

## SCHEME OF EXAMINATION -M.SC GEOLOGY

(Effective from the Academic Year 2018-2019)

**Department of Geology**  
Acharya Nagarjuna University

<b>I - Semester</b>						
Code	Number	Title of Paper	No. Credits	Max, Marks 100		Exam. Hrs.
				Internal	External	
				30	70	
G101	Paper - I	Mineralogy, Crystallography and Crystal Optics	4	30	70	3
G102	Paper -II	Structural Geology and Tectonics	4	30	70	3
G103	Paper -III	Indian Stratigraphy and Paleontology	4	30	70	3
G104	Paper - IV	Geomorphology and Engineering Geology	4	30	70	3
G105		Survey	2	50		3
G101	Practical - I	Mineralogy, Crystallography and Crystal Optics	2	15	35	3
G102	Practical - II	Structural Geology and Tectonics	2	15	35	3
G103	Practical -III	Indian Stratigraphy and Paleontology	2	15	35	3
G104	Practical -IV	Geomorphology and Engineering Geology	2	15	35	3

<b>II - Semester</b>						
Code	Number	Title of Paper	No. Credits	Max, Marks 100		Exam. Hrs.
				Internal	External	
				30	70	
G201	Paper - I	Igneous and Metamorphic Petrology	4	30	70	3
G202	Paper -II	Indian Mineral Deposits and Mineral Economics	4	30	70	3
G203	Paper -III	Sedimentology and Marine Geology	4	30	70	3
G204	Paper - IV	Environmental Geology	4	30	70	3
G205		Field work	2	50		3
<b>MOOCs - I</b>			<b>4</b>	-	-	-
G201	Practical - I	Igneous and Metamorphic Petrology	2	15	35	3
G202	Practical - II	Indian Mineral Deposits and Mineral Economics	2	15	35	3
G203	Practical -III	Sedimentology and Marine Geology	2	15	35	3
G204	Practical -IV	Environmental Geology	2	15	35	3

<b>III - Semester</b>						
Code	Number	Title of Paper	No. Credits	Max, Marks 100		Exam. Hrs.
				Internal	External	
				30	70	
G301	Paper - I	Geochemistry and Mineral Exploration	4	30	70	3
G302	Paper -II	Fuel Geology	4	30	70	3
G303	Paper -III	Statistical and Computer Applications in Geology	4	30	70	3
G304	Paper - IV	Surface and Underground Mining	4	30	70	3
G305		Mine camp	2	50		3
<b>MOOCs - II</b>			<b>4</b>	-	-	-
G301	Practical - I	Geochemistry and Mineral Exploration	2	15	35	3
G302	Practical - II	Fuel Geology	2	15	35	3
G303	Practical -III	Statistical and Computer Applications in Geology	2	15	35	3
G304	Practical -IV	Surface and Underground Mining	2	15	35	3

<b>IV - Semester</b>						
Code	Number	Title of Paper	No. Credits	Max, Marks 100		Exam. Hrs.
				Internal	External	
				30	70	
G401	Paper - I	Gemmology	4	30	70	3
G402	Paper -II	Petroleum Exploration	4	30	70	3
G403	Paper -III	Hydrogeology	4	30	70	3
G404	Paper - IV	Remote Sensing and Geograpic Information Systems	4	30	70	3
<b>G405</b>		<b>Project viva</b>	<b>2</b>	<b>50</b>		<b>2</b>
G401	Practical - I	Gemmology	2	15	35	3
G402	Practical - II	Petroleum Exploration	2	15	35	3
G403	Practical -III	Hydrogeology	2	15	35	3
G404	Practical -IV	Remote Sensing and Geograpic Information Systems	2	15	35	3

**M.Sc. GEOLOGY : ACHARYA NAGARJUNA UNIVERSITY**

**I SEMESTER THEORY SYLLABUS, PAPER G101**

**MINERALOGY, CRYSTALLOGRAPHY AND CRYSTAL OPTIC**

( Effective from the batch of 2018-2019 )

Silicate Mineralogy

UNIT – I

- 1) Structures and classification of Silicates 2) Atomic structure, Mineral chemistry, Physical and Optical properties and mode of occurrence of silicates : a) Olivine group  
b) Pyroxene group c) Amphibole group d) Feldspar group e) Mica group f) Garnet group

UNIT - II

Atomic structure, Mineral chemistry, physical and optical properties and mode of occurrence of a) Epidote group b) Silica group c) Zeolite group d) Andalusite e) Kyanite f) Sillimanite  
g) Staurolite h) Topaz i) Beryl j) Zircon k) Tourmaline  
l) Spinel m) Chlorite n) Nepheline o) Vermiculite

UNIT – III- Non-Silicate Mineralogy

Classification of Non-Silicates - Native Elements – Metals – Semi-Metals – Non-Metals, Sulphides, Oxides, Hydroxides, Carbonates, Sulphates, Halides, Molybdates, Phosphates, Arsenates, Venadates – Details on atomic structure, Chemistry, Physical and optical properties and paragenesis of the above classes.

UNIT – IV – Crystallography & Crystal Optics

- 1) Symmetry of crystals –Thirty two crystal classes 2) Bravais Lattices in the Crystal systems 3) Law of zones and zone- relations 4) Twins; Twin-Laws 5) X-ray Diffraction – d-spacing and cell parameters 6) Crystal projections – Spherical, Stereographic and Gnomonic projections 7) Construction of Petrological Microscope- Nicol Prism –Thin-section and Polished-section making -- Optical Properties of Minerals—Accessory plates

**M.Sc. GEOLOGY : ACHARYA NAGARJUNA UNIVERSITY**

**I SEMESTER : PRACTICAL SYLLABUS, PAPER G101**

**MINERALOGY, CRYSTALLOGRAPHY AND CRYSTAL OPTICS**

- 1) Megascopic and Microscopic study of silicate and non-silicate minerals.
- 2) Calculation of mineral formulae from chemical analysis of silicate Minerals and their identification based on chemical data.
- 3) Crystal Models – Symmetry Elements and Forms; Habit of important minerals . Stereographic projections.
- 4) Exercises on Etching and staining of minerals.
- 5) Determination of R.I. and order of Interference colours in thin sections.

***BOOKS***

- 1) Deer W. A., Howie R. A. and Zussman, J., 1996. The Rock Forming Minerals, Longman.
- 2) Berry L. G., and Mason B., Descriptive Mineralogy.
- 3) Paul Kerr. Optical Mineralogy.
- 4) Phillips.Wm.R and Griffen D.T. 1986. Optical Mineralogy. GBS edition.
- 5) Putnis Andrew 1992. Introduction to Mineral Sciences. Cambridge University Press.
- 6) Dana, W. E. A Text Book of Mineralogy.
- 7) Sachinath Mitra, Fundamentals of Optical, spectroscopic and x-ray Mineralogy.
- 8) Dana Text Book of Mineralogy Revised by Ford.

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**MODEL QUESTION PAPER**  
(Effective from academic year 2018-19)  
M.Sc. DEGREE EXAMINATION (Nov/ Dec. 2018) (G 101)  
**ACHARYA NAGARJUNA UNIVERSITY:**  
**I- SEMESTER**

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**PARER - 1 MINERALOGY, CRYSTALLOGRAPHY AND CRYSTAL OPTICS**

Time : 3 hours

Answer ALL questions

Max Marks: 70

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**Section –A**

3 x 6 = 18 Marks

1. Answer the all questions and each question carries equal marks.
- Physical Properties of Microcline
  - Mode of occurrence of Zircon
  - Graphite
  - Galena
  - Extinction Angle
  - Nicol Prism

**Section-- B**

13 x 4 = 52 Marks

UNIT - I

2. Write brief account of Mica group of Minerals describing their Structure, Physical, Chemical and Optical properties.

OR

3. Write short notes on any **TWO** of the following:
- Ortho-Pyroxenes.
  - Plagioclase Feldspars
  - Pyralpsite Series

UNIT - II

4. Write an essay on aluminosilicates

OR

5. Write short notes on any **TWO** of the following:
- Beryl.
  - Sphene.
  - Staurolite

UNIT – III

6. Write an essay on Oxide group of Minerals.

OR

7. Distinguish between any **TWO** pairs of minerals.
- Calcite and Aragonite
  - Diamond and graphite.
  - Pyrite and Marcasite.

UNIT – IV

8. Describe how X-ray Diffraction is made use in identifying the minerals.

OR

9. Write short notes on any **TWO** of the following:
- Crystal Twinning
  - Crystal Projections
  - Accessory Plates.

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M.Sc. GEOLOGY 1<sup>ST</sup> SEMESTER SYLLABUS

PAPER 102, STRUCTURAL GEOLOGY AND TECTONICS

(Effective from the admitted batch of 2018-2019)

UNIT – I

Objectives of Structural geology, Mechanical principles – Materials of the outer shell of the Earth, Atoms, Gases, liquids and solids; Composition and resolution of forces, differential forces. Concept of stress and strain. Stress-strain diagrams. Mechanics of plastic deformation. Principles of failure by rupture – Relation of rupture to strain, Foliation; types of foliation and importance of foliation in determining major structures. Lineation – Origin and Types of lineation.

UNIT – II

Geometry and Mechanics of folding:- Different classifications of folds. Buckling, status of strain within and outside buckled layers and field evidences of buckling. Recognition of folds. Mechanics and causes of folding. Joints classification and significance. Description and classification of faults. Criteria for faulting. Classification and origin of different types of shear zones.

UNIT – III

Structure and composition of earth interior. The crustal evolution of the earth. Tectonic evolution of Dharwars, Eastern Ghats, Aravalis, Singhbhum, Cuddapahs and Himalaya.

UNIT IV

Continental drift theory, Principles of plate tectonics; types of plates, ocean floor spreading, subduction zone, transform faults, causes for plate movement, rate of plate movement, benioff zone, island arcs, back arcs, mantle plume and hot spot. Plate tectonics and seismicity.

GEOLOGY 1<sup>ST</sup> SEMESTER PRACTICAL SYLLABUS  
PRACTICAL 102  
STRUCTURAL GEOLOGY AND TECTONICS  
(Effective from the batch of 2018-2019)

- 1) Calculation of true & apparent dip.
- 2) Estimation of thickness – Depth of ore body.
- 3) Determination of Throw/Heave/Stratigraphic separation etc., related to faults.
- 4) Preparation and interpretation of geological maps and sections.
- 5) Use of stereonet in Structural problems.
- 6) Study of large scale tectonic features of the Earth.

