

*SCIENCE FACULTY*

**NORTH MAHARASHTRA UNIVERSITY, JALGAON**



**SYLLABUS**

**FOR**

**M.Sc.Part-II**

**Applied Geology**

**(With effect from June - 2014)**

**M. Sc. (Applied Geology)**

**Semester I**

- GS 101: Mineralogy and Crystallography.
- GS 102: Principles of Stratigraphy and Palaeontology
- GS 103: Sedimentology
- GS 104: Practicals related to Mineralogy, Crystallography and Palaeontology.
- GS 105: Practicals related to Sedimentology
- GS 106: Tutorial 1

**Semester II**

- GS 201: Igneous and Metamorphic Petrology
- GS 202: Physics and Chemistry of the Earth.
- GS 203: Geomorphology, Structural Geology and Tectonics
- GS 204: Practicals related to Igneous and Metamorphic Petrology
- GS 205: Practicals related to Geomorphology, Structural Geology and Tectonics
- GS 206: Tutorial 2

**Semester III**

- GS 301: Indian Stratigraphy.
- GS 302: Indian mineral deposits, exploration and mining
- GS 303: Remote sensing and GIS
- GS 304: Practicals related to Indian mineral deposits, exploration and mining.
- GS 305: Practicals related to Remote sensing and GIS.
- GS 306: Seminar 1

**Semester IV**

- GS 401: Petroleum Geology.
- GS 402: Hydrogeology
- GS 403: Engineering and environmental Geology.
- GS 404: Practicals related to Petroleum Geology, Hydrogeology, Engineering and environmental Geology
- GS405: Dissertation
- GS 406: Seminar 2

**Note:** Industrial training/Geological field mapping/allotted geological project work/ Dissertation is compulsory for M. Sc. (Applied Geology) students.

**SCHOOL OF ENVIRONMENTAL AND EARTH SCIENCES**  
**North Maharashtra University, Jalgaon**  
**COURSE STRUCTURE WITH CREDIT**  
**M.Sc. (Applied Geology)**

	<b>Course</b>	<b>Marks</b>	<b>Hrs./Week</b>	<b>Credit</b>	<b>Total</b>
<b>Semester I</b>	GS-101	100	04	04	<b>21</b>
	GS-102	100	04	04	
	GS-103	100	04	04	
	GS-104	100	08	04	
	GS-105	100	08	04	
	GS-106	25	01	01	
<b>Semester II</b>	GS-201	100	04	04	<b>21</b>
	GS-202	100	04	04	
	GS-203	100	04	04	
	GS-204	100	08	04	
	GS-205	100	08	04	
	GS-206	25	01	01	
<b>Semester III</b>	GS-301	100	04	04	<b>21</b>
	GS-302	100	04	04	
	GS-303	100	04	04	
	GS-304	100	08	04	
	GS-305	100	08	04	
	GS-306	25	01	01	
<b>Semester IV</b>	GS-401	100	04	04	<b>21</b>
	GS-402	100	04	04	
	GS-403	100	04	04	
	GS-404	100	08	04	
	GS-405	100	08	04	
	GS-406	25	01	01	

**Grand Total: 84**

## **SEMESTER – III**

### **GS-301: INDIAN STRATIGRAPHY**

#### **Unit - I: Archeans**

1. Tectonic framework of India – Cratons and Mobile Belts
2. Dharwar Craton EDC and WDC (Gold Bering Schist belts and Iron Ore Group)
3. Singbhum Craton (OMG, OMTG and Iron Ore Group)
4. Baster Craton (Sukma, Bengpal and Bailadila Series)
5. Arvalli Craton (BGC, Sandmata Complex, Bhiwara Super group)
6. Budelkhand (Supracrustal Gneisses and Budelkhand Granite)

#### **Unit - II: Mobile Belts**

1. Satpura Mobile Belts
2. Pandyan Mobile Belts
3. Easter Ghats Mobile Belts (Charnockite and Khondalite)

#### **Unit - III: Proterozoics of Peninsular India**

1. Delhi Super Group
2. Vidhayan Super Group
3. Cuddapah Super Group
4. Sausar- Sakoli Group
5. Kaladgi Group Bhima
6. Pranhita-Godavari Group

