

Deccan Education Society's
FERGUSSON COLLEGE, PUNE
(AUTONOMOUS)

PROPOSED SYLLABUS UNDER AUTONOMY

FIRST YEAR B.Sc.
SEMESTER –I

SYLLABUS FOR F.Y. B.Sc. GEOLOGY

Academic Year 2016-2017

Deccan Education Society's
FERGUSSON COLLEGE, PUNE
Scheme of Course Structure (Faculty of Science)

| Particulars | Name of Paper | Code | Title of Paper | No. of Credits |
|---------------------|------------------------|-------------|--|-----------------------|
| F.Y. Semester I | Theory Paper - 1 | GLY1101 | Earth System Science | 2 |
| | Theory Paper - 2 | GLY1102 | Mineral Science | 2 |
| | Practical Paper - 1 | GLY1103 | Practicals related to GLY1101 and GLY1102 | 2 |
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| F.Y. Semester II | Theory Paper - 3 | GLY1201 | Palaeontology | 2 |
| | Theory Paper - 4 | GLY1202 | Petrology | 2 |
| | Practical Paper - 2 | GLY1203 | Practicals related to GLY1201 and GLY1202 + 2-3 Days Field Component | 2 |

PAPER - I: GLY1101 Earth System Science
[Credit -2: No. of Lectures 36]

| | Title and Contents | No. of Lectures |
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| Unit - I | <p align="center">EARTH: ITS ORIGIN, AGE, INTERIOR AND PROCESSES (1 Credit)</p> <p>A)</p> <p>1) Introduction: Definition of geology, its divisions, sub-divisions and scope</p> <p>2) Planet Earth Origin of the Universe (Big Bang Theory), Origin of the Solar System (Nebular, Encounter and Tidal theory)</p> <p>a) Earth: Its size, shape and density. Temperature, pressure and magnetism within the earth, Present day hypsographic curve</p> <p>b) Age of the Earth: A brief account of the historical methods.</p> <p>c) Determination of age by the K/Ar, U/Th and Carbon dating methods</p> <p>d) Geological Time Scale: Concept and Criteria.</p> <p>B)</p> <p>a) The Earth's Atmosphere (Introduction to Atmospheric circulation, weather and climate changes, land-air-sea interactions, global climatic changes), Hydrosphere (Introduction to ocean currents, types and causes, significance), Lithosphere (Structure and composition) and Biosphere (Ecology and food chain)</p> <p>b) Earth's crust, mantle and core</p> <p>c) Continental Drift: Concept and evidences- continental fit, geological and palaeontological evidences</p> <p>d) Plate Tectonics: A brief introduction.</p> <p>e) Concept of Isostasy: Pratt's and Airy's model.</p> | <p>1</p> <p>8</p> <p>2</p> <p>2</p> <p>2</p> <p>1</p> |
| Unit - II | <p align="center">DYNAMICS OF THE EARTH (1 Credit)</p> <p>A) Geomorphic processes and landforms</p> <p>❖ Weathering, erosion and denudation Types of weathering:</p> <ul style="list-style-type: none"> • Mechanical – frost wedging, frost action, insolation, activities of organic life and exfoliation • Chemical-hydrolysis, hydration, solution, carbonation and oxidation | <p>2</p> |

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| | <p>❖ The dynamics of erosional and depositional landforms resulting from the action of:</p> <p>a) River</p> <ul style="list-style-type: none"> • Erosional landforms – waterfall, potholes, mesa and butte, meandering and ox-bow lake. • Depositional landforms- delta and types, alluvial fans, flood plains and river terraces. <p>b) Wind</p> <ul style="list-style-type: none"> • Erosional landforms - deflation and deflation armour, yardangs, mushroom rock. • Depositional landforms - sand dunes and its types, loess. <p>c) Sea</p> <ul style="list-style-type: none"> • Erosional landforms - sea cliff, sea cave, natural arch, sea stack • Depositional landforms- Beach and long shore drift deposits <p>d) Glaciers</p> <ul style="list-style-type: none"> • Erosional landforms - Valleys (U shaped and hanging valleys), crevasse, cirque, crag and tail • Depositional landforms - moraines and its types, drumlins, eskers. <p>B)</p> <p>a) Types of Mountains: Fold, fault block, volcanic and residual.</p> <p>b) Volcanoes: Genesis of volcanoes, Central and fissure type of eruptions. Products of volcanoes, effects of volcanoes, earth’s volcanic belts.</p> <p>c) Earthquakes: Definition, terminology, causes, intensity and magnitude. Recording of earthquakes (Modern recording method). Use of seismic waves and their importance in interpreting the earth’s internal structure. Seismic zones. History and susceptibility of the Indian subcontinent to earthquakes.</p> <p>d) Disasters and Disaster Management: Disaster: Definition, types, effects, phases, prevention, mitigation and preparedness. A case study of any one Indian disaster. Disaster Management: Definition, types, warning, precautions, mitigation and management.</p> | <p style="text-align: right;">7</p> <p style="text-align: right;">1</p> <p style="text-align: right;">3</p> <p style="text-align: right;">3</p> <p style="text-align: right;">2</p> |
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References:

