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JAI NARAIN VYAS UNIVERSITY, JODHPUR
FACULTY OF SCIENCE
NEW CAMPUS

B. Sc. I Year Geology 2020-2021

Theory		
Paper I	Physical Geology	50 Marks
Paper II	Mineralogy	50 Marks
Paper III	Palaeobiology	50 Marks
Practicals	: Practical Examination	75 Marks
		Total 225 Marks

Duration of each theory paper Examination 3 Hrs.

Duration of Practical Examination 3 Hrs.

PAPER I: PHYSICAL GEOLOGY

Unit I

Geology and its perspectives. Introduction to basic tenets of origin of the Universe, the solar system. Earth in the Solar System: origin, size, shape, mass, density, rotational and revolution parameters. Age of the Earth. Chemical composition of the Earth. Internal structure of the Earth. Formation of hydrosphere, atmosphere and biosphere. Internal heat and Radioactivity of the Earth; Convection in the earth's core and its magnetic field.

Unit II

Elementary ideas of continental drift, Sea floor spreading and the theory of plate tectonics. Types of plates. Causes and rate of plate movement. Application of theory of plate tectonics in Geology to explain origin of mineral deposits Mountains, Earthquake belts, Island arcs and various Petrogenesis.

Unit III

Rock Weathering. Difference between Weathering and Erosion. Types of weathering, Soil formation, soil profile and soil types.

Geological work of rivers, glaciers, wind and groundwater.

Unit IV

Earthquakes: Their causes, effects and distribution. Earthquake waves. Measurement of Earthquakes.

Volcanoes: Types, Products and distribution.

Unit V

Oceanography : Geological work of Ocean; Physical features of Oceans, Coasts, Deep Sea trench, Midoceanic Ridges and Abyssal plain. Generation of oceanic currents, surface currents and global ocean Conveyor system; waveerosion and beach processes; ocean as a thermostat for the earth's surface heat balance.

Climatology : Atmospheric circulation, weather and climate changes. Land-air-sea interaction, Earth's heat budget and global climatic changes. Glacial, interglacial periods and ice ages.

PAPER II: MINERALOGY

Unit I

Fundamental laws of crystallography, elements of crystal symmetry, Millers, Weiss and Millarian system of notation and parameters. Crystal forms and their classification into crystal system, Introduction to space lattice.

Study of the normal classes of following crystal systems – Cubic system, Tetragonal system, Hexagonal system, Trigonal system, Orthorhombic system, monoclinic system and Triclinic system.

Unit II

Physical properties of minerals. Physical properties of Important Silicate and economic minerals. Concept of Isomorphism, Polymorphism, Solid solution, Exsolution. Elementary idea

about structure and classification of silicate minerals. Physical properties of the following minerals.

Quartz, Jasper, Orthoclase, Plagioclase, Microcline, Muscovite, Biotite, Garnet, Olivine, Augite, Hornblende, Tourmaline, Talc, Gypsum, Fluorite, Calcite, Apatite, Barite, Asbestos, Corundum, Phosphorite, Beryl, Kyanite, Galena, Sphalerite, Chalcopyrite, Pyrite, Magnetite, Hematite, Chromite, Pyrolusite and Psilomelane, Bauxite and Coal.

Unit III

Petrological microscope and its construction; principles of optics as applied to orthoscopic and conoscopic study of minerals: color, form, Relief, pleochroism, Interference colour, Extinction. Uniaxial and biaxial characters of minerals. Study of optical properties of Muscovite, Biotite, Quartz, Orthoclase, Microcline, Plagioclase, Olivine, Augite and Hornblende.

Unit IV

Mineralogical study of the following families.

- (i) Olivine (ii) Pyroxene (iii) Amphiboles

Unit V

Mineralogical study of the following families.

