PYAY UNIVERSITY

DEPARTMENT OF GEOLOGY

CURRICULUM FOR BSc DEGREE COURSE

BSc FIRST YEAR **SEMESTER I**

Module No.	Module Name	Credit	Hours/week	
			Lecture	Prac/ Tuto
မ ၁၀၀၁	မြန်မာစာ	3	2	2
Eng 1001	English	3	2	2
Geol 1101	Principles of Geology I	4	3	2
Elective (1)	*	3	2	2
Elective (2)	*	3	2	2
Elective (3)	Aspects of Myanmar	3	2	2
Total		19	13	12

Total Credits – 19; Total hours – 25

Foundation Courses

မ ၁၀၀၁ မြန်မာစာ

Eng 1001 English

Core Courses

Geol 1101 Principles of Geology I

Elective Courses (Student may choose any **three** of the elective courses listed below)

Chem 1001 General Chemistry I

Phys 1001 General Physics I

Math 1001 Mathematics I

AM 1001 Aspects of Myanmar (Compulsory Elective)

Elective Courses for other specializations

Geol 1001 General Geology I (for Physics, Nuclear Physics, Mathematics, Chemistry, Industrial Chemistry, Botany, Zoology, Geography)

Geol 1002 Introduction to Petrology (for Archaeology)

PYAY UNIVERSITY

DEPARTMENT OF GEOLOGY

CURRICULUM FOR BSc DEGREE COURSE

BSc FIRST YEAR **SEMESTER II**

Module No.	Module Name	Credit	Hours/week	
			Lecture	Prac/ Tuto
မ ၁၀၀၁	မြန်မာစာ	3	2	2
Eng 1002	English	3	2	2
Geol 1102	Principles of Geology II	4	3	2
Elective (1)	*	3	2	2
Elective (2)	*	3	2	2
Elective (3)	Aspects of Myanmar	3	2	2
Total		19	13	12

Total Credits – 19; Total hours – 25

Foundation Courses

မ ၁၀၀၁ မြန်မာစာ

Eng 1002 English

Core Courses

Geol 1102 Principles of Geology II

Elective Courses (Student may choose any **three** of the elective courses listed below)

Chem 1002 General Chemistry II

Phys 1002 General Physics II

Math 1003 Mathematics II

AM 1002 Aspects of Myanmar (Compulsory Elective)

Elective Courses for other specializations

Geol 1003 General Geology II (for Physics, Nuclear Physics, Mathematics, Chemistry, Industrial Chemistry, Botany, Zoology, Geography)

Geol 1004 Vertebrate Paleontology (for Archaeology)

PYAY UNIVERSITY

DEPARTMENT OF GEOLOGY

CURRICULUM FOR BSc DEGREE COURSE

BSc SECOND YEAR **SEMESTER I**

Module No.	Module Name	Credit	Hours/week	
			Lecture	Prac/ Tuto
Eng 2001	English	3	2	2
Geol 2101	Elements of Mineralogy	4	3	2
Geol 2102	Structural Geology and Tectonics I	4	3	2
Geol 2103	Field Geology and Surveying	4	3	2
Elective (1)	**	3	2	2
Elective (2)	*	3	2	2
Total		21	15	12

Total Credits – 21; Total hours – 27

Foundation Courses

Eng 2001 English

Core Courses

Geol 2101 Elements of Mineralogy

Geol 2102 Structural Geology and Tectonics I

Geol 2103 Field Geology and Surveying

Elective Courses (Student may choose any **two** of the elective courses listed below)

Geol 2104 Environmental Geology I (** Compulsory Elective)

Chem 2001 Chemistry I (for Geology)

Math 2001 Mathematics I

Phys 2003 Electric and Magnetic Fields

Elective Courses for other specializations

Geol 2001 Outline Geology of Myanmar I (for Geography and Archaeology)

PYAY UNIVERSITY

DEPARTMENT OF GEOLOGY

CURRICULUM FOR BSc DEGREE COURSE

BSc SECOND YEAR **SEMESTER II**

Module No.	Module Name	Credit	Hours/week	
			Lecture	Prac/ Tuto
Eng 2002	English	3	2	2
Geol 2105	Optical Mineralogy	4	3	2
Geol 2106	Structural Geology and Tectonics II	4	3	2
Geol 2107	Field Training Course (15 days)	4	3	2
Elective (1)	**	3	2	2
Elective (2)	*	3	2	2
Total		21	15	12

Total Credits – 21; Total hours – 27

Foundation Courses

Eng 2002 English

Core Courses

Geol 2105 Optical Mineralogy

Geol 2106 Structural Geology and Tectonics II

Geol 2107 **Field Training Course** (15 days) (Compulsory for all students and to be conducted in the selected field site(s). Assessment is to be made in the field by judging field conduct, competency, etc. of students.)