1. V. Radhakrishnan, 1987, General Geology, V.V.P. Publishers, Tuticorin
2. P. McL. D. Duff, 1993, Holmes’ Principles of Physical Geology, Chapman & Hall, London.
3. Summerfield M. A., 2000, Geomorphology and Global Tectonics, Wiley, UK
4. Kale, V.S. and Gupta, A., 2001. Introduction to Geomorphology, Orient Longman, Calcutta.

PAPER - II: GLY1102 Mineral Science
[Credit -2: No. of Lectures 36]

| | Title and Contents | No. of Lectures |
|-----------------|--|------------------------|
| Unit - I | FORMATION AND PROPERTIES OF MINERALS (1 credit) | |
| | <p>A)</p> <p>1) Introduction: Definition, branches and scope of mineralogy and uses of minerals.</p> <p style="text-align: right;">1</p> <p>2) Formation of minerals: Introduction and description of geological processes of mineral formation;</p> <p>a) Crystallization from melt.</p> <p>b) Crystallization from Solution. (evaporation and precipitation)</p> <p>c) Crystallization from Vapour (sublimation)</p> <p>d) Metamorphic processes</p> <p>e) Alteration and related weathering (oxidation and supergene sulphide enrichment)</p> <p>3) Physical properties of minerals</p> <p>a) Colour, streak, lustre, cleavage, fracture, hardness, form and specific gravity</p> <p>b) Methods of determining specific gravity</p> <p>c) Properties based on magnetism, electrical properties, and radioactivity</p> <p>d) Luminescence (Phosphorescence and Fluorescence)</p> <p style="text-align: right;">5</p> | |
| | <p>B)</p> <p>1) Optical mineralogy</p> <p>a. Nature of light – ordinary and plane polarized light.</p> <p>b. Double refraction of light (with the help of calcite crystal)</p> <p>c. Nicol’s prism and polaroids.</p> <p>d. Petrological microscope.</p> <p>e. Introduction to optical properties:– In plane polarized light: Colour, form, cleavage, cracks, relief, twinkling, pleochroism.</p> <p style="text-align: right;">6</p> | |

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| | <p>In between Crossed Nicols: Isotropism, anisotropism, extinction positions (straight, oblique, symmetrical and determination of extinction angle), interference colours, twinning (simple, multiple and cross hatching).</p> <p>2) Crystal Chemistry</p> <p>a) Geochemical affinity & geochemical classification of elements. b) Isomorphism, polymorphism, pseudomorphism. c) Silicate structures</p> | 3 |
| Unit - II | <p style="text-align: center;">MINERAL GROUPS AND CRYSTALLOGRAPHY (1 credit)</p> <p>A) Mineral Groups- Study of following mineral groups with respect to their silicate structure, chemical composition, physical and optical properties</p> <p>a) Olivine b) Pyroxene c) Amphibole d) Mica e) Feldspar f) Silica</p> <p>B) Crystallography</p> <p>a) Definition and conditions conducive for the formation of crystals. b) Crystal morphology – faces, forms, edges, solid angles, interfacial angle and its measurement by contact goniometer, law of constancy of interfacial angle. c) Symmetry of crystals – Elements of Symmetry-Plane, axis and center of symmetry; crystallographic and geometrical symmetry. d) Crystallographic axes, lettering and order of crystallographic axes, parameters, axial ratio, indices, parameter system of Weiss, index system of Miller, Law of rational indices. e) Study of following crystallographic systems with respect to their elements of symmetry, crystallographic axes and their forms with indices.</p> | 9 |

