorphic petrology, Pearson.

**Semester –III; Paper – II; Paper – GL: 302**

**Title - SEDIMENTARY PETROLOGY(CREDITS: 2)**

**Unit 1: Origin of sediments**

- a. Definition of Sediment and Sedimentary rocks
- b. Derivation and sources of sediments.
- c. Definition of Terms:Erosion, Transportation, Deposition, Cement and Matrix
- d. Diagenesis (Concept, Stages, Compaction and Cementation),

**Unit 2: Texture of sedimentary rocks**

- a. Grain size scale (Wentworth), Grain size distribution, Grain shape(Zingg), Roundness and Sphericity (Wadell)
- b. Classification of sediment admixture by Shepard
- c. Fabric (Framework, Matrix and Cement).
- d. Texture (Clastic, Non-clastic, Bio-clastic).

**Unit 3: Sedimentary structures and environment**

- a. Fluid flow: Laminar and turbulent flow.
- b. Particle entrainment and Transport (Traction / Rolling, Saltation, Suspension, Solution)
- c. Environment of deposition (Terrestrial and Marine).
- d. Sedimentary structures : Physical (Laminations, Ripple marks, Graded bedding, Cross bedding, Mud cracks), Chemical (Concretions, Nodules), Biological (Tracks and trails)

**Unit 4: Varieties of sedimentary rocks**

- a. Common mineral composition of siliciclastic sediments
- b. Classification based on Products of Weathering
- c. Siliciclastic rocks: Conglomerates, Sandstones, Shales, Mudstones.
- d. Classification of Carbonate (limestone) rocks by Folk.

**Unit 5: Introduction to Palaeontology**

- a. Definition of Palaeontology and fossil, importance and uses of fossil
- b. Taphonomy (favourable factors, process)
- c. Modes of preservation (altered, unaltered, petrification, permineralisation, carbonization, silicification, cast and mould, tracks and trails)

## SUGGESTED READINGS:

1. Blatt. H, Middleton, G.V. & Murray. R.C, Origin of Sedimentary Rocks.
2. Collinson, J. D. & Thompson, D. B. (1988) Sedimentary structures, Unwin- Hyman.
3. Ehlers, WG, and Blatt, H, Petrology, Igneous, Sedimentary and Metamorphic rocks,CBS Publishers
4. Folk. R.L.Petrology of Sedimentary rocks
5. Friedman & Sanders, Principles of Sedimentology., 1978. John Wiley and sons.
6. Greensmith, Sedimentary rocks
7. Huang, Petrology, McGraw Hill Book Co. – 1962)
8. Krynbein&Pettijohn, Manual of sedimentary petrology
9. Leeder, Sedimentology
10. Lindholm Roy, A practical Approach to Sedimentology
11. Moorhouse, WW, The study of rocks in thin sections, 1969. Harper and sons.
12. Nichols, G. (2009) Sedimentology and Stratigraphy, Wiley Blackwell
13. Nockold, Knox and Chinner, Petrology for Students, Cambridge University Press
14. Pettijohn, Sedimentary rocks, CBS Publ.
15. Prasad, C., 1980. A text book of sedimentology.
16. Prothero, D. R., & Schwab, F. (2004). Sedimentary Geology. Macmillan.
17. Selley Richard P (2000): Applied Sedimentology. Academic Press
18. Sengupta. S., 1997. Introduction to sedimentology. Oxford-IBH.
19. Sukhatankar R. K. Applied Sedimentology
20. Tucker, M. E. (2006) Sedimentary Petrology, Blackwell Publishing.
21. Tyrell, G. W, Principles of Petrology. Methuren and Co.
22. Williams, Turner, Gilbert- Petrography
23. Woods Henry – Invertebrate , CBS Publishers and Distributers.
24. Kulkarni et al - Concepts in Geology, Nirali Prakashan.

**Semester –III; Paper -III; Paper- GL: 303**

**Geology Practical(Credits: 2)**

**A: Igneous Petrology**

**1. Petrography of rocks:**

**a. HandSpecimens:** Granite, Diorite, Gabbro, Anorthosite, Pegmatite, Graphic Granite, Compact Basalt, Porphyritic Basalt, Andesite, Pitchstone, Obsidian, Trachyte, Rhyolite, Dunite.