### BOOKS

1. Structural geology by M. P. Billings (1968, New Delhi)
2. An outline of Structural geology by Bruce E. Hobbs., Means W. D. and Williams P. F., 1976, John Wiley
3. Structural geology and tectonic Principles by P. C. Badgley, 1965, Harper and Row
4. Folding and fracturing of rocks by Ramsay J. G. 1967 Mc Graw Hill.
5. Holmes principles of Physical geology by A. Holmes and D. L. Holmes
6. Structural geology of Rocks and Region by Davis, G. R. 1984, John Wiley
7. Aspects of tectonics, focus on South Central India by K. S. Valdiya
8. Continents a drift readings from Scientific American by J. Tuzo Wilson.

**MODEL QUESTION PAPER**  
(Effective from academic year 2018-19)  
M.Sc. DEGREE EXAMINATION (Nov/ Dec. 2018) (G 102)  
**ACHARYA NAGARJUNA UNIVERSITY:**  
**I- SEMESTER**

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**PARER - 1      STRUCTURAL GEOLOGY AND TECTONICS**

**Time : 3 hours**

**Answer ALL questions**

**Max Marks: 70**

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**SECTION –A**

1. Answer the all questions and each question carries equal marks.    Max. Marks: 6 X 3 = 18
- a) Explain the atoms, gases, liquids and solids
  - b) Recognition of folds in the field
  - c) Composition of earth interior
  - d) Mention plate boundaries
  - e) Columnar joints and its origin
  - f) Composition and resolution of forces

**SECTION - B**

Answer any FOUR questions choosing ONE question from each Unit.  
All questions carry equal marks.

**UNIT – I**

Max. Marks: 4 X 13 = 52

2. Discuss about different types of lineations

OR

3. Write notes on any TWO of the following.
- (a) Mechanics of plastic deformation
  - (b) Principles of failure by rupture
  - (c) Mullions and boudinages

**UNIT – II**

4. Describe the classification of folds
5. Write note on any TWO of the following
- (a) Parts of fold
  - (b) Causes for folding
  - (c) Shear zones

**UNIT – III**

6. Write an essay on tectonic evolution of eastern Ghats.

OR

7. Write notes on any TWO of the following
- (a) Evolution of continental crust
  - (b) Tectonics of Cuddapah basin
  - (c) Evolution of Himalayas

**UNITS – IV**

8. Give an account on mechanics of plate movement
9. Write notes on any TWO of the following
- (a) Transform fault
  - (b) Hot spots and mantle plumes
  - (c) Island arcs



**M.Sc. GEOLOGY**  
**ACHARYA NAGARJUNA UNIVERSITY**  

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**I SEMESTER**  
**THEORY SYLLABUS, PAPER -G103**  
**INDIAN STRATIGRAPHY AND PALEONTOLOGY**  
(Effective from academic year 2018-2019)  

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INDIAN STRATIGRAPHY

UNIT - I

1. Elements of Stratigraphy - Criteria for stratigraphic Classification and Correlation, Non – Paleontological criteria; Order of Superposition, Petrographical characters, Structure and Tectonics, Geophysics.
2. Paleontological Criteria – Index fossils, Fossil assemblage, Phylogeny, Micropaleontology.
3. Standard Stratigraphic Scale, Geological Time scale.

UNIT- II

1. Lithostratigraphic Classification – Super Group, Group, Formation, Member, Beds.
2. Geological Successions – Dharwar Super group, Cuddapah Super Group, Vindhyan Group, Kurnools, Jurassic of Kutch, Cauvery Basin, Gondwana Sequences , Siwaliks and Deccan Traps.

PALEONTOLOGY

UNIT – III

1. Functional morphology, Classification and Evolution of Brachiopoda, Pelecypoda, Gastropoda, Cephalopoda, Trilobita, Echinodermata and Graptolies, Plant fossils.

UNIT –IV

1. Introduction to Microfossils, Applications of Microfossils.
2. Divisions of the Marine Environment and their Characteristic Fauna and Flora.
3. Stratigraphy of Foraminifera with emphasis on Indian stratigraphic horizons.

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**M.Sc. GEOLOGY  
ACHARYA NAGARJUNA UNIVERSITY:**

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**I SEMESTER  
PRACTICAL SYLLABUS, PAPER –G103  
INDIAN STRATIGRAPHY AND PALEONTOLOGY  
(Effective from academic year 2018-2019)**

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1. Preparation of Indian Stratigraphic sequences
2. Recognition of Fossil Groups - Brachiopoda, Pelecypoda, Gastropoda, Cephalopoda, Trilobita, Echinodermata, Graptolites and plant fossils.
3. Study of morphological characters and taxonomy of selected Foraminifera and Ostracoda.

BOOKS

1. Fundamentals of Historical Geology and Stratigraphy of India – Ravindra Kumar
2. Geology of India and Burma – M.S Krishnan.
3. Introduction to Marine Micropaleontology – U Bilal Heq & Annie Boersma.
4. Elements of Micropaleontology - G. Bignot.
5. Micropaleontology – M.D. Brasier.

**MODEL QUESTION PAPER**

(Effective from academic year 2018-19)

M.Sc. DEGREE EXAMINATION (Nov/ Dec. 2018)

(G 103)

**ACHARYA NAGARJUNA UNIVERSITY:**

**I- SEMESTER**

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<b>PARER - 3</b>	<b>INDIAN STRATIGRAPHY AND PALEONTOLOGY</b>	
<b>Time : 3 hours</b>	<b>Answer ALL questions</b>	<b>Max Marks: 70</b>

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**Section - A**

3 x 6 = 18

1. Answer the all questions and each question carries equal marks
  - a) Elements of Stratigraphy
  - b) Super group
  - c) Plant fossils
  - d) Graptolites
  - e) Continental shelf
  - f) Fossil assemblage

**Section - B**

13 x 4 = 52

**UNIT - I**

2. Write an essay about Non - Paleontological criteria of correlation.  
OR
3. Write short notes on any **TWO** of the following
  - a) Index fossils
  - b) Geological Time Scale
  - c) Order of superposition

**UNIT - II**

4. Explain the Dharwarian province with a geological succession.  
OR
5. Write short notes on any **TWO** of the following
  - a) Cuddapah super group
  - b) Vindhyan
  - c) Siwaliks

**UNIT - III**

6. Give morphology of the Brachiopoda with examples.  
OR
7. Write short notes on any **Two** of the following
  - a) Graptolites
  - b) Plant fossils
  - c) Trilobite

**UNIT - IV**

8. What are microfossils. Explain the distribution of Foraminifera in Indian Stratigraphy.  
OR
9. Write shorts on any **Two** of the following
  - a) Applications of microfossils
  - b) Divisions of marine environment
  - c) Micropaleontology

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**M.SC. GEOLOGY: I SEMESTER**  
Acharya Nagarjuna University  
( Effective from academic year 2018-2019)

**THEORY PAPER-104:**

100marks and 4 credits

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**GEOMORPHOLOGY AND ENGINEERING GEOLOGY**

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**GEOMORPHOLOGY**

**UNIT - I**

1. Scope, outline and concepts of Geomorphic principles
2. Exogenesis process and topographic forms:-  
(i) Fluvial (ii) Aeolian (iii) Marine (iv) Glacial (v) Weathering and mass- wasting
3. Endogenesis process and topographic forms:-  
(i) Volcanic (ii) Fold and fault

**UNIT - II**

1. Planation an and planar surface – Concepts of Peneplation and Pediplanation
2. Stastical study on drainage basin and terrain morphometry
4. Conventional and modern study:-  
(i) Topomap (ii) Aerial photo and satellite image
3. Applied and exploration study :-  
(i) Ground water (ii) Mineral (iii) Mega-engineering projects  
(iv) Geo-environment projects

**ENGINEERING GEOLOGY**

**UNIT - III**

1. Building stones and Road metals:- (i) Types (ii) physical and engineering properties
2. Landslides :- (i) Types (ii) Properties (iii) Restoration measures
3. Soils – (i) Types (ii) Textural classes (iii). Properties and mechanics
4. Coastal erosion:- (i). Topography and nature (ii). Tidal dynamics (iii). Restoration study

**UNIT - IV**

1. Geological investigations for site and route section:-  
(i) Dams and reservoirs and different designs (ii) Tunnels and canals  
(iii) Road ways and ghat ways
2. Historical study on problems of river valley projects – failures and results:-  
(i) River flooding (ii) Water supply (iii) Erosion and siltation

**M.SC. GEOLOGY: I SEMESTER**  
Acharya Nagarjuna University  
( Effective from academic year 2018-2019)

**PRACTICAL PAPER- 104:**

50 marks and 2 credits

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**GEOMORPHOLOGY AND ENGINEERING GEOLOGY**

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**GEOMORPHOLOGY**

1. Topomap interpretation:- (i). Physiography, (ii). Drainage (iii). Structural trends (iv). Lineaments (v). Geomorphic study (vi). Hydromorphical study
2. Preparation and interpretation of topographic profiles from topomaps
3. Delineation of catchment areas of drainage basin and morphometry analysis
4. Study of remote sensing data :- (i). Aerial photo (ii). Satellite multi spectral image

**ENGINEERING GEOLOGY**

1. Topomap study on topographic environment for ideal site and route selection:-  
(i) Dams (ii) Reservoirs (iii) Canal alignment (iv) Check dams  
(v) Flood water storage (vi) Ghat roads
2. Identification of building stones and rock metal and study for physical and engineering properties
3. Visit to barrages, power houses, tunnels etc.

**BOOKS**

1. Principles of Geomorphology – William D. Thornbury, 1984, Wiley Eastern Limited.
2. Fundamentals of Geomorphology – Richard John Huggett (Routledge Pub. London),2007
3. Key concepts in Geomorphology – Bierman and Montgomery (W.H.Freeman)
4. Introduction to Coastal processes and Geomorphology – Robin Davidson Arnott, 2010
5. Introduction to Physical Geology – A. N. Strahler (John wiley)
6. Fluvial Processes in Geomorphology (1964) L. B. Leopold Eurasia Publishing House, New Delhi.
7. A text book of, Geomorphology – P. G. Worcester.
8. Engineering Geology – Parbin Singh
9. Engineering Geology for Civil Engineers(1995). – D. Venkata Reddy Oxford & IBH, New Delhi.
10. Engineering Geology - Dimitri

**MODEL QUESTION PAPER**

(Effective from academic year 2018-19)

M.Sc. DEGREE EXAMINATION (Nov/ Dec. 2018)

(G 104)

**ACHARYA NAGARJUNA UNIVERSITY:**

**I- SEMESTER**

**PARER - 4**

**GEOMORPHOLOGY AND ENGINEERING GEOLOGY**

**Time : 3 hours**

**Answer ALL questions**

**Max Marks: 70**

**Section –A**

**3 x 6 = 18**

1. Answer the all questions and each question carries equal marks
- What is principle of uniformitarianism?
  - Write about effects of transgression and regression sea level.
  - What is soil profile?
  - Write about deltaic landforms
  - What s difference between fracture and fault?
  - What is tensile stress?