- (i) Quartz (ii) Feldspar (iii) Mica (iv) Garnet

PAPER III: PALAEOBIOLOGY

Unit I

Fossils, their preservation and uses. Elementary idea of organic evolution. Morphology of hard parts and geological distribution of Foraminifera. Introduction to *Nummulites*.

Unit II

Study of morphology and geological distribution of Graptoloidea, Echinoidea and Corals. Introduction to *Monograptus*, *Diplograptus*, *Cidaris*, *Hemiaster*, *Micraster*, *Calceola* and *Zaphrentis*.

Unit III

Study of morphology of hard parts and geological distribution of Gastropoda, Lamellibranchia and Trilobita. Introduction to *Trochus*, *Murex*, *Physa*, *Turritella*, *Natica*, *Conus* and *Cyprea*, *Lima*, *Pecten*, *Ostrea*, *Graphea*, *Exogyra*, *Mytilus*, *Trigonia* and *Hippurites*. *Calymene*, *Paradoxides*, *Trinucleus* and *Phacops*,

Unit IV

Study of morphology and geological distribution of Brachiopoda and Cephalopoda. Introduction to *Productus*, *Spirifer*, *Terebratulina*, *Rhynchonella*, *Nautilus*, *Belemnites*, *Phylloceras*, *Orthoceras*, *Goniatites*, *Ceratites* and *Perisphinctes*.

Unit V

Elementary knowledge of Gondwana flora and vertebrates of Siwaliks. Evolutionary history of Man, Horse and elephant. Introduction to *Glosopteris*, *Gangmopteris*, *Vertibraria* and *Ptilophyllum*.

PRACTICALS

- (1) Identification and Description of fossils in hand specimens.
- (2) Identification and Physical Properties of Minerals in hand specimens.
- (3) Identification and Description of Minerals under Petrological microscope
- (4) Study of Geomorphic features and forms. Physical Geology Models.
- (5) Sessional Marks.

SUGGESTED READING

1. Dutta A. K. 'Physical Geology.'
2. Gosh Mukul 'Bhautic BhuVigyan.' Madhya Pradesh Hindi Granth Academy., Bhopal.
3. Arthur Holmes. 'Principles of Physical Geology'
4. Savinder Singh 'BhuAkratiVigyan'
5. Read H.H. 'Rutley's Elements of Mineralogy. 26th Ed CBS Pub. New Delhi
6. Jain B.C 'Khaniztatha Crystal Vigyan., Madhya Pradesh Hindi Granth Academy., Bhopal.

7. Tiwari D. R. 'KhanizVigyan'. Madhya Pradesh Hindi Granth Academy., Bhopal.
8. Deer WA, Howie RA and Zussman J. 1996: 'The Rock forming minerals' Longman publishers.
9. Woods, H., 1985: 'Invertebrate Palaeontology' CBS Publishers and Distributions.
10. Mishra R P 'JeevashmVigyan'. Madhya Pradesh Hindi Granth Academy., Bhopal.
11. P. C. Jain and M.S. Anantharaman: Palaeontology Evolution and AnimalDistribution. Vishal Publications.
12. Moore R. C., Lalicher CG and Fisher AC: 'Invertebrate fossils'. McGraw Hill.

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B. Sc. II year Geology 2020-21

Theory

Paper I	Igneous and Metamorphic Petrology	50 Marks
Paper II	Sedimentary Petrology	50 Marks
Paper III	Stratigraphy	50 Marks
Practicals	: Practical Examination	75 Marks

Total 225 Marks

Duration of each theory paper Examination 3 Hrs.

Duration of Practical Examination 3 Hrs.

PAPER I : IGNEOUS AND METAMORPHIC PETROLOGY

Unit I:

Composition of magma. Crystallization of Unicomponent(Silica), Bicomponent(Ab-An) and Tricomponentmagma(Ab-An-Di). Bowen's Reaction Series. Forms and Structures of Igneous rocks

Unit II:

Textures and their genetic implications for Igneous rocks. Elementary idea of classification of Igneous rocks based on Mineralogical, Mode of occurrence and Geochemical factors. Tabular classification of Igneous rocks.