Elective Courses (Student may choose any **two** of the elective courses listed below)

Geol 2108 Environmental Geology II (** Compulsory Elective)

Chem 2004 Chemistry II (for Geology)

Math 2004 Mathematics II

Phys 2004 Thermal Physics

Elective Courses for other specializations

Geol 2002 Outline Geology of Myanmar II (for Geography and Archaeology)

PYAY UNIVERSITY

DEPARTMENT OF GEOLOGY

CURRICULUM FOR BSc DEGREE COURSE

BSc THIRD YEAR **SEMESTER I**

Module No.	Module Name	Credit	Hours/week	
			Lecture	Prac/ Tuto
Eng 3001	English	3	2	2
Geol 3101	Igneous Petrology I	4	3	2
Geol 3102	Sedimentary Petrology I	4	3	2
Geol 3103	Invertebrate Paleontology I	4	3	2
Geol 3104	Metamorphic Petrology	4	3	2
Elective	*	3	2	2
Total		22	16	12

Total Credits – 22; Total hours – 28

Foundation Courses

Eng 3001 English

Core Courses

Geol 3101 Igneous Petrology I

Geol 3102 Sedimentary Petrology I

Geol 3103 Invertebrate Paleontology I

Geol 3104 Metamorphic Petrology

Elective Courses (Student may choose any **one** of the elective courses listed below)

Geol 3105 Principles of Geophysics

Geol 3106 Marine Geology I

Geol 3107 Geomorphology

Elective Courses for other specializations

Geol 3001 Paleontology I (for Anthropology)

PYAY UNIVERSITY

DEPARTMENT OF GEOLOGY

CURRICULUM FOR BSc DEGREE COURSE

BSc THIRD YEAR **SEMESTER II**

Module No.	Module Name	Credit	Hours/week	
			Lecture	Prac/ Tuto
Eng 3002	English	3	2	2
Geol 3108	Igneous Petrology II	4	3	2
Geol 3109	Sedimentary Petrology II	4	3	2
Geol 3110	Invertebrate Paleontology II	4	3	2
Geol 3111	Field Training Course (21 days)	4	3	2
Elective	*	3	2	2
Total		22	16	12

Total Credits – 22; Total hours – 28

Foundation Courses

Eng 3002 English

Core Courses

Geol 3108 Igneous Petrology II

Geol 3109 Sedimentary Petrology II

Geol 3110 Invertebrate Paleontology II

Geol 3111 **Field Training Course** (21 days) (Compulsory for all students and to be conducted in the selected field site(s). Assessment is to be made in the field by judging field conduct, competency, etc. of students.)

Elective Courses (Student may choose any **one** of the elective courses listed below)

Geol 3112 Principles of Geochemistry

Geol 3113 Marine Geology II

Geol 3114 Advanced Surveying

Elective Courses for other specializations

Geol 3002 Paleontology II (for Anthropology)

PYAY UNIVERSITY

DEPARTMENT OF GEOLOGY

CURRICULUM FOR BSc DEGREE COURSE

BSc FOURTH YEAR **SEMESTER I**

Module No.	Module Name	Credit	Hours/week	
			Lecture	Prac/ Tuto
Eng 4001	English	3	2	2
Geol 4101	Stratigraphic Principles and Practice	4	3	2
Geol 4102	Geology of Myanmar I	4	3	2
Geol 4103	Economic Geology	4	3	2
Geol 4104	Photogeology and Remote sensing	4	3	2
Elective	*	3	2	2
Total		22	16	12

Total Credits – 22; Total hours – 28

Foundation Courses

Eng 4001 English

Core Courses

Geol 4101 Stratigraphic Principles and Practice

Geol 4102 Geology of Myanmar I

Geol 4103 Economic Geology

Geol 4104 Photogeology and Remote sensing

Elective Courses (Student may choose any **one** of the elective courses listed below)

Geol 4105 Applied Geology I (Engineering Geology and Hydrogeology)