**Section –B**

**13 x 4 =52**

**UNIT – I**

2. Give a detailed account on fluvial processes and associated landforms at various stages.

Or

3. Write short notes on any TWO

- Present is the key to the past
- Antecedent and anticonsequent stream
- Desert pavement

**UNIT – II**

4. Discuss about the application of geomorphologic studies in ground water investigation in fluvial and hard rock terrains

Or

5. Explain about any TWO

- Peneplanation and pediplanation
- Drainage texture
- Environments of placer deposits

**UNIT – III**

6. Discuss about the various forms of coastal erosion in Andhra Pradesh and the measures to be suggested against them.

Or

7. Write short notes on TWO

- Properties of dressing stones
- Liquifaction
- Measures for beach budget

**UNIT – IV**

8. Write in detail about geological investigations to be carried out for selection of route alignment for water canal and tunnel.

Or

9. Give account on TWO

- Geo-environmental changes due to dams and reservoirs
- Adverse results due to interconnecting rivers
- Water storage and supply in limestone landscape

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M.SC. GEOLOGY SYLLABUS (NAGARJUNA UNIVERSITY)

FIRST SEMESTER

(Effective from the admitted batch of 2018-2019)

**PAPER 105- SURVEYING**

1. Introduction – Traverse Surveying, (Using clinometer/Brutton compass)
  - a) Open Traverse
  - b) Closed Traverse
  - c) Cross Staff survey
  - d) Prismatic compass survey.
  
2. Plane table survey –
  - a) Radial method
  - b) Intersection method
  - c) Traversing
  - d) Two point problem
  - e) Three point problem
  
3. Levelling (Using Abney Level/Brutton Compass)
  - a) Profiling
  - b) Calculating heights
  - c) Dumpy level Profiling
  
4. Contouring –
  - a) Dumpy level
  - b) Telescopic Alidade
  
5. Introduction to Theodolite and operation method (Demonstration).

**M.Sc. GEOLOGY : ACHARYA NAGARJUNA UNIVERSITY**

**II SEMESTER *THEORY* SYLLABUS, PAPER G201**

**IGNEOUS AND METAMORPHIC PETROLOGY**

( Effective from the academic year of 2018-2019 )

**UNIT – I**

1) Forms of Igneous Rocks 2) Mega and Micro -Structures 3) Textures of Igneous rocks 4) Reaction series in magmatic system 5) Phase equilibrium of single, binary, Ternary silicate systems 6) Classification of Igneous rocks. 7) Petrographic Provinces-Variation Diagrams

**UNIT – II**

1) Trace elements in Petrological processes 2) Magmatic differentiation and Assimilation. 3) Petrography of the following groups: a) Granite-Granodiorite-Diorite b) Syenite-Nepheline syenite c) Gabbro-Peridotite-Dunite d) Dolerite e) Rhyolite-Trachyte-Dacite f) Andesite-Basalt g) Phonolite-Leucitophyre. Petrography and origin of the following : Pegmatites, Maffic rocks, carbonatites, Lamprophyres, Monomineralic rocks.

**UNIT – III**

1) Nature of Metamorphism and factors controlling metamorphism. 2) Structures and textures of metamorphic rocks. 3) Metamorphic Minerals and processes. 4) Metamorphic Zones and Mineralogical grade. 5) Mineral paragenesis and Metamorphic facies. 6) ACF, AKF and AFM diagrams.

**UNIT – IV**

1) Classification of metamorphic rocks. 2) Cataclastic, Regional and contact metamorphism of argillaceous, arenaceous, calcareous and basic igneous rocks. 3) Mylonite Zones. 4) Burial Metamorphic bodies. 5) Regional dynamothermal metamorphic bodies. 6) Schorl Rocks. 7) High pressure facies. 8) Low-pressure facies. G) serpentinites.



**M.Sc. GEOLOGY : ACHARYA NAGARJUNA UNIVERSITY**

**II SEMESTER PRACTICAL SYLLABUS, PAPER G201**

**IGNEOUS AND METAMORPHIC PETROLOGY**

**A. Igneous Petrology**

1. Identification of important rock types in hand specimens and thin section study of rocks from India.
2. Construction of variation of diagrams.
3. Calculation of C.I.P.W. Norm (Based on Mineralogical Magazine, 34; 276-282, C. H. Keelsy, 1965)
4. Model analysis of rocks by point counting.

**B. Metamorphic Petrology**

1. Identification of following rock types in hand specimens and in thin sections: Slate, Marble, Green-schist facies of rocks (Phyllites-Mica-Schist). Amphibolite facies of rocks (Hornblend schist); Pyroxene facies of rocks (Charnockite); Granulite facies of rocks (Garnetiferous gneisses) Eelolite facies of rocks (Eelolites); Quartzites; schorl rocks.
2. Plotting of metamorphic minerals on ACF, AKF diagrams.
3. Determination of finite strain in metamorphic rocks by drawing strain ellipse.

**BOOKS**

1. Igneous and Metamorphic Petrology by Myron G. Best.
2. Igneous Petrology by Anthony Hall.
3. Igneous and Metamorphic Petrology by Anthony R. Philpotts.
4. Metamorphic Petrology by Francis J. Turner.
5. Petrogenesis of Metamorphic Rocks by H. G. F. Winkler.
6. The Principles of Petrology by G. W. Tyrrell.
7. Igneous and Metamorphic Petrology by Turner and Verhoogen.
8. The study of rocks in Thin sections by W. W. Moorhouse.
9. Petrographic Methods and calculation by Arthur Holmes.

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**MODEL QUESTION PAPER**

(Effective from academic year 2018-19)

M.Sc. DEGREE EXAMINATION (Mar/ Apr. 2019)

(G 201)

**ACHARYA NAGARJUNA UNIVERSITY:**

**II- SEMESTER**

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**PARER - 1 IGNEOUS AND METAMORPHIC PETROLOGY**

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**Time : 3 hours**

**Answer ALL questions**

**Max Marks: 70**

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**Section –A**

3 x 6 = 18 Marks

1. Answer the all questions and each question carries equal marks
  - a) Pillowed structures
  - b) Vesicular Basalts
  - c) Spherulitic Structures
  - d) Riecke's Principle
  - e) Gneissic Structure
  - f) Thermal Metamorphism

**Section-- B**

13 x 4 = 52 Marks

UNIT – I

2. Describe various forms of igneous rocks with neat sketches.
- OR
3. Write about any **TWO** of the following:
    - a) Reaction series.
    - b) Natural glass.
    - c) Ophitic Texture.

UNIT – II

4. Give an account of Magmatic Differentiation process
- OR
5. Write about any **TWO** of the following:
    - a) Basalt –Andesite family
    - b). Monomineralic Rocks
    - c) Carbonatites.

UNIT – III

6. Describe Various kinds of metamorphism with suitable examples.
- OR
7. Write about any **TWO** of the following:
    - a) Mineral paragenesis
    - b) ACF-Diagrams
    - c) Metamorphic Textures

UNIT – IV

8. Write an essay on classification of metamorphic rocks.
- OR
9. Write about any **TWO** of the following:
    - a)..
    - b)
    - c) Charnockites
    - d) Schorl Rocks
    - e) Eclogites.

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M.Sc. GEOLOGY II SEMESTER SYLLABUS  
(Effective from the batch of 2018-2019)  
Paper 202 INDIAN MINERAL DEPOSITS AND MINERAL ECONOMICS  
UNIT – I

Introduction, classification of economic mineral deposits, mode of occurrence and formation of ore deposits; magmatic concentration, hydrothermal processes (cavity filling and replacement), contact metasomatism, oxidation and supergene enrichment, residual and mechanical concentration, sublimation, evaporation, sedimentation and metamorphism. .

UNIT – II

Geological setting, characteristic features, genesis, distribution and uses of metallic and non-metallic ore deposits in India. Iron, Manganese, Chromium, Aluminium, Nickel, Titanium, Molybdenum, Gold, Silver, Platinum, Copper – Lead – Zinc deposits of India. Deposits of Phosphorates, Limestone, Barytes, Diamonds, Graphite, Calcite and Micas..

UNIT – III

Concept of mineral economics. Significance of minerals in nations economy. Use of various minerals in manufacturing industries – metals, non-metals, fuels. National Mineral Policy. Classification of minerals – major, minor, fuels, Strategic, critical and essential minerals.

UNIT – IV

Reserves, Production and distribution of various minerals in the world. Tenor grade & Specifications of important minerals with examples. Conservation and substitution of minerals – low grade, ores use of scrap, new technologies, synthetics & Synthesis. Changing pattern of mineral consumption. Growth of mineral Industry in India & Andhra Pradesh. Minerals and mineral based industries in Andhra Pradesh.

**TEXT BOOKS**

1. Introduction to India's economic Minerals by N. L. Sharma and K. S. V. Ram.
2. Economic Mineral deposits by Jensen and Bateman.
3. Indian Bureau of Mines – year books.
4. Ore deposits of India by Gokhale and Rao, T. C.
5. Indian Mineral deposits by S. Krishna Swamy.
6. An Introduction to Mineral Economics by K. K. Chatterjee, Wiley Eastern Ltd.
7. Mineral economics by R. K. Sinha and N. L. Sharma.
8. Minerals in World Industry by Vosknil, W. W.

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M.Sc. GEOLOGY II SEMESTER PRACTICAL SYLLABUS  
PAPER 202

INDIAN MINERAL DEPOSITS AND MINERAL ECONOMICS  
(Effective from the admitted batch of 2018-2019)

Description, identification, and industrial uses of megascopic ore minerals of Iron, Manganese, Chromium, Nickel, Tatanium, Molybdenum, Copper, Lead, Zinc, Gold, Silver, Platinum, Bauxite, Phosphorates, limestone, Barytes, diamonds Graphite, Calcite, Micas. Practical assignments on ore deposits. Microscopic identification of ore minerals. Estimation of reserves by geometric and graphic methods.

**MODEL QUESTION PAPER**

(Effective from academic year 2018-19)

M.Sc. DEGREE EXAMINATION (Mar/ Apr. 2019)

(G 202)

**ACHARYA NAGARJUNA UNIVERSITY:**

**II- SEMESTER**

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**PARER - 2 INDIAN MINERAL DEPOSITS AND MINERAL ECONOMICS**

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**Time : 3 hours**

**Answer ALL questions**

**Max Marks: 70**

**Section –A**

3 x 6 = 18 Marks

1. Answer the all questions and each question carries equal marks.
  - a) Evaporation process
  - b) Graphite deposits of India
  - c) Explain concept of mineral economics
  - d) Classification of minerals
  - e) Placer deposits
  - f) Mention about various preccious metals

**SECTION – B**

Answer any FOUR questions choosing ONE question from each Unit.