#### **Unit - IV: Phanerozoic Stratigraphy of India**

1. Ophiolite Belt (Indus, Shayok, Trans- Himalaya and Karakoram Batholiths)
2. Stratigraphic and Tectonics of Siwalik
3. Stratigraphic and Tectonics of Spiti Valley
4. Gondwana Super Group
5. Deccan Volcanic Province (DVP)
6. Marine transgression and regression

#### **Unit - V: Recent Geology**

1. Cenozoic Geology of India
2. Quaternary Sediments
3. World stratigraphy – Time Scale and geologic events

## **Books Recommended**

- ❖ Boggs, S. (2001) Principles of Sedimentology and Stratigraphy, Prentice Hall.
- ❖ Danbar, C.O. and Rodgers, J. (1957) Principles of Stratigraphy, John Wiley and Sons.
- ❖ Doyle, P. and Bennett. M.R. (1996) Unlocking the Stratigraphic Record, John Wiley and Sons.
- ❖ Krishnan, M.S. (1982) Geology of India and Burma, C.B.S. Publ. and Distributors, Delhi.
- ❖ Naqvi, S.M. and Rogers, J.J.W. (1987) Precambrian Geology of India, Oxford University Press.
- ❖ Pascoe, E.H. (1968) A Manual of the Geology of India and Burma (Vols.I-IV), Govt. of India Press, Delhi.
- ❖ Pomeroy, C. (1982) The Cenozoic Era: Tertiary and Quaternary, Ellis Harwood Ltd., Halsted Press.
- ❖ Schoch, Robert, M. (1989) Stratigraphy: Principles and Methods, Van Nostrand Reinhold, New York.
- ❖ Ramakrishnan, M. and Vaidyanadhan, R. (2008) Geology of India, Vol.1, Geological Society of India, Bangalore.
- ❖ Vaidyanadhan, R. and Ramakrishnan, M. (2008) Geology of India, Vol.2, Geological Society of India, Bangalore.

## **GS-302: INDIAN MINERAL DEPOSITS, EXPLORATION AND MINING**

### **Unit – I: Ore genesis:**

1. Ore bearing fluid, Fluid inclusion studies, Ore deposits and ore minerals
2. Metallogenetic Epochs and Provinces
3. Magmatic processes of mineralization, Porphyry, Skarn and hydrothermal mineralization, Ores and metamorphism- cause and effect relations, Stratiform and Stratabound ores.
4. Mineralization associated with – (i) Ultramafic, mafic and acidic rocks. (ii) Greenstone belts. (iii) Komatites, Anorthosites and Kimberlites and (iv) Submarine volcanism

### **Unit – II: Indian Mineral Deposits:**

1. Occurrence and distribution in India of metalliferous deposits – base metals, iron, manganese, aluminum, chromium, nickel, gold, silver and molybdenum.
2. Indian deposits of non-metals – mica, asbestos, barites, gypsum, graphite, apatite and beryl, Gemstones, refractory minerals, abrasives and minerals used in glass, fertilizer, paint, ceramic and cement industries, Building stones, Phosphorite deposits, Placer deposits and rare earth minerals.

### **Unit – III: Indian Coal deposits and Mineral Economics:**

1. Coal deposits: Classification, genesis and distribution of coal fields in India
2. Strategic, critical and essential minerals,
3. India's status in mineral production changing patterns of minerals consumption, National Mineral Policy,
4. Mineral Concession Rules, Marine mineral resources and Law of sea.

### **Unit – IV: Mineral exploration:**

1. Surface and subsurface exploration techniques
2. Guides to ore: Regional and Topographical Guides, Mineralogical Guides Structural Guides and Stratigraphic Guides
1. Prospecting for economic minerals – drilling, sampling and assaying,
2. Geophysical techniques – gravity, electrical, magnetic, airborne and seismic geophysical techniques.
3. Geomorphological and remote sensing techniques
4. Geobotanical and geochemical methods
5. Geochemical prospecting

### **Unit – V: Drilling, Logging and Mining:**

3. Drilling Methods: Percussion Drills – Jumper bar drills- Pneumatic drills - Churn drills- Reich drills, Rotary Drills -Auger drills -Colyx drills-Turbo drills- Diamond drills
4. Borehole logging and surveys for deviation.