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| | i. Orthorhombic | (Type: Barytes) | |
| | ii. Tetragonal | (Type: Zircon) | |
| | iii. Cubic | (Type: Galena) | |
| | iv. Hexagonal | (Type: Beryl) | |
| | v. Monoclinic | (Type: Gypsum) | |
| | vi. Triclinic | (Type: Axinite) | |

References:

1. Read, H. H., 1916, Rutley's Elements of Mineralogy, 26th Edition, Thomas Murby & Co., London.
2. Gribble, C. D., 1988, Rutley's Elements of Mineralogy, 27th Edition, Unwin Hyman, London.
3. Berry, L. G., Dietrich, R. V., and Mason, B., 1985, Mineralogy, CBS Publishers & Distributors, India, 561p.

| | PAPER - III: GLY1103 Practicals related to GLY1101 and GLY1102 [Credit -2: No. of Practicals 10] |
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| | Title of Experiment / Practical |
| 1 | Physical properties of minerals Colour, form, streak, luster, cleavage, fracture, hardness and Specific gravity. |
| 2 | Identification of following Megascopic minerals in hand specimens with the help of physical properties Silica Group: Quartz, Rock crystal, Rose Quartz, Milky Quartz, Smoky quartz, Amethyst, Chalcedony, Agate, Jasper, Flint, Opal Feldspar Group: Orthoclase, Plagioclase Mica Group: Biotite, Muscovite |
| 3 | Identification of following Megascopic minerals in hand specimens with the help of physical properties Ca-Ba bearing minerals: Calcite, Fluorite, Gypsum, Baryte. Ore minerals: Magnetite, Haematite, Chromite, Chalcopyrite, Galena, Pyrolusite, Bauxite and Graphite Other Group minerals: <ul style="list-style-type: none"> • Garnet • Olivine • Amphibole- Hornblende • Zeolite- Apophyllite, Stilbite • Alluminosilicate-Kyanite • Talc |
| 4 | <ul style="list-style-type: none"> • Study of elements of symmetry • Crystallographic axes and forms with indices of the Cubic System (Type- Galena) representing all the fundamental crystal forms. |
| 5 | Crystallographic axes and forms with indices of the Orthorhombic System (Type- Baryte), Monoclinic System (Type- Gypsum) and Triclinic System (Type- Axinite) representing all the fundamental crystal forms |
| 6 | <ul style="list-style-type: none"> • Crystallographic axes and forms with indices of the Tetragonal System (Type-Zircon) and Hexagonal System (Type- Beryl) representing all the fundamental crystal forms • Measurement of interfacial angle with Contact Goniometer |
| 7 | Study of topographic maps with section drawing |
| 8 | <ul style="list-style-type: none"> • Study of toposheets • Study of landforms |

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| 9 | <ul style="list-style-type: none">• Stream ordering in a drainage basin• To find the epicenter of an earthquake using seismic data |
| 10 | Revision Practical |

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Academic Year 2016-2017

PAPER - I: GLY1201 Palaeontology**[Credit -2: No. of Lectures 36]**

| | Title and Contents | No. of Lectures |
|-----------------|--|---|
| Unit - I | <p>Introduction to Palaeontology and Invertebrate Palaeontology</p> <p>A)</p> <p>a) Palaeontology: Definition, branches, Importance and scope.</p> <p>b) Fossils: Definition, conditions and modes of preservation of fossils.</p> <p>c) Techniques used in collection (Spot and channel), preservation and illustration of mega fossils.</p> <p>d) Uses and Importance of fossils.</p> <p>e) Mass extinction, causes and evidence</p> <p>Systematic position, morphology of hard parts, geological and geographical distribution of the following:</p> <p>Phylum Mollusca:</p> <p>I. Class Lamellibranchia or Bivalvia: Morphology of hard parts of the shell, ornamentation and types of hinge lines.</p> <p>II. Class Gastropoda: Morphology of hard parts of the shell and forms of the gastropod shell.</p> <p>III. Class Cephalopoda: Morphology of hard parts of Nautilus, Ammonoids, Belemnites and type of suture lines.</p> <p>Comparison between Nautilus and Ammonoids.</p> <p>Evolutionary trends in Ammonoids</p> | <p>3</p> <p>2</p> <p>2</p> <p>2</p> |
| | <p>B)</p> <p>Systematic position, morphology of hard parts, geological and geographical distribution of the following:</p> <p>A) Phylum Brachiopoda</p> <p>Morphology of hard parts of Class Articulata and Inarticulata. Types of brachial skeleton.</p> <p>Comparison between Lamellibranchs and Brachiopods.</p> <p>B) Phylum Echinodermata</p> <p>Class Echinoidea: Morphology of hard parts of Regularia. Variation in the apical disc in echinoids.</p> <p>A) Phylum Arthropoda</p> <p>Class Trilobita – Morphology of hard parts of</p> | <p>2</p> <p>2</p> <p>2</p> |

