S.Y.B.Sc Syllabus Revision Workshop
(3^{rd} - 4^{th} October 2008)
Geology Dept,
Fergusson College, Pune-411004

PROPOSED REVISED SYLLABUS

TO BE IMPLEMENTED

FROM

YEAR 2009-2010

UNIVERSITY OF PUNE
S.Y.B.Sc Revised Syllabus (w.e.f. June 2009)
SEMESTER-I
Paper-I: GL: 211 –Mineralogy

1. DESCRIPTIVE MINERALOGY (No. of Lecture)

A) Mineral Kingdom: Crystalline and Non-Crystalline minerals. (2)

B) Classification of minerals based on Chemical Composition and Silicate Structure. (2)

C) Study of the following mineral groups with respect to Silicate Structure, Chemical Composition, Physical and Optical properties and Paragenesis.

i. Olivine
ii. Pyroxene
iii. Amphibole
iv. Mica
v. Chlorite
vi. Feldspar
vii. Silica (18)

D) Gemstones:

i. Introduction (Three basic attributes of Gemstones, Beauty, Durability and Rarity)
ii. Scope and Importance
iii. Study of the following gemstones with respect to their Physical Properties (Crystal System, Hardness and Sp Gravity), Optical Properties (Colour, Luster, Singly Refracting / Doubly Refracting and Refractive Index) and Indian geographical occurrences.
   a) Diamond
   b) Corundum(Ruby, Sapphire)
   c) Beryl (Aquamarine, Emerald)
   d) Silica(Rock crystal, Amethyst, Citrine, Tiger's eye, Opal)
   e) Tourmaline
   f) Topaz
   g) Garnet(Almandine)

(5)

2. CRYSTALLOGRAPHY:

A) Definition of a Crystal, External and Internal Imperfections in Crystals, Growth of crystals in cavities, Etch figures and Solution Pits. (3)

B) Study of Holohedral, Hemihedral and Hemimorphic forms of crystals with suitable examples. (1)

C) i) Study of Cubic system (Type- Pyrite and Type Tetrahedrite) Comparative study of three types of Cubic system.
ii) Study of Hexagonal system (Type-Calcite, Type-Quartz, &Type-Tourmaline), Comparative study of four Types of Hexagonal system. (4)

D) Twinning in crystals: Definition, Causes, terms related to Twinning, Types of Twins and Laws of Twinning in the different crystal systems. (3)

3. OPTICS:

A) Isotropism and Anisotropism in minerals
B) Phenomenon of Extinction, Extinction Position in minerals of different Crystal System with respect to Vibration Direction and Optic Orientation.
C) Phenomenon of Interference Colours and Newton's Scale of Interference Colours . (7)

(Total Lecture=45)

SEMESTER-II
Paper-I: GL: 221-Petrology

1) IGNEOUS PETROLOGY:

(A) Physico-chemical constitution of Magma.
a) Niggli's molecules and their role in mineral formation
b) Fixed and fugitive phases
c) Minerals of low and high silication
d) Concept of Primary Magma (4)

(B) Crystallization of Magma.
a) i) Unicomponent Magma
ii) Factors controlling grain size of igneous rocks
b) Bicomponent Magma
i) Eutectic crystallization
ii) Solid solutions (Plagioclase series) (3)

(C) Textures and Microstructures:
a) Definition, factors determining the texture of rocks
b) Study of following texture with respect to characters examples and genesis-
Poikilitic, Ophitic, Subophitic, Intergranular, Intersertal, Directive, Intergrowth (Graphic)

c) Study of following structures / micro structures with respect to characters, examples and genesis- Xenolithic, Orbicular, Spherulitic, Perlitic and Expansion Cracks, Reaction Rims. (7)

(D) Tabular classification of igneous rocks based on Colour Index, Depth of Formation, Feldspar Content, Chemical Composition and Saturation Concept showing the position of the following rocks-
Granite, Gabbro, Dunite, Pegmatite, Dolerite, Rhyolite, Pumice, Basalt, Syenite, Diorite, Trachyte, Andesite, Graphic granite, Porphyries, Obsidian and Pitchstone. (1)