All questions carry equal marks.

Max. Marks: 4 X 13 = 52

**UNIT - I**

2. Give a detailed account on magmatic concentration process with suitable examples  
OR
3. Write notes on any **TWO** of the following
  - (a) Cavity filling deposits
  - (b) Supergene enrichment deposits
  - (c) Residual concentration process

**UNIT - II**

4. Write the geological setting, genesis and distribution of Iron ore deposits of India  
OR
5. Write notes on any **TWO** of the following
  - (a). Chromite deposits of eastern ghats of India
  - (b) Phosporite deposits of India
  - (c) Mica deposits of Andhra Pradesh

**UNIT – III**

6. Discuss various conservative measures of minerals  
OR
7. Write notes on any **TWO** of the following
  - (a) Strategic, critical and essential minerals
  - (b) National mineral policy
  - (c) Industrial minerals

**UNIT - IV**

8. Discuss about tenor, grade and specification for industries  
OR
9. Write notes on any **TWO** of the following
  - (a) Mineral based industries of Andhra Pradesh
  - (b) Use of scrap, synthetics and new technologies
  - (c) Changing pattern of mineral industry

**M.Sc. GEOLOGY**  
**ACHARYA NAGARJUNA UNIVERSITY**

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II- SEMESTER , THEORY SYLLABUS, PAPER – G203

**SEDIMENTOLOGY AND MARINE GEOLOGY**

(Effective from the admitted batch of 2018-2019)

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**SEDIMENTOLOGY**

**UNIT - I**

1. Sedimentary Processes – Physical processes: Shearing, Fluid mechanics and Transport Mechanics.
2. Classifying and Naming of Sedimentary rocks- Descriptive and Genetic classifications: Limestones, Authigenic rocks, Carbonaceous rocks, Terrigenous rocks (Shales, Sandstones, Conglomerates, Breccias, Pyroclastic rocks).

**UNIT – II**

3. Sedimentary Rocks – Brief study of texture, structure, chemical composition and mineralogical composition of Conglomerates, Breccias, Sandstones, Shales and Limestones.
4. Provenance Studies – Lithology, position, distance and climate of source area, relief and tectonism.
5. Lithification and Diagenesis – Lithification, diagenesis, compaction pressure solution, carbonate cementation, source of calcium carbonate cement. Lithification by sea water and fresh water.

**MARINE GEOLOGY**

**UNIT - III**

6. Methods of exploring the Ocean floor and Sediment sampling Methods- Echo-Soundings, Grab/Snapper sampler, Coring devices, Bottom Photography, Diving.
7. Morphology of the Oceans – Hypsometry, Continental Shelf, Continental Slope, Continental Rise, Ocean Basin floor, Ocean ridges.
8. Oceanic Crust-Structure : Seismic refraction Seismic reflection, Deep sea Drilling Dredging of Fracture Zones, Ophiolitic complexes. Petrology and sources of oceanic crust

**UNIT – IV**

9. Ocean circulation – Surface circulation : Surface water temperatures salinities, Density and wind, Elements of surface circulation – The Coriolis Effect, Geostrophic currents, The Ekman spiral, Upwelling, Equatorial currents, Western Boundary currents, Deep circulation.
10. Sea-Level History and Seismic stratigraphy – Importance of Sea – Level changes and its causes, Quaternary - Mesozoic – Tertiary sea level Changes.
11. Coral Reefs – Classification and origin – Coral Reefs – Favorable conditions ,classification, origin, uses, threats.

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**M.Sc. GEOLOGY**  
**ACHARYA NAGARJUNA UNIVERSITY:**  

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**II- SEMESTER, PRACTICAL SYLLABUS, PAPER – G203**  
**SEDIMENTOLOGY AND MARINE GEOLOGY**  
(Effective from the admitted batch of 2018-2019)  

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**SEDIMENTOLOGY**

1. Study of Primary and Secondary sedimentary structures. Microscopic and Megascopic study of some important sedimentary rocks-Conglomerate, Breccia, Sandstone, Limestone, Shale, Laterite.
2. Separation of Heavy Minerals.
3. Microscopic study of Detrital Minerals.
4. Estimation of calcium carbonate and organic matter from sediments.
5. Preparation of sedimentary maps from analytical data.

**MARINE GEOLOGY**

4. Beach profile measurements.
5. Mechanical analysis of sediments and calculation of statistical parameters.
6. Demonstration of sampling devices.
7. Analysis of Bathymetric charts.

**BOOKS**

1. Sedimentary Rocks – F. J. Pettijohn.
2. Principles of Sedimentology – G. M. Friedman and J. E. Sanders.
3. Marine Geology – F. P. Shephard.
4. Submarine Geology – J. Kennath
5. The Mineral Resources – John L. Mero.

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**MODEL QUESTION PAPER**  
(Effective from academic year 2018-19)  
M.Sc. DEGREE EXAMINATION (Mar/ Apr. 2019) (G 203)  
**ACHARYA NAGARJUNA UNIVERSITY:**  
**II- SEMESTER**

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**PARER - 3                      SEDIMENTOLOGY AND MARINE GEOLOGY**

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**Time : 3 hours**  
**Marks: 70**

**Answer ALL questions**

**Max**

**Section – A**

3 x 6 = 18

1. Answer the all questions and each question carries equal marks.
- a) Classification of authigenic rocks
  - b) Cementation of Limestone's
  - c) Oceanic Ridges
  - d) Coriolis effect
  - e) Manganese Nodules
  - f) Salinity in Oceans

**Section – B**

13 x 4 = 52

UNIT – I

2. Write about the classification of Limestones.  
OR
3. Write short notes on any TWO of the following
- (a). Physical Processes
  - (b) Classification of Pyroclastic rocks
  - (d) Classification of Sandstones

UNIT – II

4. Define a Provenance. Explain various Parameters that are useful in studying Provenance.  
OR
5. Write short notes on any TWO of the following
- (a) Texture of Sandstone
  - (b) Conglomerate
  3. Diagenesis

UNIT – III

6. Explain the Morphology of Ocean basins.  
OR
7. Write short notes on any TWO of the following
- (a) Echo-sounding
  - (b) Transitional Environments
  - (c) Microfossils

UNIT – IV

OR

8. Write short notes on any Two of the following
- (a) Surface Circulation
  - (b) Bottom currents
  3. Ekman Spiral

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**M.SC. GEOLOGY: II SEMESTER**  
Acharya Nagarjuna University  
(Effective from academic year 2018-2019)

**THEORY PAPER-204:**

100marks and 4 credits

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**ENVIRONMENTAL GEOLOGY**

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**UNIT- I**

1. Environmental Geology : (a) Introduction -fundamental principles, objectives, and scope (b) Basic concepts
2. Earth system and its components
3. Climate : (a) Structure and composition of atmosphere (b) Solar radiation and heat balance (c) Global wind circulation and rainfall distribution
4. Ocean : (a) Water circulatory patterns (b) Impact on climate and weather
5. Earth materials and processes: (a) Plate tectonics (b) Geological cycles- rocks, minerals, soils and water (c) Surface processes for landform development

**UNIT- II**

1. Natural events and hazards (Nature, cause, damage, and preventive methods) :  
(a) River flooding (b) Cyclones and storms (c) Earth quakes and volcanoes (d) Landslides and avalanches (e) Coastal process and tsunami
2. Soil erosion and degradation: (a) Types of erosion and degradation (b) Conservation and management practices
3. Climate change and global warming: (a) Natural and man-made reasons (b) Effects on ecosystems, natural resources, surface and ground water, soil fertility, food production, energy consumption, coastal regions and sea level, diseases.

**UNIT- III**

1. Human interaction and impacts:
  - (a) Surface and underground mining (i) Mineral development
  - (b) Industrialization and urbanization: (i) Air pollution- change in heat balance, effects of green house gases, water vapour and other particulates; acid rains (ii) Depletion of natural vegetation, (iii) Surface and ground water hydrology- water supply and use, water pollution and degradation, water management (d) waste disposal
  - (c) Role of dams, reservoirs, mega structures and heavy traffic infrastructures on natural process
  - (d) Land evaluation and planning for land use practices

## UNIT- IV

1. Geological factors and human health: Role of trace elements of fluorine, Iodine, zinc, selenium, lead, arsenic and mercury.
2. Geologic environment for certain chronic diseases – heart, lung and cancer
3. Environmental legislation

### Reference Books:

1. Environmental Geology –Edward A. Keller (CBS Publishers and Distributors)
2. Environmental Geoscience -Strahler A.N. and Strahler A.H. 1973 (Hamilton Pub)
3. Environmental Geology in Indian context – Valdiya K.S (McGraw Hill)
4. Fundamentals of Physical geography – Text book for XI, NCERT
5. The Earth's changing surface – Bradshaw M.J and Abbott A.J and Gelsthorpe 1978 (ELBS Pub)
6. Earth the living Planet – Bradshaw M.J 1979 ( ELBS)
7. Geological hazards resources and Environmental Planning – Gary B. Griggs and John A gilchrist (Wadsworth pub. Calif)
8. Geology in Environmental planning – Arthur D Howard and Irwin Remson (McGraw Hill)
9. Oil Erosion and Conservation – Tripathy R.P and Sing H.P (Wiley Eastern Ltd)
10. The Dynamic Earth System \_ Patwardhan A.M (Prentice Hall)
11. India's Environmental problems and perspective – RadhaKrishna B.P and Ramachandran K.K (Geological Society of India)

**M.SC. GEOLOGY: II SEMESTER**  
Acharya Nagarjuna University  
(Effective from academic year 2018-2019)

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**PRACTICAL PAPER-204:**

50 marks and 2 credits

**ENVIRONMENTAL GEOLOGY**

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1. Study the nature of river flooding and construction of Hydrographs
2. Procedure to estimate the earth quake magnitude by graphical method
3. Study of plate boundaries, seismic and volcanic zones from maps
4. Map drawing and interpretation of seismic zones in India
5. Study of flood prone areas in river basins from maps
6. Study of forest types of India from maps
7. Study of soil types and soil erosion in India from maps
8. Analysis procedures for a few elements and compounds of water
9. Study of coastal regions of India from satellite images
10. Aerial photo study for different terrain environment

**MODEL QUESTION PAPER**

(Effective from academic year 2018-19)

M.Sc. DEGREE EXAMINATION (Mar/ Apr. 2019)

(G 204)

**ACHARYA NAGARJUNA UNIVERSITY:**

**II- SEMESTER**

**PARER - 4**

**ENVIRONMENTAL GEOLOGY**

**Time : 3 hours**

**Answer ALL questions**

**Max Marks: 70**

**Section –A**

**3 x 6 = 18 Marks**

1. Answer the all questions and each question carries equal marks.
- Write about the currents circulation in ocean bodies
  - What is El Nino and La Nano?
  - How is tsunami developed?
  - What are environmental changes due to dams?
  - What are health effects due to fluorides in water?
  - What is acid rain?