Geol 4106 Historical Geology

Geol 4107 Statistical Geology

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DEPARTMENT OF GEOLOGY

CURRICULUM FOR BSc DEGREE COURSE

BSc FOURTH YEAR **SEMESTER II**

Module No.	Module Name	Credit	Hours/week	
			Lecture	Prac/ Tuto
Eng 4002	English	3	2	2
Geol 4108	Mineral Deposits of Myanmar	4	3	2
Geol 4109	Geology of Myanmar II	4	3	2
Geol 4110	Exploration Geology	4	3	2
Geol 4111	Field Training Course (21 days)	4	3	2
Elective	*	3	2	2
Total		22	16	12

Total Credits – 22; Total hours – 28

Foundation Courses

Eng 4002 English

Core Courses

Geol 4108 Mineral Deposits of Myanmar

Geol 4109 Geology of Myanmar II

Geol 4110 Exploration Geology

Geol 4111 **Field Training Course** (21 days) (Compulsory for all students and to be conducted in the selected field site(s). Assessment is to be made in the field by judging field conduct, competency, etc. of students.)

Elective Courses (Student may choose any **one** of the elective courses listed below)

Geol 4112 Applied Geology II (Petroleum Geology)

Geol 4113 Gemmology

Geol 4114 Quaternary Geology

N. B. Term/Project paper must be submitted by each group not more than 10 students. Group paper presentation must be included.

PYAY UNIVERSITY

DEPARTMENT OF GEOLOGY

SYLLABUS FOR BSc DEGREE COURSE

BSc FIRST YEAR

Geol 1101 PRINCIPLES OF GEOLOGY I

1. The Earth: Geology and its uses; The earth's internal structure and composition, age, and origin.
2. Earth Materials: Minerals and their properties; Common rock–forming minerals; Common ore minerals; Igneous rocks; Sedimentary rocks; Metamorphic rocks; The rock cycle.

Practical Work

Mineral properties; Common rock–forming and ore minerals; Common igneous, sedimentary and metamorphic rocks; Topographic maps.

References

1.Skinner, B. J. & S. C. Potter (1992), *The Dynamic Earth* (2nd Ed.)

2.Foster, R. J. (1988), *General Geology* (5th Ed.)

3.ဒေါက်တာဦးသိန်း(၁၉၇၈) အထွေထွေဗဟုသုတ

Geol 1102 PRINCIPLES OF GEOLOGY II

1.Earth Processes:

External Geological Processes: Weathering; Geological works of running water, groundwater, mass movements, the sea, wind and ice.

Internal Geological Processes: Volcanism; Seismicity; Orogeny; Plate tectonics.

2.Geological Structures: Folds; Faults; Joints: Unconformities.

3.Earth History: Radiometric Dating; Geologic Time Scale; Fossils and Fossilization; Evolution of life.

4.Earth Resources: Mineral Deposits; Fossil Fuels; Brief account of mineral deposits of Myanmar.

Practical Work

Block diagrams; Geological Maps.

References

1.Skinner, B. J. & S. C. Potter (1992). *The Dynamic Earth* (2nd Ed.)

2.Foster, R. J. (1988). *General Geology* (5th Ed.)

PYAY UNIVERSITY

DEPARTMENT OF GEOLOGY

SYLLABUS FOR BSc DEGREE COURSE

BSc SECOND YEAR

Geol 2101 ELEMENTS OF MINERALOGY

1.Crystallography: Elements of symmetry; Crystal notations; Stereographic projection; Common crystal classes and common crystal forms; Twinning in crystals

2.Crystal chemistry: major silicate structures; chemical bonding

Mineralogical relations: chemical variations (Ionic substitution, Solid solution, Isomorphism), structural variations (Polymorphism)

Practical Work

Study of common crystal forms; Miller Indices; Stereographic Projection.

References

1.Read, H. H., (1976). *Rutley's Elements of Mineralogy* (26th Ed.)

2.Brownlow, A. H., (1979). *Geochemistry*

3.Wade, F. A & R. A Maltox, (1960). *Elements of Crystallography and Mineralogy*

Geol 2102 STRUCTURAL GEOLOGY AND TECTONICS I

1. Definition & Scope
2. Bedding and its recognition: top and bottom determination
3. Mechanical properties; forces, stress and strain, factors controlling behavior of materials
4. Types of deformation and mechanics of plastic deformation
5. Fractures: tensional fractures and shear fractures, compression fractures, (Joint, genetic classification of joints, interpretation of joint diagrams) etc.
6. Mechanics of folding: description and classification of folds; types of fold
7. Mechanics of faulting, description and classification of faults, normal fault, strike–slip fault, reverse fault, thrust fault and overthrust, criteria for recognition of faults
8. Morphotectonics and lineaments

Practical Work

Determination of true and apparent dips, Outcrop pattern and structural block diagrams; Joint diagram; Construction of cross–sections.