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| | <p>Trilobites and evolutionary trends.</p> <p>B) Phylum Coelenterata Class Anthozoa- Madreporaria, polyp, medusa, types of septa.</p> <p>C) Origin and evolution of life over geological time.</p> <p>D) Concepts of organic evolution. (Definition, Evidence of evolution, Macro & Micro evolution, Darwinism, Lamarckism & Mutation)</p> | <p>1</p> <p>1</p> <p>1</p> |
| Unit - II | <p>Micropalaeontology, Palaeobotany, Palaeo-ichnology and Vertebrate Palaeontology</p> <p>A) Micropalaeontology</p> <p>a) Introduction to Micropalaeontology</p> <p>b) Definition, different types of microfossils, their size range and composition</p> <p>c) Different branches of Micropalaeontology, uses of microfossils</p> <p>d) Field and Laboratory Techniques</p> <p>i. Field techniques for collection of microfossils (sampling methods)</p> <p>ii. Laboratory techniques for separation- Mechanical and chemicals methods, Recovery of microfossils from shale and limestone. Separation of microfossils from coal (maceration), Preservation and Illustration.</p> <p>e) Study of the following microfossils: (with respect to their morphology, environmental and paleo-ecological significance)</p> <p>(i) Foraminifers</p> <p>(ii) Ostracods</p> <p>(iii) Diatoms and Radiolarian</p> <p>B) Palaeobotany</p> <p>a) Introduction to Palaeobotany, Classification of Plants, preservation of parts of plants ,</p> <p>b) Study of Pollens and Spores</p> <p>C) Vertebrate Palaeontology</p> <p>a) Introduction to Vertebrate Palaeontology, Brief classification of Vertebrates: Class <u>Agnatha</u> (jawless fishes), Class <u>Chondrichthyes</u> (cartilaginous fishes), Class <u>Osteichthyes</u> (bony fishes), Class <u>Amphibia</u> (amphibians), Class <u>Reptilia</u> (reptiles), Class Aves (birds), Class <u>Mammalia</u> (mammals) with two examples from each class,</p> <p>b) Evolution of Man</p> <p>D) Paleo-ichnology Ichnofossils its classification, significance</p> | <p>1</p> <p>1</p> <p>1</p> <p>2</p> <p>4</p> <p>1</p> <p>2</p> <p>2</p> <p>2</p> <p>2</p> |

References:

1. Woods, H., 1958, Text Book of Palaeontology (Invertebrate), Cambridge University Press, UK.
2. Clarkston E.N.K., 1998, Invertebrate Palaeontology and Evolution, 4th Edition, Wiley - Blackwell, 468p.
3. Brasier, M.D., 2011, Microfossils, Chapman & Hall, UK, 193p.
4. Michael Benton, 2004, Vertebrate Palaeontology, 3rd Edition, Wiley-Blackwell, USA

PAPER –II: GLY1202 Petrology
[Credit -2: No. of Lectures 36]

| | Title and Contents | No. of Lectures |
|----------|---|---|
| Unit - I | <p style="text-align: center;">INTRODUCTION TO PETROLOGY AND IGNEOUS PETROLOGY (1 Credit)</p> <p>A) Introduction to Petrology a) Definition of petrology, lithology, petrography, petrogenesis. b) Major divisions and diagnostic characteristic of rocks: igneous, sedimentary and metamorphic. c) Rock cycle.</p> <p>Igneous Petrology</p> <p>a) Magma, its composition, physico-chemical constitution of magma, Bowen’s reaction series and formation of crystals and glass b) Forms of Igneous bodies: Intrusive-Concordant-sill, Discordant-dyke and batholith; Extrusive-Lava flows</p> <p>B) Textures and Structures</p> <p>a) Textures: Definition and factors controlling following textures: granitic, porphyritic, poikilitic, directive, glassy b) Structures: Vesicular, amygdaloidal, blocky, pillow, flow, columnar c) Classification of igneous rocks, basis of Classification: Depth of formation, silica percentage, type of feldspar content and colour index, Tabular classification. Study of following rocks-dunite, granite, gabbro, syenite, diorite, pegmatite, dolerite, rhyolite, basalt, trachyte, andesite</p> | <p style="text-align: center;">3</p> <p style="text-align: center;">3</p> <p style="text-align: center;">2</p> <p style="text-align: center;">3</p> <p style="text-align: center;">2</p> <p style="text-align: center;">5</p> |