## 5. Mining Methods - Alluvial Mining- Open Cast Mining - Under ground Mining

### **Books Recommended**

- ❖ Geochemistry In Mineral Exploration Awakes, H & Wobb J.S. Harper & Row New York.
- ❖ Principles Of Geochemical Prospecting, Ginsburg. I.I. Pentagon Press, N.Y. london.
- ❖ Geochemistry Of Rare And Dispersed Chemical Elements In Society, Vinogradev.
- ❖ Biochemical Methods Of Prospecting, Malyuga, D.P.
- ❖ Geochemistry Of Epigenesis - Faibidge.
- ❖ Principles of Mining Geology, Arogyaswamy.
- ❖ Introduction To Geophysical Prospecting - Milton B, Dobrin Mc-Graw Hill Book Company, Inc
- ❖ Exploraion Geophysics - Jakaosku, J.J.
- ❖ Outlines Of Geophysical Prospecting - A manual for Geologists. M.B.R. Rao. Prasaranga, Mysore University
- ❖ Geophysical Methods in Geology - P.V. Sharma.
- ❖ Applied Geophysics In The Search For Minerals - Eve. A.S.Keys.
- ❖ Geophysical Exploration - Heilava. C.H.
- ❖ Exploration Geophysics for Geologists And Engineers - Edited by Bhimasanakaran, V.L.S. Gour. V.K. - The Association of Exploration Geophysists - Hyderabad
- ❖ Principles of Applied Geophysics - D.S. Parasnis
- ❖ Introduction to Geophysics - C. H. Howel.
- ❖ The Geology Of Ore Deposits - John M. Guilbert and charles. F.Park, Jr.W.H.Freeman and Co., New York. 1986.
- ❖ Economic Mineral Deposits, Bateman, A.M.
- ❖ Ore Deposits - Park, Jr. C.F.
- ❖ Geology Of Mineral Deposits - Smirnov, U.J.
- ❖ The Ore Minerals And Their Intergrowths - Ramhor, Dr. Paul.
- ❖ Ore Petrology - Stanton, R.L.
- ❖ India's Mineral Resources - Krishnaswamy, S.
- ❖ Metallic and Industrial minerals - Lamey Carl, A.
- ❖ Introduction To India's Economic Minerals - Sharma, N.L. & Ram. K. S.
- ❖ A Treatise On Industrial Minerals Of India-Sinha, R.L.
- ❖ Mineral Deposits Of India, Mukerjee 1999: Allied publications.
- ❖ Elements of Mining Geology, Young
- ❖ Elements of Mining - Lewis
- ❖ Mining Of Mineral Deposits – Shevyekov
- ❖ Introduction Of Mining - Stoces

## **GS-303: REMOTE SENSING AND GIS**

### **Unit – I: Fundamentals of Remote Sensing**

1. Concepts and principles of Remote Sensing
2. The nature and generation of EMR
3. Interaction of EMR with the atmosphere and earth's surface features.
4. Introduction to Photogrammetry

### **Unit – II: Satellite Remote Sensing:**

1. Satellite Remote Sensing – Data products and their specifications
2. Remote Sensing observations and platforms
3. Types of sensors, Data Resolution
4. Global and Indian Space missions

### **Unit – III: Digital Image Processing and Image Interpretation**

1. Digital Image Structure and Data recording formats
2. Image rectification and restoration
3. Image enhancement and classification
4. Image transformation and data fusion
5. Ground truths and training sets in image processing and in automated processing
6. Visual photo interpretation techniques based on 'photo elements' and 'terrain elements'

### **Unit – IV: Geographic Information Systems (GIS)**

1. Principles and applications of GIS
2. Map Projections Systems, Map Visualization
3. Traditional maps, map scales and their interpretation
4. Components of GIS, GIS data models and structures
5. GIS analysis and GIS modeling
6. Integration of Remote sensing and GIS techniques and its applications in Geological Sciences

### **Unit – V: Computer Applications and GPS**

1. Basic concepts of computer, hardware, operating systems
2. Application software in Geology
3. Principles and applications of GPS