**b. Thin Sections :** Granite, Basalt, Gabbro, Anorthosite, Trachyte, Dunite, Graphic Granite.

2. Study of megascopic structures and textures of igneous rocks: Flow structure, Vesicular, Amygdaloidal, Columnar, Ropy, Equigranular, Porphyritic, Graphic, Glassy.

**B: Sedimentary Petrology**

**3. Petrography of Rocks:**

**a. Hand specimen:** Laterite, Bauxite, Conglomerate, Breccia, Siliceous Sandstones, Ferruginous sandstones, Arkose, Glauconitic Sandstone, Shale, Mudstone, Limestones and Lamellibrach Limestones, Crinoidal Limestone Calcrete.

**b. Thin sections:** Siliceous Sandstone, Ferruginous sandstones, Arkose, Limestone, Miliolitic Limestones, Nummulitic Limestone.

4. Study of sedimentary structures and textures: Ripple marks, Graded bedding, Cross bedding, Mud cracks, Laminations, Tracks and trails, Concretions and nodules, Clastic, Bioclastic, Non-clastic.

5. Study of mode of preservation of fossil – Cast and mould, Petrification, Silicification, Imprints.

**Suggested Reading:**

1. Rabindra Nath Hota: Practical Approach to Petrology, CBS Publishers and Distributers.

**Semester –III; (Skill Enhancement Course- SEC-I) Paper –GL:304**

**Title – HYDROGEOLOGY (Credits- 2)**

**Unit 1: Introduction and basic concepts**

- a. Definition of Hydrology, Geohydrology and Hydrogeology
- b. Scope of hydrogeology and its societal relevance
- c. Distribution of water on the earth
- d. Origin of water ( meteoric, juvenile, connate, magmatic and metamorphic
- e. Hydrologic cycle: Definition of: precipitation, evapo-transpiration, run-off, soil moisture, infiltration and subsurface movement of water, recharge and discharge.
- f. Rock properties affecting groundwater, Vertical distribution of subsurface water
- g. Types of aquifer (aquiclude, aquitard, aquifuge, confined, unconfined, perched),
- h. Aquifer parameters (porosity, permeability, specific yield, specific retention, transmissivity),
- i. Type of wells (dug, bore, dug cum bore)

**Unit 2: Groundwater flow**

- a. Darcy's law
- b. Introduction to Permeability and hydraulic conductivity, Storativity, piezometric level

**Unit 3: Well hydraulics and Groundwater exploration**

Concept of Well Inventory

Surface-based groundwater exploration methods (Wenner and Schlumberger)

**Unit 4: Groundwater chemistry**

- a. Physical and chemical properties of water and water quality (pH, TDS, Conductance, Hardness, Alkalinity, Chlorides, Ca, Mg, Na, F, NO<sub>3</sub>)

**PRACTICALS:**

- a. Well Inventory – Questionnaire
- b. Water potential zones of India (map study).
- c. VES



**SUGGESTED READINGS:**

1. Davis, S. N. and De Weist, R.J.M. 1966. Hydrogeology, John Wiley & Sons Inc., N.Y.
2. Gautam Mahajan Groundwater Surveys and Investigation:
3. H. Raghunath Groundwater:
4. Karanth K.R., 1987, Groundwater: Assessment, Development and management, Tata McGraw-
5. Karnath K. R. Groundwater Assessment, Development and Management:
6. Murthy J. V. S. Watershed management in India:
7. Todd D. K. Groundwater: Hydrology:
8. Todd, D. K. 2006. Groundwater hydrology, 2nd Ed., John Wiley & Sons, N.Y.