Unit III:

Metamorphism and its kinds and agents. Concept of depth zones, facies and grades of metamorphism. Texture and structures of metamorphic rocks.

Unit VI:

Regional metamorphism of argillaceous, arenaceous and mafic rocks. Thermal metamorphism of carbonate rocks. Cataclastic metamorphism.

Unit V:

Megascopic and microscopic characteristics and petrogenesis of following rocks. (A) Granite, Syenite, Gabbro, Anorthosite, Peridotite, Pegmatite, Lamprophyre, Rhyolite, Basalt. (B) Quartzite, Marble, Phyllite, Schist, Slate, Gneiss, Migmatite, Granulite and Charnokite.

PAPER II:SEDIMENTARY PETROLOGY**Unit I:**

Sediments and Sedimentary rocks, the process of their formation;

Sedimentary structure: Surface structure- ripple marks, sole marks, rill marks, rain prints.

Internal structure: bedding, graded bedding, cross bedding and penecontemporaneous deformation. Biogenic structures:stromatolites and ichnofossils.

Unit II:

Texture of sedimentary rocks; grain size their distribution and geological significance, shape sphericity and roundness, packing orientation and internal fabric of sedimentary rock.

Heavy minerals: The process of separation and study for provenance determination.

Unit III:

Types of sediments and sedimentary rocks- clastic rocks, their classification and characteristics,Petrogenesis of common clastic rocks.Characteristics of Sandstone, Siltstone, Shale, Conglomerate and Breccia.

Unit IV:

Chemical and Biogenic Rocks : Characteristics, classification and origin. Characteristics of Limestone, Dolomite, Phosphorite, Lignite and Coal.

Unit V:

Elementary knowledge of sedimentary environments. Characteristics of their products: Glacial, Lacustrine, Fluvial, Deltaic Shore line, Shelf and deep marine environments.

PAPER III: STRATIGRAPHY

Unit I:

Geological Time Scale: various boundaries and characteristics of each division and Indian equivalents. Time -unit, Rock -unit and Time -Rock -unit, Principles of Stratigraphy Stratigraphic correlation and various methods of its determination.

Unit II:

Archean Geology of Dharwar Craton, Singhbhum Craton, Baster Craton and Eastern Ghat Craton and Rajasthan Craton (Bhilwara Supergroup to include BGC and Pre-Aravalli-metasediments).

Unit III:

Proterozoic: Aravalli Supergroup, Cuddapah Supergroup, Delhi Supergroup, Vindhyan Supergroup and Malani Igneous Suite. Permian -Triassic boundary.

Unit IV:

Palaeozoics and Mesozoics of Salt Range, Spiti, Kashmir and Kumaun Himalaya. Marwar Supergroup and Mesozoics of Rajasthan. Jurassic of Kutch, Cretaceous of Trichinopoly. Gondwana Supergroup and Deccan Traps. Cretaceous -Tertiary boundary.

Unit V

Tertiary Rocks of North-eastern India, Western Rajasthan and Kachchh. Siwalik Supergroup. Quaternary Geology: Indogangetic plains, Thar Desert. Unheavels and lost of river Saraswati.

PRACTICALS

1. Petrological characteristics (Mineralogy, texture and structural and Petrogenesis) of important Igneous, Metamorphic and Sedimentary rocks in hand specimens.
2. Petrological characteristics (Mineralogy, texture and structural and Petrogenesis) of important Igneous, Metamorphic and Sedimentary rocks under Petrological Microscope.
3. Identification and Stratigraphic Ordering of rock samples.
4. Demarcation of important Supergroups of Indian Stratigraphy in outline map of India.
5. Preparation of Geological map of western Rajasthan in Lab.