## **Books Recommended**

- ❖ Lattman, L.H. and Ray, R.G. (1965) Aerial photographs in field geology, McGraw Hill.
- ❖ Pande, S.N. (1987) Principles and Applications of Photogeology, Wiley Eastern Limited.
- ❖ Drury, S.A. (1997, 2001) Image Interpretation in Geology, Chapman and Hall, London.
- ❖ Gupta, R.P. (1991) Remote Sensing Geology, Springer-Verlag.
- ❖ Lillesand, T.M. and Kiefer, R.W. (2000) Remote Sensing and Image Interpretation, John Wiley and Sons Inc., New York.
- ❖ Siegal, B.S. and Gillespie, A.R. (1980) Remote Sensing in Geology, John Wiley.
- ❖ Miller, V.C. (1961) Phologeology, McGraw Hill
- ❖ Sabins, F.F. Jr. (2000) Remote Sensing Principles and Interpretations, W.H. Freeman & Company, USA.
- ❖ Berhardsen, T. (1999) Geographic Information System: an introduction, Wiley, New York
- ❖ Curran, P.J. (1985) Principles of Remote Sensing, Longman Scientific & Tech. Group, Essex, England
- ❖ Richards, J.A. (1986) Remote Sensing Digital Analysis: an introduction, Springer-Verlag, Berlin.
- ❖ Burrough, P.P. and MacDonnel, R.A. (1998) Principles of GIS, Oxford University Press.
- ❖ Ray, R.G. (1969) Aerial Photographs in Geologic Interpretations, USGS Proc Paper 373
- ❖ Mikhail, E.M. (1980) Photogrammatry, Harper and Row
- ❖ Paine, D.P. (1981) Aerial photography and Image Interpretation for Resource Management, John Wiley.
- ❖ Jensen, J.R. (1986) Introductory Digital Image Processing: A Remote Perspective. Prentice Hall, New Jersey.
- ❖ Jain, A.K. (1989) Fundamentals of digital image processing, Prentice Hall India.
- ❖ Bonham-Carter, G.F. (1994) Geographic Information System for Geoscientists: Modelling with GIS, Pergamon.
- ❖ Maguire, D.J., Goodchild, M.F. and Rhind, D.W. (1991) GIS - Principles and Applications, Longman Scientific and Technical.
- ❖ Burrough, P.A. (1986) Principles of Geographical Information Systems for land resources assessment. Clarendon Press, Oxford.

**GS-304: PRACTICALS RELATED TO INDIAN MINERAL DEPOSITS,  
EXPLORATION AND MINING**

1. Delineation of ore deposit based on exploration data.
2. Economic evaluation of ore deposit.
3. Preparation of technical report.
4. Geochemical map interpretation, Interpretation of anomalies groundwater and river water, Selection of geochemical methods in mineral exploration.
5. Interpretation of field geophysical data gravity, magnetic, electrical, seismic and radio active in deciphering groundwater, mineralized zones and construction site evaluation.
6. Study of metallic and non- metallic economic minerals.

**GS-305: PRACTICALS RELATED TO REMOTE SENSING AND GIS**

1. Determination of photo scale,
2. Study of traditional maps
3. Visual interpretation of earth's features from aerial photographs and satellite images
4. Stereo-photo interpretation
5. Photogrametric computation
6. Preparation of different thematic maps in GIS
7. Operation of GPS
8. Drawing flow charts for the computer programs required in solving Geoscientific problems

## **SEMESTER – III**

### **GS-401: PETROLEUM GEOLOGY**

#### **Unit – I: Composition of Reservoir and Source rocks**

1. Composition of hydrocarbons & non hydrocarbons component
2. Physico-chemical properties of hydrocarbons (oil, gas, oil field waters, Coal bed methane, hydrates)
3. Surface & subsurface occurrences of hydrocarbons
4. Theories of Organic and inorganic Origin of hydrocarbons: Merits & Demerits
5. Organic petroleum geochemistry and conversion of organic matter into hydrocarbons
6. Kerogen : Composition, classification and types
7. Source & reservoir rocks (porosity & permeability); petroliferous basins

#### **Unit – II: Total Petroleum Systems**

1. Limestone Classification
2. Migration-Primary & Secondary, characteristics & processes
3. Accumulation: Favorable & unfavorable conditions; nature of accumulation
4. Clastic and Non-clastic Reservoirs rocks
5. Traps: introduction, conditions of formation and Types
6. Introduction to Oil-Water, Gas-Oil Contacts
7. Fluid flow within Reservoirs