2. SEDIMENTARY PETROLOGY:

(A) Derivation of sediments.
a) Sources of sediments
b) Mineral composition of clastic/ detrital sediments
c) Concept of matrix and cement and its effect on porosity and permeability (2)

(B) Transportation of Detrital/ Clastic sediments:
a) Modes of Transportation (Including phases of traction)
b) Definition of Competence, Capacity and Load of transporting Medium
c) Modification of sediments during transport with respect to Size, Roundness, Sphericity, Composition and Specific Gravity (3)

(C) Diagenesis :
Outline of following diagenetic processes:-
Cementation, Authigenesis, Diagenetic Metasomatism, Diagenetic Differentiation and Intrastratal Solution. (2)

(D) Study of following secondary deposits with respect to definition, texture/structure, mineral composition and their varieties.
a) Residual-Latertite, Bauxite, Soil
b) Rudaceous- Conglomerate, Breccia
c) Arenaceous- Sandstones
d) Siltstones
e) Argillaceous- Clays, Mudstone, Shale
f) Chemical deposits- Siliceous, Carbonates, Ferruginous and Salts.
g) Biochemical- Organic Limestone, Phosphatic Siliceous- and Carbonaceous Deposits. (5)

(E) Primary Sedimentary Structures:
Description of following primary structures with respect to their origin and environmental significance.
Lamination, Bedding, Cross Bedding, Graded Bedding, , Ripple Marks, Mud-cracks. (3)

3. METAMORPHIC PETROLOGY:

A) Metamorphism and Metamorphic minerals:
a) Salient features of metamorphism as a process
b) Difference between Metamorphism, Weathering, diagenesis and Metasomatism
c) Metamorphic minerals- Stress and aAti-stress minerals, Idioblastic and Xenoblastic crystals. (4)

B) Metamorphism and Metamorphic Products:
Definition, general characteristics, textures/structures and mineral transformation involved during -
a) Regional Metamorphism of
i) Argillaceous rocks
ii) Quartzofeldspathic rocks
iii) Basic igneous rocks
b) Cataclasis and its products-
Crush Breccia, Crush Conglomerate, Cataclasite
c) Thermal Metamorphism of-
i) Pure and impure limestones
ii) Arenaceous rocks (11)

(Total Lecture- 45)

SEMESTER - I
Paper-II: GL-212: Structural Geology

1. INTRODUCTION:
A) Definition and its relation with other branches of geology
B) Tectonic and Non-tectonic structures. (2)

2. PLANAR/LINEAR STRUCTURES, OUTLIER/INLIER:
A) Attitude of planer feature – Strike & Dip
B) True & Apparent Dip, True Apparent thickness, True Apparent Width of Outcrop and Vertical Thickness of planar feature.
C) Attitude of Linear Feature, Bearing, Plunge and Rake of Linear Feature in given Planer Feature.
D) Outline and Inlier- Definition & Formation.
E) Clinometer Compass and its uses. (5)

3. FOLDS:

A) a) Definition, causes and parts of folds: - axis, axial plane, limb, hinge, crystal line, crystal plane, trough line and trough plane.

b) Definition, causes and characters of the following types of folds: - anticline, syncline, anticlinorium, synclinorium, symmetrical, asymmetrical, overturned, recumbent, isoclinal, chevron, box, fan, monocline, homocline, Structural terrace, open, close, drag, plunging and non-plunging, doubly plunging, dome and basin. Decollement, diapir, disharmonic, suprataneous. (5)

B) Concepts of fold systems and refolding. (1)

C) Method to determine the depth of folding- Principle, assumptions, merits and limitations. (2)

D) Recognition of folds by direct observation, plotting attitude of beds on map, topographic studies, drilling and mining data. (3)

E) Methods of representation of folds. (2)

4. JOINTS:

A) Definition and general characteristics of joints

B) Rupturing under tension, compression, couple and torsion

C) Geometric and genetic classification of joints with examples (3)