References

1. Park, R. G., (1983). *Foundations of Structural Geology*
2. Billings, M. P., (1972). *Structural Geology* (2nd Ed.)
3. Badgley, P. C., (1959). *Structural Methods for Exploration Geologists*
4. Pluijm, B .A. D. and Marshak, S., (1997). *Earth's Structure: An Introduction to Structural Geology and Tectonic*

Geol 2103 FIELD GEOLOGY AND SURVEYING

FIELD GEOLOGY

1. Scope, importance; uses
2. Methods of observations and measurements:
   Use of topographic maps and air–photos; tape–and –compass traverse method; outcrop mapping; outcrop procedures; sampling and collecting; recording
3. Field work with sedimentary rocks
4. Field work with igneous rocks
5. Field work with metamorphic rocks
6. Preparation of Geological maps and cross–sections
7. Writing Geological reports

SURVEYING

1. Scope, definitions, and applications; Types of surveying; Instruments
2. Linear and angular measurements
3. Chain / tape surveying
4. Compass surveying (by prismatic, Brunton and clinometer compasses)
5. Levelling

Practical Work for Field Geology

Exercises on the uses of Geological compasses, traverse method, joint rose diagrams, stereographic projection of planar and linear structures; Study of Geological maps and cross–sections.

Practical Work for Surveying

Linear and angular measurements; Chain / tape surveying; Alidade surveying; Levelling; Volume of earthwork and calculations.

References

1. Compton, R.R. (1985). *Geology in the Field* (2nd Ed.)
2. Davis, R. E. (1955). *Elementary Plane Surveying* (3rd Ed.)
3. Kissam, P. (1956). *Surveying* (2nd Ed.)

Geol 2104 ENVIRONMENTAL GEOLOGY I

1. Introduction: General Consideration, Environmental Geology – An Overview; Environmentalism
   - Fundamental Concepts of Environmental Geology
   - Earth System; Earth Resources

2. Geologic Hazards: Hazards from earthquakes and tsunamis; Hazards from ground failures; Hazards from volcanic eruptions; Expansive soils; their causes and mitigation
3. Hydrologic Hazards: Hazards from floods, Coastal hazards, Their causes and mitigation

Tutorial / Practical

Causes and mitigation of natural Geologic and hydrologic hazards; earth resources

References

1. Keller, E. A. (1988). *Environmental Geology* (5th Ed.)
2. Murck, B. W., B. J. Skinner and S. C. Porter (1996). *Environmental Geology*
3. Hays, W. W (Ed) (1981). *Facing Geologic and Hydrologic Hazards* (USGS Pub.)
4. ADPC, (2009). *Hazards Profiles of Myanmar*

Geol 2105 OPTICAL MINERALOGY

1. Principles of Optical Mineralogy: Nature and properties of light; Polarizing microscope; Optical properties of minerals (under orthoscope and conoscope); Preparation of thin sections
2. Systematic Mineralogy: Classification; Physical and optical properties of olivine, pyroxene, amphibole, mica, feldspar, feldspathoid, silica groups, and other important minerals and mineral groups (Garnet, Tourmaline, Carbonate, Aluminosilicate groups, etc)
3. Important Gem Minerals: Physical properties of diamond, ruby, sapphire, emerald, aquamarine, peridot, jadeite

Practical Work

Megascopic and microscopic studies of common and important minerals

References

1. Read, H.H., (1976). *Rutley's Elements of Mineralogy* (26th Ed.)
2. Kerr, P.F., (1977). *Optical Mineralogy* (4th Ed.)

Geol 2106 STRUCTURAL GEOLOGY AND TECTONICS II

1. Cleavage and schistosity: origin, relation of cleavage and schistosity to major structures
2. Secondary lineation: origin, types of secondary lineation, relation of lineation to major structures

3. Structural petrology or Petrofabrics
4. Continental drift
5. Sea–floor spreading
6. Plate tectonics

Practical Work

Stereographic projection of bedding, foliation and lineation, Orthographic and stereographic projection in solving fold and fault problems, Structural contour map, Structural map with faults

References

R.G. Park, (1983). *Foundations of Structural Geology*

Billings, M. P. (1972*). Structural Geology* (2nd Ed.)