#### **Unit – III: Exploration & Logging**

1. Introduction to Geophysical
2. Logging: Introduction, Types & Interpretation.
3. Seismic methods: Principles, techniques, tools and interpretation
4. Electrical logs: Principles, techniques, tools and interpretation
5. Gamma ray & neutron logs: Principles, techniques, tools and interpretation

#### **Unit – IV: Drilling Techniques**

1. Introduction to Drilling methods,
2. Rigs and their types used in oil exploration
3. Component of Rigs & Drilling Mechanism.
4. Drilling and mud parameters
5. Enhance Oil Recovery (EOR): Primary, Secondary & Tertiary

#### **Unit – V: Petroliferous basins**

1. World scenario and at least one case study of economically important Hydrocarbon deposits;
2. Petroliferous basins of India

3. Stratigraphy, lithology, structure and reserve estimation of – Bombay high, Krishna Godavari, Assam, Cambay and Jaisalmer Basins

### **Books Recommended**

- ❖ Levenson, A.L. (1970) Geology of Petroleum, Freeman and Company.
- ❖ North, F.K. (1985) Petroleum Geology, Allen and Unwin.
- ❖ Holson, G.D. and Tiratsoo, E.N. (1985) Introduction to Petroleum Geology, Gulf Publ. Houston, Texas.
- ❖ Tissot, B.P. and Welte, D.H. (1984) Petroleum Formation and Occurrence, Springer- Verlag.
- ❖ Selley, R.G. (1998) Elements of Petroleum Geology, Academic Press.
- ❖ Russel : Petroleum Geology
- ❖ Primer of Oil well drilling : By IADC
- ❖ Bhagwan Sahay : Mud logging
- ❖ Person : Geological Well drilling technology
- ❖ Cray and Cole : Oil & well drilling technology
- ❖ Kennedy : Fundamentals of Drilling
- ❖ Hearst & Nelson : Well logging for physical properties
- ❖ Killips & Killips (200) Organic Geochemistry
- ❖ F. K North Petroleum Geology

## **GS-402: HYDROGEOLOGY**

### **Unit – I: Introduction**

1. Hydrosphere – Hydrological Cycle, Evaporation, condensation, precipitation, interception, runoff cycle (surface, subsurface and groundwater), infiltration.
2. Factors that affect occurrence of groundwater – Climate, topography and geology
3. Hydrogeological classification of rocks
4. Constraints of water resources
5. Hydrologic properties of Rocks – Porosity, Hydraulic conductivity
6. Derivation and validation of Darcy's Law.
7. Aquifers – Characteristics of unconfined and confined aquifers
8. Behaviour of alluvium, sedimentary, crystalline and volcanic rocks as aquifers

### **Unit – II: Wells and Pumping tests**

1. Types of well
2. Flow net analysis
3. Pumping tests – principles – types of pumping tests, procedures, determination of aquifer properties and well characteristics by simple graphical methods.
4. Significance of Transmissivity, Storativity and specific capacity of wells.
5. Water Audit and its significance.

### **Unit – III: Groundwater quality and Aquifer Mapping**

1. Quality of groundwater – chemical standards for drinking and irrigational water- concept of hydro-geochemical facies
2. Seawater intrusion – Ghyben Herzberg relation – remedial measures
3. Environmental interpretation of quality data and its impact.
4. Concept Aquifer Mapping, Methodology, Techniques and Model Study.

### **Unit – IV: Exploration techniques**

1. Integrated approach to groundwater prospecting: Role of toposheets and remote sensing in groundwater exploration
2. Hydrogeomorphological mapping
3. Surface and subsurface Geophysical methods,
4. Tracer techniques Exploratory Borewell programme.
5. Type of Ground water Investigation Processes.

### **Unit – V: Watershed Development and management**

1. Introduction to Watershed development : Artificial recharge techniques, surface water harvesting techniques.
2. Conjunctive use of groundwater.
3. Groundwater provinces of India.
4. Groundwater in Maharashtra state.
5. Groundwater legislation

### **Books Recommended**

- ❖ Davies, S.N. and De Wiest, R.J.N. (1966) Hydrogeology, John Wiley and Sons, New York.
- ❖ Driscoll, F.G. (1988) Groundwater and Wells, UOP, Johnson Div. St. Paul. Min. USA.
- ❖ Karanth, K. R. (1989) Hydrogeology, Tata McGraw Hill Publishers.
- ❖ Nagabhushaniah, H.S. (2001) Groundwater in Hydrosphere (Groundwater hydrology), CBS Publ.
- ❖ Raghunath, H.M. (1990) Groundwater, Wiley Eastern Ltd.,
- ❖ Todd, D.K. (1995) Groundwater Hydrology, John Wiley and Sons.
- ❖ Tolman, C.F. (1937) Groundwater, McGraw Hill, New York and London.