**Semester – IV; Paper –I; Paper – GL: 401**

**Title- METAMORPHIC PETROLOGY(Credits: 2)**

**Unit 1: Metamorphism: controls and types.**

- a. Definition and scope of metamorphism.
- b. Brief description of Factors controlling metamorphism (P /T, Fluids, depth, zones)
- c. Short account of Grade of Metamorphism (Low, High, Prograde, Retrograde)
- c. Types of metamorphism - Contact,Regional, fault zone metamorphism /  
Dynamothermal (Mylonites and Fault breccia)

**Unit 2: Metamorphic facies and grades**

- a. Index minerals, Typical Metamorphic minerals
- b. Metamorphic zones and isograds.
- c. Concept of metamorphic facies and grade
- d. Mineralogical phase rule of closed and open system
- e. Metamorphic mineral reactions (prograde and retrograde)
- f. Composition Paragenesis diagram – ACF, AKF, AFM triangular fields

**Unit 3: Metamorphism and Tectonism**

- a. Relationship between metamorphism and deformation
- b. Foliated (Slaty, Schistose, Gneissose,) Non-foliated (Hornfelsic, Granulose)

**Unit 4: Metamorphic reactions**

- a. Types of Metamorphic reactions (Univariant and Divariant)
- b. Progressive metamorphism of Pelitic, Basic and Pure and Impure Carbonate rocks.

## SUGGESTED READINGS:

1. Best M. G., Igneous and Metamorphic Petrology, Wiley Publication
2. B. Bhaskar Rao, Metamorphic Petrology
3. Chatterjee S C, Petrography of the Igneous and Metamorphic rocks in India:
4. Ehlers E. G. & Blatt H, Igneous, Sedimentary and Metamorphic Petrology. CBS Pub.
5. Elthers and Blatt, Igneous and Metamorphic petrology
6. Harker Alfred, Metamorphism:
7. Huang, Petrology, McGraw Hill Book Co.
8. Mason R., Metamorphic Petrology
9. Mason, R, Petrology of Metamorphic Rocks, CBS Publ.
10. Miyashiro, Metamorphism and Metamorphic belts:
11. Moorhouse, WW The study of rocks in thin sections., 1969. Harper and sons.
12. Nockold, Knox and Chinner, Petrology for Students, Cambridge University Press
13. Philpotts, A., & Ague, J., Principles of igneous and metamorphic petrology. Cambridge Uni. Press.
14. Raymond, L. A. Petrology: the study of igneous, sedimentary, and metamorphic rocks McGraw-Hill
15. Turner and Verhoogen, Igneous and Metamorphic petrology, Allied Publishers.
16. Turner, F.J, Metamorphic petrology, McGraw Hill.
17. Tyrell G.W. Principles of Petrology –
18. Vernon R. H. and Clarke G. L., Principles of Metamorphic Petrology, Cambridge Publication
19. Williams, Turner, Gilbert, Petrography
20. Winkler HGF, Metamorphic petrology, Nirosa publications
21. Winkler, H.G.C., Petrogenesis of Metamorphic Rock, Narosa Publ.
22. Winter J D, An Introduction to Igneous and Metamorphic Petrology, Prentice Hall
23. Winter, J. D. Principles of igneous and metamorphic petrology. Pearson.
24. Yardley, An Introduction to Metamorphic Petrology, ELBS Publication
25. Yardley, B. W., & Yardley, B. W. D, An introduction to metamorphic petrology Longman.

**Semester –IV; Paper – II; Paper – GL: 402**

**Title - STRATIGRAPHIC PRINCIPLES AND INDIAN STRATIGRAPHY (Credits: 2)**

**Unit 1: Principles of stratigraphy**

- a. Fundamentals of litho-, bio- and chrono-stratigraphy
- b. Laws of Stratigraphy (Superposition, Uniformitarianism, Horizontality, Cross cutting relationship, Lateral continuity, Faunal succession)
- b. Principles of Stratigraphic Correlation
- c. Walther's Law of Facies.

**Unit 2: Stratigraphic nomenclature**

- a. Brief introduction to the concepts of Lithostratigraphy, Biostratigraphy, Chronostratigraphy, Seismicstratigraphy, Chemostratigraphy, Magnetostratigraphy, Sequencestratigraphy and Paleogeographic reconstruction

**Unit 3: Physiographic and tectonic subdivisions of India**

- a. Brief introduction to the physiographic and tectonic subdivisions of India.
- b. Major Geological and chronological Formations of India
- c. Introduction to Indian Shield and Cratons