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| <p>Unit - II</p> | <p style="text-align: center;">SEDIMENTARY AND METAMORPHIC PETROLOGY (1 Credit)</p> <p>A) Sedimentary Petrology</p> <p>a) Sediments and derivation of sediments: 2</p> <p style="padding-left: 20px;">i. source of sediments</p> <p style="padding-left: 20px;">ii. mineral composition of clastic/detrital sediments</p> <p style="padding-left: 20px;">iii. concept of matrix and cement</p> <p>b) Transportation of sediments- modes of transportation and progressive changes in sediments during transport 2</p> <p>c) Sedimentary environments and formation of sedimentary rocks 1</p> <p>d) Textures and structures 2</p> <p style="padding-left: 20px;">i. Textures- Clastic and non-clastic textures.</p> <p style="padding-left: 20px;">ii. Primary sedimentary structures- lamination, bedding, cross bedding, graded bedding, ripple marks and mud cracks.</p> <p>e) Classification of sedimentary rocks and study of following rocks- laterite, bauxite, conglomerate, breccia, varieties of sandstone, shales, chemical and organic deposits 2</p> <p>B) Metamorphic Petrology</p> <p>a) Definition of metamorphism, agents of metamorphism, kinds of metamorphism 2</p> <p>b) Metamorphic minerals- Stress and antistress minerals 1</p> <p>c) Metamorphism and metamorphic products- 3</p> <p style="padding-left: 20px;">➤ Cataclastic- crush breccias, crush conglomerate, mylonite</p> <p style="padding-left: 20px;">➤ Thermal metamorphism- quartzite, marble 2</p> <p style="padding-left: 20px;">➤ Regional metamorphism- slate, phyllite, schist and gneiss</p> <p>d) Structures in metamorphic rocks: maculose, slaty cleavage, granulose, schistose, gneissose 1</p> <p>e) Tabular classification of metamorphic rocks</p> | |
| <p>References:</p> <p>1. Tyrrell, G. W., 1978, Principles of Petrology, Chapman and Hall Ltd.</p> <p>2. Elher and Blatt, 1997, Petrology: Igneous, metamorphic and sedimentary, CBS publishers and distribution, New Delhi.</p> | | |

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| | PAPER - III: GLY1203 Practicals related to GLY1201 and GLY1202 [Credit -2: No. of Practicals 10] |
| | Title of Experiment / Practical |
| 1 | Optical properties of minerals: Study of optical properties of minerals in plane polarised light and between crossed nicols |
| 2 | Microscopic study of rock forming minerals Olivine, augite, hornblende, microcline, plagioclase, muscovite, biotite, calcite, garnet, quartz and orthoclase. |
| 3 | Identification of the following megascopic igneous rocks with respect to their texture/structure, mineral composition and classification Granite, gabbro, rhyolite, basalt (its varieties), pegmatite (Classification based on colour index, mineral composition and texture) |
| 4 | Identification of the following megascopic sedimentary rocks with respect to their texture/structure, mineral composition and classification Laterite, bauxite, breccia, conglomerate, sandstone, shale, mudstone and limestone. |
| 5 | Identification of the following megascopic metamorphic rocks with respect to their texture/structure, mineral composition and classification Slate, marble, quartzite, mica schist, hornblende schist, mica gneiss and hornblende gneiss. |
| 6 | Study of specimens from Phylum Mollusca – Class Lamellibranchia, Class Gastropoda, Class – Cephalopoda |
| 7 | Study of specimens from i. Phylum Brachiopoda. ii. Phylum Echinodermata. iii. Phylum Arthropoda. iv. Phylum Coelenterata. |
| 8 | Micropalaeontology- Study of microfossils- Two each from Foraminifera, Ostracoda, Pollens/ spores. |
| 9 | Study of ichnofossils |
| 10 | Revision |