**Section – B**

**13 x 4 = 52**

2. Give an account on fundamental concepts of Environmental geology subject  
Or
3. Write short notes on any TWO
- Objectives of environmental geology
  - Structure and composition of atmosphere
  - Out line of earth processes

**UNIT – II**

4. Discuss about the river flooding and mitigation studies  
Or
5. Explain about any TWO
- Conservation and management practices for soil erosion
  - Global warming and effects
  - Fore-warning studies for occurrence of earth quakes and volcanoes

**UNIT – III**

6. Discuss about the geo-environmental effects due to urbanization and industrialization.  
Or
7. Write short notes on TWO
- Land evaluation and planning for land use practices
  - Effects of mining of earth material
  - Water management practices

**UNIT – IV**

8. Discuss about the geological environments causing heart and lung diseases.  
Or
9. Give account on TWO
- Health problems due to iodine deficiency and geologic conditions
  - Environmental legislation
  - Dose- Response curve study for human health

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**M.Sc. GEOLOGY : ACHARYA NAGARJUNA UNIVERSITY**

**III SEMESTER, *THEORY SYLLABUS* , PAPER –G 301**

**GEOCHEMISTRY AND MINERAL EXPLORATION**

(EFFECTIVE FROM THE ACADEMIC YEAR OF 2018-2019)

**GEOCHEMISTRY**

**UNIT - I**

1) Study of abundance of elements and nuclides in the Sun and the Earth. 2) Geochemistry of the Earth's Crust, Mantle and Core. 3) Geochemical classification of elements. 4) Geochemical behaviour of Major elements in the magmatic cycle, Principles governing the Minor elements.

**UNIT - II**

1) Geochemistry of Sedimentary rocks – Physico-chemical factors, products of Sedimentation. 2) Metamorphism as Geochemical Phenomenon – Internal Metamorphism, Metasomatism. 3) Geochemical cycle. 4) Analytical Techniques – Colorimetry, Flame photometry, Atomic Absorption Spectrophotometer.

**MINERAL EXPLORATION**

**UNIT - III**

**GEOLOGICAL EXPLORATION** 1) Geological mapping - surface and sub-surface mapping. 2) Guides to ores:. 3) Drilling methods & well logging techniques . 4) Reserve estimation, evaluation and sampling techniques

**GEOPHYSICAL EXPLORATION** Principles, simple type of measuring instruments, field procedures and interpretation of data 1) Gravitational methods of prospecting 2) Magnetic methods of prospecting 3) Electrical methods - Self potential, Resistivity and equipotential method 4) Seismic Refraction and reflection methods 5) Radioactive methods of prospecting.

**GEOCHEMICAL EXPLORATION**

**UNIT - IV**

1) Geochemistry in mineral exploration, geochemical prospecting of minerals and elements as geochemical tracers 2) Geochemical associations and pathfinders and their applications. 3) Groundwater as guide, methods of sampling – analysis for geochemical prospecting. 4) Plants as Geochemical indicators- Biogeochemical Anomalies Geobotanical Indicators- Surveying Techniques and Interpretation 5) Primary environments – Primary Aureoles and primary dispersion. 6) Secondary environments – Chemical weathering, application of  $P^H$  and Eh, Adsorption, Mobility in the secondary environment.

## TEXT BOOKS

1. Principles of Geochemistry – Brian Mason.
2. Geochemistry – Goldschmidt.
3. Geochemistry – Rankama and Sahama.
4. Geochemistry in Mineral Exploration – Hawkes and Webb (1979). 2<sup>nd</sup> Edition, Academic Press, London
- 5.. Mining geology – Mc Kinstry.
6. Courses in Mining Geology by R.N.P. Arogyaswamy (1974).
7. Introduction to Geophysical prospecting: M.B. Dobrin (1976).
8. Geophysical prospecting by M. B. Rama Chandra Rao
9. Introduction to exploration geochemistry by Ervinson, A.A. (1974), Second Edition. Applied Publishing Ltd., U.S.A.
10. Rock Geochemistry in Mineral Exploration by Govett, G.J.S. (1983).
11. Geophysical Methods in Geology by Sharma P. V. 1986, Elsevier.
12. Principles of Applied Geophysics by Parasnis, D.S. (1975). Chapman and Hall.

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**M.Sc. GEOLOGY : ACHARYA NAGARJUNA UNIVERSITY**

**III SEMESTER , *PRACTICAL SYLLABUS* , PAPER 301**

**GEOCHEMISTRY AND MINERAL EXPLORATION**

1. Sample preparation and preparation of A and B Solutions.
2. Major element analysis and Trace element analysis by using flame photometry colorimetry and UV-spectrophotometer.
3. Sampling problems. Problems in ore reserve estimation. Determination of vein and fault patterns of ore bodies.
4. Preparation and interpretation of various geochemical maps.
5. Resistivity methods of prospecting: a) Wenner method b) Schlumberger method. Seismic methods of prospecting problems.
6. Computation of gravity and magnetic effects produced by a sphere, cylinder and fault buried under the ground by drawing gravity and magnetic anomaly profiles.

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**MODEL QUESTION PAPER**

(Effective from academic year 2018-19)

M.Sc. DEGREE EXAMINATION (Nov/ Dec. 2019)

**(G 301)**

**ACHARYA NAGARJUNA UNIVERSITY:**

**III- SEMESTER**

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**PARER - 1      GEOCHEMISTRY AND MINERAL EXPLORATION**

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**Time : 3 hours**

**Answer ALL questions**

**Max Marks: 70**

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**Section –A**

3 x 6 = 18 Marks

1. Answer the all questions and each question carries equal marks.
  - a) Composition of crust
  - b) Nature of mantle
  - c) Meteorites and their significance
  - d) Atmosphile Elements
  - e) Mohorovicic Discontinuity
  - f) Minor Elements

**Section-- B**

13 x 4 = 52 Marks

**UNIT - I**

2. Discuss the role of Major elements in Magmatic cycle.  
OR
3. Write short notes on any **TWO** of the following
  - a) Mantle Composition.
  - b) Geochemical classification of elements.
  - c) Abundance of elements and nuclides in the Earth.

**UNIT - II**

4. Write about Physico-Chemical factors in sedimentation.  
OR
5. Write short notes on any **TWO** of the following.
  - a) Metasomatism.
  - b) Geochemical cycle.
  - c) Flame Photometry.

**UNIT III**

6. Write an essay on structural guides used for mineral exploration with suitable examples.  
OR
7. Write short notes on any **TWO** of the following:
  - a) Drilling methods.
  - b) Reserve estimation.
  - c) Seismic Methods of prospecting

**UNIT IV**

8. Explain the bio-geochemical methods of prospecting for minerals.  
OR
9. Write short notes on any **TWO** of the following:
  - a). Plants as geochemical indicators.
  - b) Primary and secondary dispersions
  - c). Path finder elements.

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M.SC. GEOLOGY:: NAGARJUNA UNIVERSITY  
III SEMESTER SYLLABUS, PAPER 302

**FUEL GEOLOGY (COAL, PETROLEUM AND ATOMIC MINERALS)**

(Effective from the admitted batch of 2018-2019)

UNIT – I

Geological basis of coal formation – Origin of Peat swamps, paleogeographic and tectonic requirements, development of coal facies. Types of deposition, peat forming plants, nutrient supply, bacterial activity, temperature and redox, potential, diagenesis. Definition and origin of kerogen and coal. Rank, grade and type of coal. Indian and international classifications. Chemical characterization: Proximate and, ultimate analyses. Macroscopic ingredients and microscopic constituents, concept of maceral and `microlithic types.

UNIT – II

Preparation of Coal for industrial Purposes, coal carbonization (coke manufacture), Coal gasification and coal hydrogenation. coal bed methane exploration and production, coal forming epochs in the geological past. Geological and geographical distribution of coal deposits in India.

Mode of occurrence and association of atomic minerals in nature. Atomic minerals as source of energy. Methods of prospecting and productive geological horizons in India.

UNIT – III

Occurrence of Petroleum: Surface occurrence see pages – Mud volcanoes – disseminated deposits – Vein deposits – Kerogene shale. Subsurface occurrences: Showings – Pools – fields – provinces. Reservoir rock – Classification – nomenclature – fragmental Chemical – miscellaneous. The reservoir pore space. Porosity and permeability. Reservoir traps – general and structural. Classification of traps – Structural traps – caused by folding by faulting – by fracturing. Reservoir traps – Stratigraphic: Primary stratigraphic traps in clastic rocks – in chemical rocks. Secondary stratigraphic traps. Reservoir traps combination and salt domes.

UNIT – IV

Origin of Petroleum: Organic origin – nature of organic source material – modern organic matter. Transformation of organic matter into petroleum, bacterial action – heat and pressure – alteration of petroleum. Migration and accumulation of petroleum, primary migration, water squeezed out of clays – normal water circulation – sedimentary oil – recycled oil. Secondary migration: Entrained particles – capillary pressure – displacement phenomena – buoyancy – dissolved gas effects – accumulation – tilted oil – water contacts – stratigraphic barriers – vertical migration – time of accumulation.

## TEXT BOOKS

1. Stach's text book of Coal Petrology by Gerbruder Borntralger, Berlin Stuttgart, 1975/1982.
2. Text book of Coal (Indian context) by Chandra, D, Sing, R. M and Singh, M. P 2000. Tara Book Agency.
3. Geology of Petroleum by A. I. Levorsen.
4. Petroleum Geology by K. K. Landes.
5. Principles of Petroleum Geology – W. L. Russell
6. Petroleum Geology F. K. North.
7. Graphic Problems in Petroleum Geology by L. W. Leroy and Julian W. Low.
8. Radioactivity in Geology. Principles and Application by Durance E. M. 1986. Ellis Hoor wool.
9. Uranium ore deposits by Dahlkamp F. J. 1993. Springer Verlag.
10. Geochemical prospecting for Thorium and Uranium deposits by Boyle R. W. 1982. Elsevier.

M.SC. GEOLOGY :: NAGARJUNA UNIVERSITY

III SEMESTER , PAPER 302, PRACTICAL SYLLABUS

FUEL GEOLOGY (COAL, PETROLEUM AND ATOMIC MINERALS)

(Effective from the admitted batch of 2018-2019)

Coal – identification of megascopic coal samples. Proximate analysis of coal. Completion of outcrops in the given maps and calculation of coal reserves. Introduction to coal microscopy. Identification of different macerals and microlitho types. Coal rank measurements based on reflectance.