**Unit 4: Indian Stratigraphy**

- a. Introduction to Proterozoic basins of India.
- b. Lithology and geochronologic classification of Dharwar, Delhi – Aravalli Craton, Vindhyan, Cudappah, Gondwana, Jurassic of Kutch, Cretaceous of Trichinopoly, Tertiary of Assam, Siwaliks, Deccan traps
- c. Stratigraphy and Structure of Assam-Arakan basin, Krishna-Godavari basin, Cauvery basin Bombay High and Cambay basin for their hydrocarbon potential

**Unit 5: Quaternary Geology**

- a. Subdivisions of Quaternary Succession in India

**SUGGESTED READINGS:**

1. Boggs S., Principles of Sedimentology and Stratigraphy ,Prentice Hall
2. Brian Harland et al., A Geological Time Scale
3. Chakranarayan and others, Textbook of Geology (For S.Y.B.Sc.)
4. Doyle, P. & Bennett, M. R. Unlocking the Stratigraphic Record. John Wiley
5. Dunbar and Rogers, Principles of Stratigraphy
6. Grabau, Principles of Stratigraphy
7. Krishnan, M. S., Geology of India and Burma, CBS Publishers, Delhi
8. Krumbein and Sloss, Stratigraphy and Sedimentation
9. Leamon, Principles of Stratigraphy
10. Ramakrishnan, M. &Vaidyanadhan, R, Geology of India Volumes 1 & 2,. Geological Soc.India
11. Ravindra Kumar, Fundamentals of Historical Geology and Stratigraphy of India
12. Spencer E. W., Basic Concept of Historical Geology
13. Valdiya, K. S. The making of India, Macmillan India Pvt. Ltd.
14. Valdiya, K. S., The making of India, Macmillan India Pvt. Ltd.
15. Weller, J. M, Stratigraphic Principles and Practices,

**Semester – IV; Paper – III; Paper- GL-403**

**Title - Geology Practical (Credits: 2)**

**PRACTICALS:**

**A: Metamorphic Petrology**

a. Megascopic study of the following metamorphic rocks:

Serpentine, Chlorite Schist, Slate, Talc-Tremolite schist, Biotite schist, Hornblende schist, Mica Garnet schist, Amphibolite, Hornblende Gneiss, Biotite Gneiss, Marble, Quartzite, Charnockite, Kyanite Schist,

b. Microscopic study of : Marble, Quartzite, Mica Schist, Mica Garnet schist, Kyanite Schist, Charnockite, Hornblende Gneiss.

c. Laboratory exercises in graphic plots for petrochemistry and interpretation of assemblages ACF, AKF, AFM

**B: Indian Stratigraphy**

1. Study of geological map, Tectonic map of India
2. Identification of major stratigraphic units of Indian Geology.
3. Study of rocks in hand specimens from known Indian stratigraphic horizons
4. Study of different Proterozoic supercontinent reconstructions.
5. Map showing Petroliferous Basins of India
6. Maps showing Shield, Cratons, Mobile belts, Sedimentary Basins of India

**Suggested Reading:**

1. Rabindra Nath Hota: Practical Approach to Petrology, CBS Publishers and Distributers.
2. Krishnan, M. S., Geology of India and Burma, CBS Publishers, Delhi
3. Ravindra Kumar, Fundamentals of Historical Geology and Stratigraphy of India

**Title - WATERSHED DEVELOPMENT**

**Unit: 1 Concept of Watershed**

Definition, Characteristics and classification of watershed

Integrated Multi-disciplinary Approach

**Unit: 2 Preparation and Development of watershed**

Demarcation and leveling of watershed

Soil and Soil Moisture

Conservation measures for watershed – Plugging, Trenching, furrowing, Contour technique

**Unit: 3 Groundwater and rainwater Management**

Rainwater harvesting: Concept and methods

Introduction to Artificial recharge of groundwater – Roof-water harvesting, Soak pit, Check dams,

Stop dams, Gabion structure, Mud dam on nala, Percolation tanks.

**Unit: 4 Socioeconomics of watershed management**

State and integrated approach – Transfer of technology

Participation of citizens – Awareness and participation

Water budget

**Suggested Readings:**

1. J. V. S. Murty: Watershed Management, New Age International Publishers.
2. Dr. Santosh Saksena: Methods of Artificial Recharge of Groundwater, GARC Publicatiions, Balaghat.