Badgley, P.C. (1959). *Structural Methods for Exploration Geologists*

Pluijm, B .A. D. and Marshak, S., (1997). *Earth's Structure: An Introduction to Structural Geology and Tectonics*

Geol 2107 FIELD TRAINING COURSE

15–day compulsory field training in the designated field areas. Examination paper for the Geology of the field area is required.

Geol 2108 ENVIRONMENTAL GEOLOGY II

1. Human–induced Hazards and Problems: Waste disposal, Soil degradation, erosion and desertification, Their causes and mitigation
2. Using and Caring for Earth Resources: Mineral resources, Fossil fuels, Water resources, Land use.
3. Protection and Preservation of the Natural Environment in Myanmar: Status of environmental degradation in Myanmar, Environmental problems facing Myanmar and suggested remedial actions, Environmental education, Policy, and Legislation.

Tutorial / Practical

Tutorials on human–induced Geologic and hydrologic hazards; earth resources; land use

References

1. Keller, E. A. (1988). *Environmental Geology* (5th Ed.)
2. Murck, B. W., B. J. Skinner and S. C. Porter (1996). *Environmental Geology*
3. Hays, W. W (Ed) (1981). Facing Geologic and Hydrologic Hazards, (USGS Pub.)
4. Miller, G. T. (1998). *Environmental Science with working the Earth*
5. ADPC, (2009). *Hazard Profiles in Myanmar*

PYAY UNIVERSITY

DEPARTMENT OF GEOLOGY

SYLLABUS FOR BSc DEGREE COURSE

BSc THIRD YEAR

Geol 3101 IGNEOUS PETROLOGY I

1. Introduction
2. Magmatic processes: stages in magmatic consolidation; fractional crystallization and Bowen's reaction series
3. Igneous structures and field relationships
4. Textures and microstructures of igneous rocks
5. IUGS classifications of igneous rocks

Practical Work

1. Megascopic petrography of igneous rocks of Myanmar.
2. Textures and microstructures of igneous rocks in thin section.

References

1. Williams, H, F. J. Turner & C. M. Gilbert (1954). *Petrography.*
2. Hatch, F. H., A.K. Wells & M. K. Wells (1972). *Petrology of the Igneous Rocks* (3rd Ed.)
3. Hyndman, D. W., (1985). *Petrology of Igneous and Metamorphic Rocks.* (2nd Ed.)
4. Winter, J. D. (2001). *An Introduction to Igneous and Metamorphic Petrology.*

Geol 3102 SEDIMENTARY PETROLOGY I

1. Introduction; Scope; History; Uses
2. Processes of sedimentation; Weathering; Erosion; Transportation; Deposition and Depositional Environments; Post–depositional Changes.
3. Properties of sediments: Composition; Textures; Structures; Mass properties
4. Products of sedimentation; Classification of sedimentary rocks

Practical Work

1. Megascopic petrography of common sedimentary rocks
2. Size frequency distribution

3. Microscopic study of clastic sedimentary rocks

References

1. Pettijohn, F. J. (1975). *Sedimentary Rocks* (3rd Ed.)
2. Williams, H., F.J. Turner & C.M. Gilbert (1954). *Petrography*
3. Reineck, H. E. and I. B. Singh (1980). *Depositional Sedimentary Environment with References to Terrigeneous clastics*. (Second Revised and Update Edition)
4. Blatt, H., G. Middleton, R. Murray (1980) *Origin of Sedimentary Rocks* (2nd Ed.)
5. Tucker, H. E. (1991) *Sedimentary Petrology* (2nd Ed.)

Geol 3103 INVERTEBRATE PALEONTOLOGY I

1. Introduction, meaning and scope.
2. Fossils and fossilization.
3. Systematics and Nomenclature
4. Systematic study of phyla Protozoa, Porifera, Coelenterata, Bryozoa, Graptolithina, mentioning general features, morphological characteristics, classification, paleoecology, and stratigraphic significance.

Practical Work

1. Types of fossilization
2. Identification and systematic description of selected important genera of phyla Protozoa, Porifera, Coelenterata, Bryozoa and Graptolithina.