6. Sessional Marks.

SUGGESTED READING

1. Tyrrell GW: Principles of Petrology
2. Tyrell GW: Shailikike Sidhant, Madhya Pradesh Hindi Granth Academy, Bhopal.
3. Pettijohn: Sedimentary Rocks, C. B. S. Publication, New Delhi
4. Best, M. G.: Igneous and Metamorphic Petrology C. B. S. Publication, New Delhi.
5. Krishnan M S : Geology of India and Burma, C. B. S. Publication, New Delhi.
6. Ravindra Kumar: Fundamentals of Historical Geology and Stratigraphy of India. Willey Eastern New Delhi
7. Wadia D. N.: Geology of India
8. Bharatvarshka Bhuvigyan : Madhya Pradesh Hindi Granth Academy, Bhopal.
9. Roy A. B. and Jakhar S.R. : Geology of Rajasthan (Northwest India) Precambrian to Recent. Scientific Publishers (India), Jodhpur.

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B. Sc. III year Geology 2020-21

Theory

Paper I	Economic Geology	50 Marks
Paper II	Structural Geology	50 Marks
Paper III	Applied Geology	50 Marks
Practicals	: Practical Examination	75 Marks

Total 225 Marks

Duration of each theory paper Examination 3 Hrs.

Duration of Practical Examination 3 Hrs.

PAPER I : ECONOMIC GEOLOGY

UnitI:

Ore forming process and deposits: Magmatic Concentration, Pegmatite, Contact metasomatism (including Skarns), Hydrothermal process and deposits.

UnitII:

Ore forming process and deposits: Sedimentation (Chemical Precipitation and Evaporation), Weathering (Residual and Mechanical Concentration), Oxidation and Supergene sulphide enrichment. Volcanogenic, Metamorphic and Biogenic Process and deposits.

UnitIII:

Geological setup and economic aspects of (a) Gold deposits of India (including Kolar Gold Field), (b) Lead Zinc and Copper deposits of India (including Zawar, Rajpura-Dariba, Malanjkhand, Khetri and Singhbhum deposits) (c) Iron and manganese deposits of India (d) Aluminium, Chromium, Tin and Tungsten deposits of India.

Physical properties, mode of occurrence and genesis, Indian location and economic use of following Ore minerals: Native Gold, Galena, Sphalerite, Chalcopyrite, Limonite (Gossan), Magnetite, Hematite, Pyrolusite, Psilomelane, Wed Ore, Bauxite, Chromite, Wolframite and Cassiterite.

Unit VI:

Description of minerals used and the industries including, Cement, Fertilizer, Refractory, Abrasive, and Gem Stones.

Introduction of mineral used and industries including, Glass and Ceramics, Paint and Pigments, Insulator, Electronic and Building Stones.

Physical properties, mode of occurrence and genesis, economic use and Indian location of following industrial minerals and rocks: Apatite, Phosphorite, Pyrite, Gypsum, Diamond, Zircon, Kyanite, Magnesite, Garnet, Corundum, Quartz, Feldspar, Asbestos, Wollastonite, Talc, Fluorite, Barite, Muscovite, Ochur, Malachite, Azurite, Graphite. Limestone, Marble and Granite.

Unit V:

Energy Minerals: (A) Coal: Proximate and ultimate analysis of coal, classification of coals, ranks of coal, Origin of coal. Indian coal fields (B) Petroleum: Origin of Petroleum. Petroleum Geology of Bombay High, Cambay basin, Northeastern India and Barmer-Sanchor basin, (C) Nuclear Minerals: Types and Origin of various Uranium and Thorium deposits. Geology of Jaduguda Uranium deposit. Coastal Thorium Sand deposits.

PAPER II: STRUCTURAL GEOLOGY**Unit I:**

Concept of Bed, Dip and Strike, True and Apparent dips. Toposheet, Clinometer, Brunton Compass. Geological Map: Definition and its Components. Methods of geological mapping in the field. Determination of thickness of bed, dip and strike in the Geological map. Preparation of cross section of Geological maps.