5. FAULTS:

A) Definition of fault as a planer zone, terms associated with Faults / fault zones (1)

B) Movements along faults- absolute, relative, apparent, translational and rotational (2)

C) Slips, separations, shift along faults (3)

D) Effects of faulting on disrupted strata (2)

E) Geometric classification of faults (2)

F) Genetic classification of faults (2)

G) Recognition of faults in the field (3)

6. UNCONFORMITY:

Definition, stages in development of unconformities, Structural classification of unconformities, Recognition of unconformity in the field.
Distinguishing unconformable contacts from intrusive contacts and faults. (4)

7. Determination of top of bed with the help of primary structures and interpretation of major structures with which they are associated. (3)

(Total Lecture- 45)

SEMESTER-II

Paper-II: GL: 222 - Stratigraphy and Palaeontology

STRATIGRAPHY

1. Introduction, definition, principles of stratigraphy, development of stratigraphic concepts, importance of stratigraphy. (2)

2. Stratigraphic classification & Nomenclature, study of stratigraphic elements, lithostratigraphy and its units, chronostratigraphy and its units, biostratigraphy and its units. Inter-relationship between lithostratigraphic, chronostratigraphic and biostratigraphic units. (7)

3. Stratification : processes, Controlling stratification-physical, chemical and biological.
Vertical succession, alternations, varves, cycles (symmetrical and asymmetrical) (8)

4. Unconformity: definition, importance in stratigraphy environmental classification and stratigraphic evidence of unconformities. (2)

5. Correlation: definition and evidence for correlation-physical and palaeontological. (4)

6. Methods of collecting stratigraphic data (stratigraphic procedures on outcrop and subsurface) (2)

PALAEONTOLOGY

7. INVERTEBRATE PALAEONTOLOGY:

A) Concepts of organic evolution
(Definition, Evidence of evolution, Macro & Micro evolution, Darwinism, Lamarckism & Mutation)
B) Evolutionary trends in Ammonoids and Trilobites. (6)

8. MICROPALAEONTOLOGY:

A) Introduction (1)
B) Definition, different types of microfossils, their size range and composition. Different branches of Micropalaeontology. Uses of microfossils (2)

C) (a) Field techniques for collection of microfossils (sampling methods)
(b) Laboratory techniques for separation- Mechanical and chemicals methods, Recovery of microfossils from shale and limestone. Separation of microfossils from coal (maceration), Preparation and Illustration. (5)

D) Study of the following microfossils: (with respect to their morphology, environmental and paleo-ecological significance)
(a) Foraminifers
(b) Ostracods
(c) Pollens and Spores (6)

(**Total Lecture =45)**

Books:

1. Structural Geology: M.P. Billings
2. Invertebrate Palaeontology : Henry Wood
3. Elements of Micropalaeontology : G.Bignot
4. Invertebrate Palaentology and Evolution: Clarkson
5. Principles of Invertebrate Palaentology: Robert Shrock and William Twenhofel
6. Principles of Palaentology: David Romp and Steven Stanely
7. Principles of Palaentology: T. Olivier
8. Basic Concepts of Historical Geology: E.W.Spencer
9. Historical Geology: Dunbar
10. Principles of Stratigraphy: Weller
11. Fundamentals of Historical Geology and Stratigraphy of India: Ravindra Kumar
12. Introduction to Microfossils: Danial Jones
13. Structural Geology: Miyashiro
14. Principles of Stratigraphy: Leman
15. Sedimentation and Stratigraphy: Krumbein and Sloss.