References

1. Shrock , R. R., & W. H. Twenhofel (1953). *Principles of Invertebrate Paleontology*
2. Moore, R. C., C. G. Lalicker & A. G. Fischer, (1952). *Invertebrate Fossils*
3. Easton, W. H. (1960). *Invertebrate Paleontology*
4. Clarkson, E. N. K. (1993). *Invertebrate Paleontology and Evolution* (3rd Ed.)

Geol 3104 METAMORPHIC PETROLOGY

1. Introduction: Scope; History

2. Metamorphism: Agents; Processes; Types
3. Textures and structures of metamorphic rocks
4. Classification of metamorphic rocks
5. Metamorphic grades, zones and facies
6. Metamorphism of pelitic, quartzo–feldspathic, calcareous, magnesian, and basic rocks
7. Relationship between regional metamorphism and tectonism
8. Metamorphic belts and epochs of Myanmar

Practical works

1. Megascopic petrography of common metamorphic rocks
2. Textures of metamorphic rocks
3. Microscopic petrology of common metamorphic rocks

References

1. Williams, H, F. J. Turner & C. M. Gilbert (1954). *Petrography.*
2. Winter, J. D. (2001). *An Introduction to Igneous and Metamorphic Petrology.*
3. Hyndman, D. W., (1985). *Petrology of Igneous and Metamorphic Rocks* (2nd Ed.)
4. Raymond, L. A (1995). *Petrology (Igneous, Sedimentary, Metamorphic Rocks).*
5. Yardley, B. W. D (1983). *An Introduction to Metamorphic Petrology.*

Geol 3105 PRINCIPLES OF GEOPHYSICS

1. Introduction to Geophysics: Physical properties of rocks and minerals; Classification of geophysical methods; The geophysical model; Direct and indirect applications; Ambiguity in interpretation.
2. The basic principles and practices in gravity method, Magnetic method, Electrical method, Resistivity methods, Electromagnetic methods, Induced Polarization method, Radioactive method, Seismic method.

Tutorial / Practical Work

Tutorial on subfields of geophysics; Petrophysical properties; Principles of geophysics; Geophysical methods.

References

1. Parasnis (1986). *Principles of Applied Geophysics.* (4th Ed.)
2. Howell, A. K. *Introduction to Geophysics*

Geol 3106 MARINE GEOLOGY I

1. Overview and history of marine geology; Internal structures of the earth; The earth's gravity field; The earth's magnetic field.
2. Ocean Morphology and Geophysics: The continental margin; The oceanic ridges; Fracture zones; The ocean–basin floor; Marginal trenches; Seismic reflection; Seismic refraction.
3. Ocean Basin Tectonics: Principal features of ocean spreading centres; Principal features of ocean subduction zones.
4. Study of continental margins: passive continental margins (Rift); Active continental margins (Accretionary prisms).
5. Submarine and Island arc volcanoes.

Tutorial

Ocean morphology, Ocean basin tectonics, Continental margins

References

1. Kennet, J. P. (1982). *Marine Geology*. (2nd Ed.) New York, Prentice Hall
2. Seibold, E., and Berger, W. H., (1996). *The Sea Floor : An Introduction to Marine Geology*, Springer–Verlag. (3rd Ed.)
3. Duxbury A. C. and A. B. Duxbury (1984). *An Introduction to World's Oceans*. (2nd Ed.)
4. Erickson. J. (2003). *Marine Geology: Exploring the New Frontiers of the Ocean.*

Geol 3107 GEOMORPHOLOGY

1. Basic concepts of geomorphology: Scale; processes; Structural influences; Climate; People as geomorphic agents.

2. Fluvial processes and their landforms: Streams and valleys; Drainage patterns; Stream meandering; Fluvial cycles; River terraces; Peneplain concept.
3. Tectonic and structural landforms; Landforms controlled by faults; Landforms controlled by folds.
4. Karst landforms: Surface landforms; Subsurface caves and springs; Karst evolution.
5. Coastal processes and landforms: Tides, waves and currents; Eustatic sea–level changes; Erosional and depositional landforms of coasts; Deltas and estuaries; Continental shelves and submarine canyons.
6. Paleogeomorphology: Relict landforms; Burried landforms; Exhumed landforms.
7. Applied geomorphology: Application to hydrology; Application to economic geology; Application to engineering projects; Application to oil exploration.