Megascopic and microscopic study of cores and well cuttings. Study of geological maps and sections of important oil fields of India and world. preparation of stratigraphic cross sections. Megascopic study of some uranium and thorium bearing minerals and rocks.

**MODEL QUESTION PAPER**

(Effective from academic year 2018-19)

M.Sc. DEGREE EXAMINATION (Nov/ Dec. 2019)

(G 302)

**ACHARYA NAGARJUNA UNIVERSITY:**

**III- SEMESTER**

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**PARER - 2 FUEL GEOLOGY (COAL, PETROLEUM AND ATOMIC MINERALS)**

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**Time : 3 hours**

**Answer ALL questions**

**Max Marks: 70**

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**Section –A**

3 x 6 = 18 Marks

1. Answer the all questions and each question carries equal marks.

- a) Rank and grades of coal
- b) Macrolithotypes
- c) Mention different types of atomic minerals occurs in nature
- d) Important coal forming epochs
- e) Differences between reservoir rock and source rock
- f) Buoyancy

**SECTION –B**

Answer any FOUR questions choosing ONE question from each Unit.

All questions carry equal marks.

Max. Marks: 4 X 13 = 52

**UNIT - I**

2. Give an account of concept of maceral and classification of microlithotypes

OR

3. Write notes on any TWO of the following

- (a) Evolutionary development of flora
- (b) Proximate analysis
- (c) Explain the kerogen and coal

**UNIT – II**

4. Write essay on geographical distribution of coal deposits in India

OR

5. Write notes on any TWO of the following

- (a) Coal carbonization
- (b) Coal bed methane
- (c) Mode of occurrence of atomic minerals in nature

**UNIT- III**

6. Define the reservoir rock?. Describe the classification of reservoir rocks

OR

7. Write notes on any TWO of the following

- (a) Structural traps
- (b) Surface occurrence of petroleum
- (c) Mention about oil pool, oil field and oil province

**UNIT – IV**

8. Write an essay on origin of petroleum

OR

9. Write notes on any TWO of the following

- (a) Primary migration
- (b) Dissolved gas effects
- (c) Stratigraphic barriers

**M.Sc. GEOLOGY**  
**ACHARYA NAGARJUNA UNIVERSITY:**  
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III-SEMESTER , THEORY SYLLABUS, PAPER – G303  
**STATISTICAL AND COMPUTER APPLICATIONS IN GEOLOGY**  
(Effective from the admitted batch of 2018-2019)  
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**STATISTICAL APPLICATIONS**

**UNIT – I**

1. Frequency Distribution, frequency curve and its characteristics – Mean, Median and Mode, Relationship between mean, median and mode.
2. Cumulative frequency – Characteristics of cumulative frequency curve, Applications of cumulative Frequency curves.
3. Variance, Standard Deviation, Covariance, Coefficient of variation, Skewness and kurtosis.

**UNIT – II**

4. Normal distribution – Characteristics of Normal curve, Finding the Areas under Normal curve.
5. Binomial distribution – Characteristics, Approximating, uses.
6. Sampling - Simple Random sampling, Restricted Random sampling – Grid sampling, Stratified sampling, Cluster sampling .

**COMPUTER APPLICATIONS**

**UNIT – III**

7. M.S Office - Introduction, M S Word , M S Excel, M S Power point, MS Access.
8. M S Word- M S Word – File, Edit, View, Insert, Format, Tools, Table.

**UNIT – V**

9. M S Excel – File, Edit, View, Insert, Format, Tools, Data.
10. M S Power point- File, Edit, View, Insert, Format, Tools, Slide show, Animation.

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**M.Sc. GEOLOGY**  
**ACHARYA NAGARJUNA UNIVERSITY:**  

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**III- SEMESTER, PRACTICAL SYLLABUS, PAPER – G303**  
**STATISTICAL AND COMPUTER APPLICATIONS IN GEOLOGY**  
(Effective from the admitted batch of 2018-2019)  

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STATISTICAL APPLICATIONS

1. Problems related to theory syllabus.
2. Graph preparation related to theory syllabus.

COMPUTER APPLICATIONS

1. M.S Word – Word Processing
2. Tabulation of data using Excel
3. Graphs preparation in Excel
4. Slide preparation and Animation

TEXT BOOKS

1. Geostatistics with applications in Earth Sciences. D. D. Sharma, 2002, Capital Publishing Company, New Delhi, 170
2. Statistics for Geoscientists – Techniques and applications. Saroj K. Pal, 1998, Concept Publishing Company, 601
3. Working in M S Office – Ron Mansfield. Tata McGraw Hill.
4. Introduction to Computers – V. Raja Raman.

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**MODEL QUESTION PAPER**

(Effective from academic year 2018-19)

M.Sc. DEGREE EXAMINATION (Nov/ Dec. 2018)

(G 303)

**ACHARYA NAGARJUNA UNIVERSITY:**

**III- SEMESTER**

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**PARER - 3 STATISTICAL AND COMPUTER APPLICATIONS IN GEOLOGY**

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**Time : 3 hours**

**Answer ALL questions**

**Max Marks: 70**

**Section –A**

3 x 6 = 18 Marks

1. Answer the all questions and each question carries equal marks.
  - a) Mean
  - b) Median
  - c) Sampling
  - d) MS- Word
  - e) MS- Excel
  - f) MS - PowerPoint

**Section – B**

13 x 4 = 52

**UNIT – I**

2. What are the characteristics of a frequency curve? Explain hypsometric curve.  
OR
3. Write short notes on any TWO of the following
  - a) Standard Deviation
  - b) Covariance
  - c) Skewness

**UNIT –II**

4. What are the Characters of a binomial distribution? Explain its uses.  
OR
5. Write short notes on any TWO of the following
  - a) Areas under normal curve
  - b) Sampling plan
  - c) Planning a sample survey

**UNIT –III**

6. What are the applications of MS Word.  
OR
7. Write short notes on any **Two** of the following
  - a) M. S. Office.
  - c) Tool Bars
  - d) MS Word-Edit

**UNIT –IV**

8. How M. S. Power Point is useful in Text and Picture Presentation Explain?  
OR
9. Write short notes on any **Two** of the following
  - a) Excel Graphs.
  - b) Power Point – Animation
  - c) Excel- Edit

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**M.Sc. GEOLOGY : ACHARYA NAGARJUNA UNIVERSITY**  
**III SEMESTER THEORY SYLLABUS, PAPER G.304**  
**Surface and Underground Mining**  
( Effective from the batch of 2018 - 2019 )

**UNIT – I**

Mines and Minerals ( Regulations and development ) - Act ,1957 – Mining Lease – Minor Minerals – Prospecting license – Renewal – Royalty and dead rent – Mineral concession rules (1960) – Certification of approval – Mining license for scheduled minerals - Tenor and Grade - Mine Management - Mine Safety, Types of mining methods – **Alluvial mining** – Pan and Batea – Long tom – Sluicing ( Ground Sluicing ) – Derrick and cable way – Hydraulicking – Drift mining – Fore poling and Dredging.

**UNIT – II**

**Open cast mining or quarrying** – Bench mining , Glory Hole mining, Kaolin mining ; Strip mining – Rippling , Drilling and blasting , Power shovels, Dumpers, Scrapers , land dredges bucket wheel excavators, conveyor belt , Spreaders and Dragline Operations and mining of the minerals from ocean ( On the beach – placer deposits, From the Shelf – Sand and Gravel, From the deep – Ferromanganese Nodules )

**UNIT – III**

**Underground Coal Mining** – Classification of underground Coal mining methods – Panel system , Board and pillar method, Long wall advancing, Long wall retreating , Horizon mining , Strip mining , mine supports , Lighting, Ventilation. **Underground metal mining** – Shaft Sinking methods , Gophering , Breast stopping, Open over hand Stopping , Open underhand Stopping , Underground Glory hole mining , Pillar and Chamber method, Sublevel Stopping method, Drifting , Rising and winzings , Lighting, haulage and ventilation.

**UNIT – IV**

**Ore dressing and beneficiation : Crushing** – Jaw crushers, Gyratory crushers , cone crushers, Sledging rolls, Hammer mill or Pulverator , Stamping, Spring rolls , Manual crushing : **Grinding** – Sizing by Screening , Flotation , magnetic separation , Electrostatic Separation ; Concentration of Ore by Washing and Scrubbing, Jigging , Tabling and miscellaneous methods.



**M.Sc. GEOLOGY : ACHARYA NAGARJUNA UNIVERSITY**  
**III SEMESTER *Practical* , PAPER G.304**  
**Surface and Underground Mining**  
( Effective from the batch of 2018 - 2019 )

**Practicals :**

1. Calculation of percentage of Metal and calculation of Grade in the following Ores– Iron, Chromium, Manganese, Copper, Aluminum, Magnesium, Zink, Titanium, Silver
2. Analysis of Lime stone
3. Proximate and ultimate analysis of Coal
4. Performance of Hand –Jig
5. Flow Sheet design
6. Use of the fallowing for upgrading the Ore  
Jaw Crusher, Roller Crusher, Ball mill, Rod mill, Seaving , Panning, Jigging, Froth Flotation, Tabling

**Books :**

1. Courses in Mining Geology – Arogyaswamy.
2. Mining Geology – Hugh Exton Mckinstry
3. Principles of Mineral Dressing – Gaudin
4. Mining Policy Initiatives – Dhar, Gautam
5. Mineral Processing Technology – Wills
6. Mining of Mineral Deposits – L. Shevyakov
7. Mining the Ocean – T.K.S.Murthy
8. P.Seshagiri Rao's Law of Mines and Minerals – N. Hunaimy, Asia Law House, Hyderabad.
9. Indian Bureau of Mines, Nagapur Guidelines for mining plan preparation 1994.
10. Indian Minerals year Books, Published by Indian Bureau of Mines, Nagapur.

**MODEL QUESTION PAPER**

(Effective from academic year 2018-19)

M.Sc. DEGREE EXAMINATION (Nov/ Dec. 2019)

(G 304)

**ACHARYA NAGARJUNA UNIVERSITY: III- SEMESTER**

**PARER – 304 Surface and Underground Mining**

**Time : 3 hours**

**Answer ALL questions**

**Max Marks: 70**

**Section –A**

3 x 6 = 18 Marks

**Answer all the questions . All questions carry equal marks**

- a) Mineral Concession Rules (1960)
- b) Tenor
- c) Kaolin Mining
- d) Rising and Winzing
- e) Hammer Mill
- f) Jigging

**Section-- B**

13 x 4 = 52 Marks

**Answer any FOUR questions choosing ONE question from each Unit.**

**All questions carry equal marks.**

**UNIT - I**

1. Write brief account on Mines and Mineral regulations and Development Act , 1957
- OR
2. Write short notes on any **TWO** of the following:
    - a) Mine Lease.
    - b) Royalty and Dead rent
    - c) Pan and Batea Method of alluvial Mining

**UNIT - II**

3. Enumerate and describe various open cast mining methods
- OR
4. Write short notes on any **TWO** of the following:
    - a) Drilling and Blasting.
    - b) Conveyor belt.
    - c) Drag line

**UNIT – III**

5. Write Brief account of Coal Mining methods
- OR
6. Write short notes on any **TWO** of the following :
    - a) Board and pillar Method of Coal mining
    - b) Ventilation in Coal mining
    - c) Haulage in Metal mining.