Paper III: GL:-223 - Geology Practical

Total Practicals-22

1. MINERALOGY:

a) Megascopic: (At least 15 minerals from amongst the following)
Study & identification of the following minerals in hand specimens:
Sanidine, Labradorite, Sodalite, Leucite, Hypersthene, Actinolite, Tremolite, Wollastonite, Beryl, Tourmaline, Staurolite, Epidote, Chlorite, Serpentine, Kaolinite, Asbestos, Apatite, Topaz, Corundum.

b) i) Ore minerals (any four)-
Wolframite, Stibnite, Malachite, Azurite, Iron pyrite, Iron glance, Psilomalaene.
ii) Gemstones (any four)-
Corundum (ruby, sapphire), Tourmaline, Beryl (aquamarine, emerald), Amethyst, Garnet, Zircon, Olivine (peridot)

c) Microscopic :
Study and identification of the following minerals under microscope:
Quartz, Orthoclase, Sanidine, Leucite, Hauyne / Nosean, Hypersthene, Diopside, Actinolite, Tremolite, Tourmaline, Andalusite, Chlorite, Sphene.

2. CRYSTALLOGRAPHY:

A) Study of Crystallographic Axes, Elements of Symmetry and Forms with Indices of:-
a) i) Cubic system (Type-Pyrite and Type-Tetrahedrite)
ii) Hexagonal system (Type- calcite, Type-Tourmaline and Type- Quartz)
b) Study of the Twinned crystals
At least one twin crystal from each crystal system representing different types of twins.

3. PETROLOGY:

Megascopic and Microscopic study and identification of the following rocks.

A) IGNEOUS ROCKS:

a) Megascopic:-
Syenite, Diorite, Syenite - Porphyry, Trachyte, Andesite, Dolerite, Graphic granite, Dunite, Pitchstone, Obsidian.

b) Microscopic:-
Granite, Gabbro, Graphic granite, Syenite, Trachyte, Andesite, Rhyolite, Basalt, Dunite, Pitchstone.

B) SEDIMENTARY ROCKS:

a) Megascopic:-

Arkose, sGrit, Sandstones (siliceous, ferrugineous and calcareous), Nummulitic Limestone, Meliolitic Limestone,Oolitic Limestone.

b) Study of following Primary Sedimentary Structures in hand specimen with their Environmental Significance.

1. Bedding
2. Cross bedding
3. Graded bedding
4. Ripple marks
5. Mud/ Sun cracks.

c) Microscopic:-

Ferruginous Sandstone, Arkose, Oolitic Limestone, Nummulitic Limestone.

C) METAMORPHIC ROCKS:

a) Megascopic:

Any two varieties of Marble, Banded Haematite Quartzite, Phyllite, Chlorite schist, Mica garnet schist, Actinolite schist, Kyanite schist, Staurolite schist. Granite gneiss.

b) Microscopic:

Quartzite, Marble, Mica garnet schist, Hornblende schist, Biotite gneiss, Hornblende gneiss.

4. **MICRO-PALAEONTOLOGY:**

Micro fossils- Two each from Foraminifera, Ostracod, Pollens/ Spores.

STRUCTURAL GEOLOGY

A) Study of Geological Maps:

a) One conformable series A with one vertical dyke.
b) Two conformable series.
c) One conformable series with one/ two vertical faults.
d) One unconformity and one vertical fault.

B) Structural problems:

a) Problems involving hill slope (hill slope given/ hill slope to be determined), true dip, true thickness, true width of outcrop and vertical thickness of the bed.
b) Problems involving true and apparent Dip, true and apparent thickness, true and apparent width of outcrop and vertical thickness of the bed (True dip & true thickness/ Vertical thickness/ width of the outcrop given).
c) Problems involving true and apparent dip of the bed-
   i) True dip of the bed given- To find out apparent dip amount in the given apparent dip direction
   ii) True dip of the bed given- To determine apparent dip direction for given apparent dip amount.
   iii) Two apparent dip amounts in two different directions given- To find out strike direction, true dip direction and true dip amount.

Note- (Problems B and C to be solved by using descriptive geometry method involving construction of vertical section in desired directions)
*Dip angle to be given in degrees.

***Field Work**- Compulsory Geology field work for 4 to 7 days in a region with geologically diversified rock types and structures in any suitable Indian occurrences under the guidance of a teacher. Students should submit a written field study report along with representative field samples.