Practical Work

1. Interpretation of topographic maps for the purpose of geologic information.
2. Interpretation of air–photographs and geological maps.

References

1. Thornbury, W.D. (1969). *Principles of Geomorphology* (2nd Ed.)
2. Selby, M.J. (1985). *Earth's Changing Surface; An Introduction to Geomorphology.*

Geol 3108 IGNEOUS PETROLOGY II

1. Petrography of various clans of the acid, intermediate, basic and ultramafic groups, pyroclastic rocks and lamprophyres
2. Igneous associations at various plate boundaries
3. A brief account of igneous activity in Myanmar
4. Major granitoid belts of Myanmar
5. The Central Igneous Belt

Practical Work

Microscopic petrology of igneous rocks of Myanmar.

References

1. Williams, H, F. J. Turner & C. M. Gilbert (1954). *Petrography.*
2. Hatch, F. H., A.K. Wells & M. K. Wells (1972). *Petrology of the Igneous Rocks* (3rd Ed.)
3. Winter, J. D. (2001). *An Introduction to Igneous and Metamorphic Petrology.*

Geol 3109 SEDIMENTARY PETROLOGY II

1. Clastic sedimentary rocks: Conglomerates and breccias; Sandstones; Siltstones; Shales.
2. Chemical and organic sedimentary rocks: Limestones; Dolomites and dolomitization; Chert; Evaporites; Iron formations
3. Depositional environments and facies of alluvial, deltaic, shallow marine (with tempestite and tsunamites), deep sea, and pelagic sedimentation.

Practical Work

1. Megascopic petrography of common sedimentary rocks
2. Microscopic petrology of clastic and carbonate sedimentary rocks

References

1. Pettijohn, F. J. (1975). *Sedimentary Rocks.* (3rd. Ed.)
2. Williams, H., F.J. Turner & C.M. Gilbert (1954). *Petrography*
3. Reineck, H. E. and I. B. Singh (1980). *Depositional Sedimentary Environment with References to Terrigeneous clastic* (Second Revised and Update Edition)
4. Blatt, H., G. Middleton, R. Murray (1980). *Origin of Sedimentary Rocks* (2nd Ed.)
5. Tucker, H. E. (1991) *Sedimentary Petrology* (2nd Ed.)

Geol 3110 INVERTEBRATE PALEONTOLOGY II

1. Systematic study of phyla Echinodermata; Arthropoda; Brachiopoda; and Mollusca; mentioning general features; morphological characteristics; classification; paleoecology; and stratigraphic importance.
2. Introduction to trace fossils.

Practical Work

Study of morphological features, identification and systematic description of selected important genera of phyla Echinodermata, Arthropoda, Brachiopoda and Mollusca, and trace fossils.

References

1. Shrock, R. R., & W. H. Twenhofel (1953). *Principles of Invertebrate Paleontology*
2. Moore, R. C., C. G. Lalicker & A. G. Fischer, (1952). *Invertebrate Fossils*
3. Easton, W. H. (1960). *Invertebrate Paleontology*
4. Clarkson, E. N. K. (1993). *Invertebrate Paleontology and Evolution*, (3rd Ed.)
5. Lindholm, R. C. (1987). *A Practical Approach to Sedimentology*

Geol 3111 FIELD TRAINING COURSE

21–day compulsory field training in the designated field areas. Examination paper for the Geology of the field area is required.

Geol 3112 PRINCIPLES OF GEOCHEMISTRY

1. Composition of the earth and its relation to the universe
2. Some thermodynamics and crystal and isotopes chemistry
3. The role of geochemical processes in magmatism; Sedimentation and metamorphism;
4. The geochemical nature of the atmosphere, hydrosphere, and biosphere
5. The geochemical cycle
6. Introduction to exploration geochemistry

Tutorial Work

Tutorial works on crystal and isotopes chemistry, Geochemical processes, Atmosphere, Hydrosphere, and Biosphere, Geochemical cycle, Exploration geochemistry.

References

1. Mason, B., (1990). *Principles of Geochemistry*. (4th Ed.)

Geol 3113 MARINE GEOLOGY II

1. The oceanic crust: Structure; Petrology and sources of oceanic crust; Deep–sea drilling data, Evidence from ophiolite complexes.
2. Sea–level history and seismic stratigraphy
   - The Importance of sea–level change and its causes
   - Quaternary sea–level history
   - Sedimentary cycles
   - Seismic stratigraphy
3. Coastal geology; Marine sedimentation and erosional processes.
4. Introduction to ocean sediments: Calcareous sediments; Siliceous sediments; Nature and distribution of sediments in continental Shelf, Slope and abyssal plain.