## **GS-403: ENGINEERING AND ENVIRONMENTAL GEOSCIENCES**

### **Unit – I: Introduction to Engineering Geology**

1. Scope of Engineering Geology
2. Engineering properties of rocks and soils; and their determination.
3. Rock mechanics: Behavior of rocks under stress, Rock failure mechanisms

### **Unit – II: Construction Sites**

1. Geological considerations for the selection of dam sites
2. Geological considerations for Spillways,
3. Geological considerations for tunnels and Bridges

### **Unit – III: Geo-material**

1. Building stones and road metals; Aggregates and its classification
2. Rock testing: Mechanical test, Chemical test, Durability test
3. Aggregate resource development:
  - a. Requirement of primary fragmentation
  - b. Planning of quarry, hill slope side or open pit.
  - c. Removal of overburden and its disposition at suitable site
  - d. Selection of drilling, blasting method for main blasting and secondary breaking for given size of fragmentation
  - e. Selection of equipment's for drilling, loading, hauling to crusher site
  - f. Methods of extraction of aggregate resources
  - g. Use of synthetic materials used as remedial measures
  - h. Estimation of overburden thickness & rock strata classification

### **Unit – IV: Introduction to Environmental Geology**

1. Introduction, Fundamental concepts, scope. Man and environment.
2. Natural and Man- made hazards and disasters
  - a. Lithospheric hazards- volcanoes, earth quakes, landslides, land subsidence, tsunamis, meteorite strike, etc.
  - b. Hydrospheric hazards- sea level changes, coastal hazards, water pollution (sea, river and ground water), floods
  - c. Atmospheric hazards- air pollution, acid rain, etc
  - d. Man-made hazards- industrial, nuclear, mining, etc
3. Remedial measures: Introduction, origin, characteristics and preventive measures- water pollution, soil pollution and air pollution.
4. EIA (Environmental Impact Assessment) and case studies.

### **Unit – V: Marine Geology**

1. Introduction and significance of Physical, Chemical and Biological oceanography
2. Shallow and deep water Marine Resources and significance: E.g. Polymetallic nodules and oozes
3. Tidal Energy: Introduction and harnessing
4. Marine pollution: Oil spills and nuclear waste disposal

### **Books Recommended**

- ❖ Bell, F.G. (1999) Geological Hazards, Routledge, London.
- ❖ Bryant, E. (1985) Natural Hazards, Cambridge Univ. Press.
- ❖ Keller, E.A. (1978) Environmental Geology, Bell and Howell, USA.
- ❖ Lal, D.S. (2007) Climatology, Sharda Pustak Bhawan, Allahabad.
- ❖ Perry, C.T. and Taylor, K.G. (2006) Environmental Sedimentology, Blackwell Publ.
- ❖ Patwardhan, A.M. (1999) The Dynamic Earth System, Prentice Hall.
- ❖ Smith, K. (1992) Environmental Hazards, Routledge, London.
- ❖ Subramaniam, V. (2001) Textbook in Environmental Science, Narosa International.
- ❖ Valdiya, K.S. (1987) Environmental Geology – Indian Context, Tata McGraw Hill.
- ❖ Bell, F.G. (1981) Engineering properties of Soils and Rocks, Butterworths Publication, London.
- ❖ Bell, F.G. (1993) Fundamentals of Engineering geology, Butterworths Publication, London.
- ❖ Garg, S.K. (2009) Physical and Engineering Geology, (6th Ed.), Khanna Publishers, New Delhi.
- ❖ GSI (1975) Engineering Geology Case Histories, Geological Survey of India, Misc. Publ., No. 29.
- ❖ Gupte, R.B. (2002) Text Book of Engineering Geology. Vidyarthi Griha Prakashan, Pune.
- ❖ Keary, P., Brooks, M. and Hill, I. (2002) An introduction to geophysical exploration, (3rd Ed.), Blackwell.
- ❖ Kesavulu, N.C. (2009) Textbook of engineering geology, (2nd Ed.), Macmillan Publishers India ltd.
- ❖ Krynine, D.P. and Judd, W.R. (1998) Principles of Engineering Geology and Geotechnics. CBS Publishers & Distributors, New Delhi.
- ❖ Reddy, D.V. (1998) Engineering Geology for Civil Engineering. Oxford & IBH Pub.Co. Pvt. Ltd., Delhi.
- ❖ Rider, M.H. (1986) The Geological Interpretation of Well Logs. (Rev. Ed.) Whittles Publishing, Caithness.
- ❖ Ries, H. and Watson, T.L. (1947) Elements of Engineering Geology (2nd Ed.). John Wiley & Sons, New York.
- ❖ Schultz, J.R. and Cleaves, A.B. (1951) Geology in Engineering. John Willey and Sons, New York.
- ❖ Singh, P. (1994) Engineering and General Geology. S.K. Kataria and Sons, Delhi.
- ❖ Telford, W.M., Geldart, L.P., Sherrif, R.E. and Keys, D.A. (1976) Applied Geophysics, Cambridge Univ. Press.
- ❖ Verma, B.P. (1997). Rock Mechanics for Engineers (3rd Ed.), Khanna Publishers, New Delhi.
- ❖ Wittke, Walter (1990). Rock Mechanics: Theory and Applications with case Histories, Springer – Verlag Publication.
- ❖ Kennet : Marine Geology
- ❖ Menard : Marine Geology