**UNIT – IV**

7. Write an essay on mineral Beneficiation principles and techniques
- OR
8. Write short notes on any **TWO** of the following:
    - a) Seiving
    - b) Flotation method
    - c) Tabling

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**M.Sc. GEOLOGY : ACHARYA NAGARJUNA UNIVERSITY**

**DEPARTMENT OF GEOLOGY**

**IV SEMESTER , *THEORY SYLLABUS*, PAPER 401  
GEMMOLOGY**

(Effective from the academic year of 2018-2019)

UNIT – I

Gem Industry in India and the world – qualities of gem stones – Navaratnas – Geological Distribution – Associated rock types – Mode of occurrence – Distribution in India – Distribution in the world – Uses of gem stones as Jewellery, property and Medicinal – Exploration for gems. Measurement Units. Role of Geologist in Gem Industry.

UNIT – II

Physical properties of gemstones – Identification of gems by X-ray diffractometry – Refractive Index – Critical angle – R.I. measurement – Immersion cell and relative Indices – Use of refractometer, reflectivity meter, spectrometer, polariscope, gemological microscope, Loupe and Petrological Microscope.

UNIT – III

Mineral Chemistry, structure and color of gems – Internal arrangement of atoms, bonding – Isomorphism – Polymorphism – Pseudomorphism – Causes of colors – Chromophores, color centers, luminescence – Alexandrite Effect – Color zoning – Use of crossed filters and Chelsea filters – Flaws in gemstones. Identification of organic and Miscellaneous gems

UNIT – IV

Gem cutting and Polishing – Styles of cutting – Cabochon cut – Faceted cut – Proportion of cutting – Planning – Diamond cutting – Colored stone cutting– polishing abrasives – Fabricated stones – bead making – carving and engraving –synthetic gemstones – Techniques of gem synthesis – Diamond synthesis – Lapidary.

**M.Sc.GEOLOGY : ACHARYA NAGARJUNA UNIVERSITY**

**DEPARTMENT OF GEOLOGY**

**IV SEMESTER *PRACTICAL SYLLABUS*, PAPER 401**

**GEMMOLOGY**

1. Megascopic Identification of some important gem minerals based on physical properties.
2. Identification of polished or finished gem stones.
3. Microscopic studies of some important gem minerals using petrological microscope.
4. Measurement of R. I. of gem minerals.
5. Exercises to distinguish between synthetic gems and natural gems.
6. Gem cutting methods and drawing styles of cutting.

**TEXT BOOKS**

1. "Gems and Gem Industry in India" by R. V. Karanth (Memoir 45, Geological Society of India, Bangalore, 1<sup>st</sup> Ed. 2000)
2. "Diamonds in India" by T. M. Babu (Geological Society of India, Bangalore, 1998)
3. "Precious Stones" by Curzio Cipriani (McDonald & Co. (Publishers) Ltd., London.
4. "Manual of Mineralogy" by Cornelis Klein and Cornelius S. Hurlbut, Jr (John Wiley & Sons Publication)
5. "Mineralogy" by L. G. Berry and Brian Mason.
6. "An Introduction to the rock forming Minerals" by Deer, Howie and Zussman (ELBS Edition)
7. "Mineralogy" by Dexter Perkins (2<sup>nd</sup> Ed. Prentice Hall of India Private Limited).

**MODEL QUESTION PAPER**  
(Effective from academic year 2018-19)  
M.Sc. DEGREE EXAMINATION (Mar/ Apr. 2020) (G 401)  
**ACHARYA NAGARJUNA UNIVERSITY:**  
**IV- SEMESTER**

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**PARER – 1** **GEMMOLOGY**

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**Time : 3 hours** **Answer ALL questions** **Max Marks: 70**

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**Section –A**

3 x 6 = 18 Marks

1. . Answer the all questions and each question carries equal marks.
  - a) Durability of Gem stones
  - b) Measuring units of gem stones
  - c) Critical Angle
  - d) Polymorphism
  - e) Chromophores
  - f) Lapidary

**Section-- B**

13 x 4 = 52 Marks

UNIT – I

2. Write an essay on the distribution of gemstones in India.  
OR
3. Write short notes on any **TWO** of the following:
  - a) Gem-bearing rocks.
  - b) Medicinal uses of gems.
  - c) Gem qualities.

UNIT – II

4. Describe how a gem mineral is identified by means of X –Ray Diffraction.  
OR
5. Write short notes on any **TWO** of the following:
  - a) Chatoyaney.
  - b) Refractive Index.
  - c) Polariscope.

UNIT – III

6. Write about Mineral chemistry, structures and colour variations in Diamond.  
OR
7. Write short notes on any **TWO** of the following:
  - a) Isomorphism.
  - b) Alexandrite Effect.
  - c) Flaws in Gem stones.

UNIT – IV

8. Write an account of various stages of gem cutting on a polishing Unit.  
OR
9. Write short notes on any **TWO** of the following:
  - a) Polishing abrasives.
  - b) Stone fabrication.
  - c) Cabochon cutting.

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M.SC. GEOLOGY: NAGARJUNA UNIVERSITY  
IV SEMESTER, PAPER 402, SYLLABUS

PETROLEUM EXPLORATION

(Effective from the admitted batch of 2018-2019)

UNIT – I

Reservoir dynamics: Reservoir conditions and temperature. Reservoir Mechanics phase relationships Interface phenomena, capillary pressure. Reservoir energy. Movement of oil and Gas in pool. Production phenomena of oil and gas.

UNIT – II

Identification and characterization of Petroleum source rocks. Amount, type and maturation of organic matter. Oil and source rock correlation. Locating petroleum prospects based on principles of petroleum generation and migration (Geological modeling). Petroliferous basins of India. Geology and Hydrocarbon prospects of Krishna, Godavari, Cauvery, Combay basins, Western offshore basins and Assam shelf. Estimations of reserves and resources. Position of oil and natural gas in India, Gas hydrates origin and future prospects.

UNIT – III

Elements of geophysical methods of exploration. Magnetic, gravity and seismic methods. Interpretation of seismic data in basin modeling and preparation of subsurface geological maps. Application of Remote sensing techniques in basin analysis.

UNIT – IV

The petroleum geologist's maps and cross sections. Elements of well drilling. Cable-tool drilling, rotary drilling various types of drilling units. Elements of logging. Electric, radioactivity and the sonic logs etc. Nuclear magnetic resonance and dielectric logging. Application of logs in petrophysical analysis and facies analysis.

TEXT BOOKS

1. Petroleum geology by North, F. K. (1985) Allen and Unwin Ltd.
2. Petroleum Formation and occurrence by Tissot, B. P. and Welte, D. H. (1984) Springer Verlag.
3. Elements of Petroleum Geology by Selley R. C. 1998. Academic Press.
4. Geology of Petroleum by A. I. Levorsen (1972)
1. Introduction to Petroleum Geology by G. D. Hobson and E. N. Tiratsoo
6. Graphic problems in Petroleum Geology by L. W. Leroy and Julian W. Low

M.SC. GEOLOGY: NAGARJUNA UNIVERSITY

IV SEMESTER, PAPER 402, PETROLEUM EXPLORATION

PRACTICAL SYLLABUS

(Effective from the admitted batch of 2018-2019)

1. Interpretation of logging data.
2. Study of important maps of Petroliferous basins and sections in India.
3. Isopach and isolith maps.
4. Development of Stratigraphic panel diagram.
5. Intertonguing deposits.
6. Correlation of Intertonguing Deposits within a Time-Rock Unit.
7. Study of Worlds important Petroliferous basins and producing oil fields - using internet.
8. Calculation of oil reserves.

**MODEL QUESTION PAPER**  
(Effective from academic year 2017-19)  
M.Sc. DEGREE EXAMINATION (Mar/ Apr. 2020) (G 402)  
**ACHARYA NAGARJUNA UNIVERSITY:**  
**IV- SEMESTER**

**PARER – 2**

**PETROLEUM EXPLORATION**

**Time : 3 hours**

**Answer ALL questions**

**Max Marks: 70**

**SECTION –A**

Max. Marks: 6 X 3 = 18

1. Answer the all questions and each question carries equal marks.
- a) Porosity and permeability
  - b) Krishna – Godavari basin
  - c) Gas hydrates
  - d) Sub-surface maps
  - e) Drilling units
  - f) Types of remote sensing techniques.

**SECTION –B**

Answer any FOUR questions choosing ONE question from each Unit.

All questions carry equal marks.

Max. Marks: 4 X 13 = 52

UNIT - I

2. Discuss about the factors causing for movement of oil and gas in a pool

OR

3. Write notes on any TWO of the following

(a) Capillary pressure    (b) Interface phenomenon    (c) Reservoir conditions

UNIT – II

4. Give an account on identification and characterization of source rocks

OR

5. Write notes on any TWO of the following

(a) Maturation of organic matter    (b) Cauvery basin  
(c) Briefly mention about oil and source rock correlation

UNIT – III

6. Explain the seismic reflection and refraction method for petroleum exploration

OR

7. Write notes on any TWO of the following

(a) Gravity method  
(b) Application of remote sensing techniques in petroleum exploration  
(c) Magnetic method

UNIT – IV

8. Write an essay on different methods of well logging

OR

9. Write notes on any TWO of the following

(a) Rotary drilling    (b) Cable tool drilling    (c) Petrophysical analysis



**M.Sc. GEOLOGY**  
**ACHARYA NAGARJUNA UNIVERSITY:**

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IV-SEMESTER , THEORY SYLLABUS, PAPER – G403

**HYDROGEOLOGY**

(Effective from the admitted batch of 2018-2019)

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**UNIT- I**

1. Hydrological cycle and its Components– Precipitation, Runoff, Infiltration and Evapotranspiration.
2. Hydrological properties of sediments and rocks – Porosity, Permeability, Transmissivity, Storage coefficient, Specific yield, Specific Retention, Barometric and Tidal efficiencies.
3. Origin and Occurrence of groundwater, Vertical Distribution of Ground water-Zone of Aeration:Soil moisture zone, Vadose zone, Capillary rise zone. Zone of Saturation, Water Table.