Unit II:

Determination of top and bottom of Sedimentary beds. Outlier, Inlier, Overlap and Offlap structures. Stereographic projection and its use in Structural analysis.

Unit III:

Fold: Definition and morphology. Geometric and genetic classifications. Elementary idea about mechanism of folding. Recognition of folds in map and field.

Unit IV:

Faults: Definition and Terminology of its parts. Classifications. Effect of Faulting on outcrops. Recognition of faults in map and field.

Unit V:

Unconformities: types and recognition. Joints: Characteristics and Types. Cleavage, Schistosity and Lineation: types and their significance to recognize the major structures.

PAPER III: APPLIED GEOLOGY**Unit I:**

Environmental Geology: Concept of natural ecosystem, Interaction and interrelation of Atmosphere, Hydrosphere, Lithosphere and Biosphere. Soils. Hydrological cycle.

Remote Sensing: Fundamentals of Remote Sensing. Preparation and study of areal photographs for Geomorphology, Structural Geology and Lithology. Preparation of Geological map using Remote Sensing. Applications of Remote sensing.

Unit II:

Groundwater hydrology: Groundwater and Surface water reservoirs. Aquifer, Aquiclude and Aquifuge. Darcy's law and its validity. Groundwater provinces of Rajasthan and India. Watershed management and linking of rivers. Quality of groundwater.

Unit III:

Engineering Geology: Types and terminology of Dams and Tunnels. Geological considerations to locate dams and tunnels including (a) Structural Geology (b) Lithology and (c) Groundwater.

Geological disasters : Earthquakes and Tsunami, Volcano, Flood and Landslide.

Unit VI:

Mineral exploration: Surface and subsurface exploration methods. Remote sensing and exploratory mapping. Geophysical exploration: Gravity, Electrical, Magnetic, and Seismic methods of exploration. Geobotanical and geochemical methods of exploration.

Drilling: Types, logging and problems.

Unit V:

Principles of mineral economics: National policy. Strategic, critical and essential minerals. Mineral production in India. Changing pattern of mineral consumption. Mineral concession rules. Marine mineral resources and Law of sea.

PRACTICALS

1. Physical properties, mode of occurrence and genesis, Indian location and economic use of Metallic minerals (ores).
2. Physical properties, mode of occurrence and genesis, Indian location and economic use of Non Metallic (industrial Minerals) and Coals.
3. Preparation of map showing distribution of important economic deposits.
4. Preparation of Cross section of Geological maps and/or completion of outcrop maps.
5. Use of Stereographic projections for Structural Geology.
6. Sessional Marks.

SUGGESTED READING

1. Jenson M and Bateman A M.: 'Economic Mineral Deposits'. John Wiley and Sons Newyork.
2. GokhleKV and GK Rao: 'Ore Deposits of India,. Thomson Press
3. Vyas GK: 'ArthikBhuVigyan'. Madhya Pradesh Hindi Granth Academy
4. Manjrekar RP: 'ArthikevamVyavharikBhuVigyan'. Madhya Pradesh Hindi Granth Academy
5. Rakshpal R. 'Bharat kiKhanizSampdaevamUdyog'. Rajasthan Hindi GranthAcademy.
6. Billings M. P.: 'Structural Geology'

7. Shrivastava D.K. SanrachnatmakBhuVigyan Madhya Pradesh Hindi Granth Academy
8. Arogyaswami RNP 'Mining Geology' CBS publishers
9. Todd 'Groundwater Hydrology'
10. Todd D. K. 'BhaumJalVigyan' Madhya Pradesh Hindi Granth Academy
11. Satyanarayan Swami B. S. 2000 : 'Engineering Geology' DhanpatRai and Cop Delhi
12. Pandey SN 1987 'Principles and Applications of Photogeology' Wiley Eastern New Delhi
13. Guha P.K., 2013. Remote Sensing for Beginners. East-west Press Pvt. Ltd. ISBN 9788176710961

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