## **GS-404: PRACTICALS RELATED TO PETROLEUM GEOLOGY, HYDROGEOLOGY, ENGINEERING AND ENVIRONMENTAL GEOLOGY**

1. Lithofacies analysis
2. Preparation of structure contour maps and structural cross sections
3. Porosity and permeability measurements
4. Well correlations: geologic and bio-stratigraphic
5. Well log interpretations
6. Isopach and lithofacies maps, Fence diagram
7. Oil Reserve Estimation
8. Core analysis
9. Analysis of rainfall data
10. Preparation of water level contour maps and their interpretation
11. Analysis of pumping test data using different methods of aquifer and well characteristics determination.
12. Plotting and analysis of hydrogeochemical data
13. Morphometric analysis and site selection for water conservative measures.
14. Water audit.
15. Various methods of Surveying used in engineering geology, Chain Surveys, Plane table surveys, Use of Surveying equipments
16. Determination of Engineering properties of Geological materials
17. Interpretation of borehole data, Preparation of bore logs / Lithologs.
18. Preparation of Report and Presentation of Engineering data
19. Water and Soil analysis, Plotting and interpretation of geochemical data.
20. Preparation of hazard Zonation map.
21. Quantification of EIA.
22. Heavy Mineral: Separation, identification and interpretation
23. Sediment Size and shape Analysis and interpretation
24. Trace element Analysis
25. Organic Carbon and Total Phosphorus Analysis
26. Foraminiferal and nano-planktons studies

## **GS-405: DISSERTATION**

Topic of the Dissertation work will be allotted to students as per the specialization of the teacher and interest of the students.

# **Job Opportunities for M.Sc. Applied Geology Students**

## **A) Central Government Organizations**

- 1. Geological Survey of India (GSI)**
- 2. Oil and Natural Gas Corporation Ltd. (ONGC)**
- 3. National Institute of Oceanography (NIO)**
- 4. Indian Space Research Organization (ISRO)**
- 5. Coal India Limited (CIL)**
- 6. Central Ground Water Board (CGWB)**
- 7. Atomic Mineral Directorate (DGM)**

## **B) State Government Organizations**

- 1. Directorate of Geology and Mining (DGM)**
- 2. Ground Water Survey and Development Agency (GSDA)**
- 3. Maharashtra Mining Corporation (MMC)**
- 4. Gujrat Mineral Development Corporation (GMDC)**

## **C) Oil , Mining and other Companies**

- 1. Well-Site Geologist**
- 2. Mud logger Geologist**
- 3. Mining geologists**

## **D) Other field**

- 1. As a consultant in groundwater exploration, water shed management**
- 2. As a consultant gem and jewelry**
- 3. As a consultant in geotechnical field.**
- 4. As a geologist in different NGOs.**