**UNIT – II**

4. Types of aquifers-Unconfined, Perched, Confined and Leaky Aquifers.
5. Movement of groundwater – Darcy’s Law and limitations, Reynold’s number, Hydraulic conductivity.
6. Groundwater Exploration – Geological methods, Remote Sensing methods, Surface Geophysical Methods.

**UNIT – III**

7. Occurrence of groundwater in Extreme Climatic Conditions-Permafrost, Highly Precipitated and Desert areas.
8. Quality of groundwater –Physical and Chemical Quality, for Drinking, Representation of chemical data.
9. Saline water intrusion in Coastal aquifers- Ghyben-Herzberg relation, Upconing, Control of saline water intrusion.

**UNIT – IV**

10. Groundwater Provinces of India- Precambrian Crystalline, Precambrian Sedimentary, Gondwana Sedimentary, Deccan trap, Cenozoic Sedimentary, Cenozoic fault basins, Ganges-Brahmaputra alluvial and Himalayan Highland Provinces.
11. Groundwater Development and Management- Concept of Basin Management, Equation of Hydrologic equilibrium, Basin Investigations, Data Collection, Different yields,Salt Balance.
12. Water Harvesting Structures- Contour Bunds, Gully Plugs, Rock Fill Dams, Check Dams, Recharge Pits.

**M.Sc. GEOLOGY**  
**ACHARYA NAGARJUNA UNIVERSITY:**  

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**IV- SEMESTER, PRACTICAL SYLLABUS, PAPER – G403**  
**HYDROGEOLOGY**  
(Effective from the admitted batch of 2018-2019)  

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1. Delineation of Drainage from the toposheets and basic aspects of
2. morphometric analysis.
3. Problems related to Hydrological Parameters.
4. Problems related to Water Quality.
5. Representation of Chemical Data.
6. Problems related to Pumping Tests.
7. Water Wells.
8. Water harvesting Structures

**BOOKS**

1. Groundwater Hydrology (1980) – D. K. Todd – John Wiley & Sons.
2. Groundwater (1987) – H. M. Raghunath – Wiley Eastern Limited.
3. Groundwater Assessment, Development and Management (1987) – K. R. Karanth-Tata-Mc Graw Hill Company.
4. Applied Hydrogeology (1988) – C. W. Fetter – Morrill Publishing Company.
5. Groundwater (1995) – Ed. P. Sankara Pitchaiah – Scientific Publishers.

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**MODEL QUESTION PAPER**

(Effective from academic year 2018-19)

M.Sc. DEGREE EXAMINATION (Mar/ Apr. 2020) (G 403)

**ACHARYA NAGARJUNA UNIVERSITY:**

**IV- SEMESTER**

**PARER - 3**

**HYDROGEOLOGY**

**Time : 3 hours**

**Answer ALL questions**

**Max Marks: 70**

**Section – A**

**3 x 6 = 18**

1. Answer the all questions and each question carries equal marks.

- a) Transmissivity
- b) Zone of Aeration
- c) Upconing
- d) Deccan trap province
- e) Maximum perennial yield
- f) Water table

**Section – B**

**13 x 4 = 52**

**UNIT – I**

2. What is Hydrological cycle? Discuss its role in the Management of water resources.

OR

3. Write short notes on any TWO of the following

- a) Prosily.
- b) Measurement of precipitation.
- c) Infiltration.

**UNIT – II**

4. Explain the different types of Aquifers.

OR

5. Write short notes on any TWO of the following

- a) Darcys law
- b) Storage Coefficient.
- c) Vertical distribution of groundwater

**UNIT – III**

6. What is a 'Saline water intrusion', Explain the Methods to control saline water intrusion.

OR

7. Write short notes on any TWO of the following

- a) Permafrost
- b) Drinking water quality Criteria
- c) Representation of hydrochemical data

**UNIT – IV**

8. Explain the different types of yields and their use in groundwater management.

OR

9. Write short notes on any TWO of the following

- a) Groundwater provinces
- b) Recharge Pits
- c) Salt balance

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**M.SC. GEOLOGY: IV SEMESTER**  
Acharya Nagarjuna University  
( Effective from academic year 2018-2019)

**THEORY PAPER- 404:**

100marks and 4 credits

**REMOTE SENSING AND GEOGRAPIC INFORMATION SYSTEMS  
(GIS)**

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**REMOTE SENSING**

UNIT – I

1. Physics of Remote Sensing:
  - (a) Introduction and definition
  - (b) Energy sources and Electromagnetic spectrum properties
  - (c) Wave theory (Maxwell) and Quantum theory (Plank)
  - (d) Interaction effects with atmosphere and earth materials
  - (e) Blackbody radiation and atmospheric windows
  - (f) Remote sensing spectral regions and properties
2. Remote Sensing platforms and sensors:
  - (a) Platform system parameters;
    - (i) Terrestrial, Airborne and Satellite platforms
    - (ii) Sun synchronous Geostationary and Multi orbital platforms
  - (b) Sensor system parameters:
    - (i) Photo, digital and scanner image sensors
    - (ii) Multi spectral photo and image systems
    - (iii) Microwave and Radar sensor system
  - (c) Satellite nature and mission details:
    - (i) Remote sensing (natural resources) satellites
    - (ii) Meteorological (atmosphere and communication) satellites
    - (iii) Microwave Satellites
    - (iv) Global Positioning System (GPS), principles and satellites

UNIT – II

1. Aerial photo:
  - (a) Introduction and objectives
    - (i) Cameras, lenses, films and filters,
  - (b) Flight mission for planning, flying height and scale.
  - (c) Types of photographs
    - (i) Vertical, Oblique (low and high) and Terrestrial.
  - (d) Stereoscope
    - (i) Stereogram and Stereo pair
  - (e) Photo elements for interpretation.
2. Applications and interpretation criteria of remote sensing data:
  - (a) Lithology and rock types
  - (b) Geological structures
  - (c) Geomorphology and hydrology
  - (d) Engineering projects

## **GEOGRAPIC INFORMATION SYSTEMS**

### UNIT--III

1. Introduction, definition and terminology of GIS
2. Computer environment of hardware and software
3. GIS architecture and contributing disciplines,
4. Functions and products
5. Spatial data and nature
5. Theoretical models and framework in GIS
6. Model categories and measurement scales

### UNIT – IV

1. Spatial Data Modeling:
    - (a) Stages in data Modeling
    - (b) Graphic representation
      - (i) Vector data (ii) Raster data (iii) Spectral data
    - (c) Vector models:
      - (i) Spagetti model (ii) Topological model (iii) Shape file (iv) Compact models.
    - (d) Raster model:
      - (i) Simple Raster arrays (ii) Compact structures (iii) Hierarchical structure
  2. Application and data analysis for urban and municipal aspects:
    - (a) Rapid land use assessment (b) Rapid land information system development
      - (i) Dynamic urban land use (ii) Semi-dynamic land use (iii) Passive land use
  3. Land use and land cover systems in India.
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**M.SC. GEOLOGY: IV SEMESTER**  
Acharya Nagarjuna University  
( Effective from academic year 2018-2019)

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**PRACTICAL PAPER- 404:**

50 marks and 2 credits

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**REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS (GIS)**

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- 1 .Stereo test and study of different types of aerial photos
2. Study of properties of instruments and photo/ image products
3. Stereoscopic photo interpretation from stereograms for topography, drainage, geomorphic and geological details
- 4.Stereoscopic photo interpretation from stereopairs for topography, drainage, geomorphic and geological details
5. Photogrammetry and measurements
6. Map reading

**TEXT BOOKS**

2. Remote sensing and Image Interpretation-T.M. Lillesand, and R.W.Keifer ( John wiley and sons), 2000
3. Image Interpretation in Geology – S.A.Drury (Allen and Unwin, London), 1987
4. Aerial-photographic interpretation – Principles and applications – D. R. Leuder.
5. Remote sensing – Principle and Interpretation- F.F.Sabins (Freeman and Co) 1987
6. Principles and Applications of Photogeology – Shiv. N. Pandey.
7. Elements of Photogrammetry – P. Wolf. (McGraw Hill) 1983
8. Remote sensing in Geomorphology –H.Th. Verstappen
9. Remote Sensing and Photogrammetry – Principles and Applications – M. L. Jhanwar and J. S. Chowhan.
10. Remote Sensing and Geographic Information Systems – M. Anji Reddy.
11. Fundamentals of Geographic Information Systems – M.N. Demers (john Wiley and Sons), 1999
12. Principles of Geographic Information Systems – P. A. Burrough and R. A. Mc Dowells
13. An Introduction to Geographic Information Technology – Sujit Choudhury, Deepankar Chakrabarti and Suchandra Choudhury (I.K.International Pub.House) 2010

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**MODEL QUESTION PAPER**  
(Effective from academic year 2018-19)

M.Sc. DEGREE EXAMINATION (Mar/ Apr. 2020) (G 404)  
**ACHARYA NAGARJUNA UNIVERSITY:**  
**III- SEMESTER**

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**PARER – 4                      REMOTE SENSING AND**  
**GEOGRAPIC INFORMATION SYSTEMS (GIS)**

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**Time : 3 hours                      Answer ALL questions                      Max Marks: 70**

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**Section –A**

6 x 3 = 18 Marks

1. a) What is sensor and scanner data?
- b) Write about the properties of oblique photo
- c) What is atmospheric window?
- d) What is spaghetti model?
- e) Write about GPS
- f) What are basic difference between vector and raster data structure?

**Section –B**

13 x 4 = 52

UNIT – I

2. Give a detailed account energy source and its interaction with atmosphere and earth surface materials.

Or

3. Write short notes on any TWO
  - (i) Blackbody radiation and atmospheric windows
  - (ii) Sun synchronous and geostationary satellite system
  - (iii) IRS remote sensing series and resolution details

UNIT – II

4. Write in detail about the properties of stereoscopic vertical photographs in comparison with oblique aerial photographs.

Or

5. Explain about any TWO
  - (i) Photo mosaic and properties of different mosaic types
  - (ii) Stereoscopic parallax and relief displacement
  - (iii) Photo basic elements and geological elements

UNIT – III

6. What is GIS and discuss about the architecture of GIS and functions.

Or

7. Write short notes on TWO
  - (i) Spatial data and their nature
  - (ii) Characteristic in vector and raster representation
  - (iii) Map projections

UNIT – IV

8. Explain about the different raster data structure models and advantages of each one.

Or

9. Give account on TWO
  - (i) Difference between Spaghetti and Topological models
  - (ii) Net-work graphical structure
  - (iii) Land use land cover system in India

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