Tutorial

Tutorials on the oceanic crust, Sea–level history and seismic stratigraphy, Coastal geology, and ocean sediments

References

1. Kennet, J. P. (1982). *Marine Geology*. (2nd Ed.). New York, Prentice Hall
2. Seibold, E., and, W. H. Berger, (1996). *The Sea Floor: An Introduction to Marine Geology*. (3rd Ed.)
3. Duxbury, A, C. and A. B. Duxbury (1984). *An Introduction to World's Oceans*. (2nd Ed.)
4. Erickson. J. (2003). *Marine Geology: Exploring the New Frontiers of the Ocean.*

Geol 3114 ADVANCED SURVEYING

1. Surveying fundamentals
2. Tape and offset surveying
3. Levelling
4. The theodolite and its use
5. Electromagnetic distance measurement
6. Satellite positioning systems
7. Survey methods
8. Orientation and position
9. Analysis and adjustment of measurements

10. Areas and volumes
11. Controls and precision
12. Hydrographic surveying

Practical Work

Tape and offset surveying, Levelling, theodolite, Satellite positioning systems, Survey methods (Traversing, Triangulation, Total station instruments), Orientation and position, Areas and volumes

References

1. Davis, R. E., Foote, F., Kelly, J. W. (1966). *Surveying.* McGraw Hill Book Co., New York.
2. Bannister, A. and Raymond, S. (1998). *Surveying.* (7th Ed.) Longman Scientific & Technical, England.

PYAY UNIVERSITY

DEPARTMENT OF GEOLOGY

SYLLABUS FOR BSc DEGREE COURSE

BSc FOURTH YEAR

Geol 4101 STRATIGRAPHIC PRINCIPLES AND PRACTICE

1. Introduction: Scope; Historical development and principles; Uses.
2. Geologic Time and Geochronology: Development of Geologic time scale; Radiometric dating; Stratigraphic stages.
3. Stratigraphic procedures: Outcrop procedures; Subsurface procedures.
4. Stratigraphic Classification and Nomenclature: Dual classification; Modern classification; Code of stratigraphic nomenclature.
5. Sedimentary facies: Definitions; Concepts; Classification; Analysis; Importance.
6. Stratigraphic correlation: Principles and problems of lithostratigraphic and chronostratigraphic correlation
7. Stratigraphic maps: Classification; Procedures; Isopach and lithofacies maps; uses.

Practical Work and/or Tutorial

Practicals and/or Tutorials on selected lecture and related topics

References

1. Krumbein, W.C. & L. L. Sloss, (1963). *Stratigraphy and Sedimentation* (2nd. Ed.).
2. Stokes, W. L. (1966). *Essentials of Earth History: an introduction to historical Geology* (2nd Ed.)
3. Lemon, R. (1990). *Principles of Stratigraphy.*
4. Doyle, P. & M. R. Bennett (eds.) (1999). *Unlocking the Stratigraphic Records*

Geol 4102 GEOLOGY OF MYANMAR I

1. History of Geological investigation in Myanmar
2. Tectonic provinces and subprovinces
3. Neotectonics and earthquakes

4. Precambrian Geology
5. Lower Paleozoic Stratigraphy
6. Upper Paleozoic Stratigraphy

Practical Work

1. Exercises on stratigraphic symbols and chronographic colours
2. Systematic study and descriptions of Geological maps of selected areas in Myanmar

References

1. Chhibber, H. L. (1934). *Geology of Burma.*
2. Bender, F. (1984). *The Geology of Burma.*
3. Win Swe (2012). *A brief outline Geology and mineral resources of Myanmar*
4. Mg Thein (2010). *Summary of Geological History of Myanmar*

Geol 4103 ECONOMIC GEOLOGY

1. Brief history of Economic Geology.
2. Petrology of mineral deposits: Magmas, solutions and sediments.
3. Classification of mineral deposits.
4. Processes of formation of mineral deposits (with examples)
5. Occurrence of mineral deposits in relation to plate–tectonic settings.

Practical Work

Practicals on ore minerals

References

1. Jensen, M. L. & A. M. Bateman (1981). *Economic Mineral Deposits* (3rd Ed.)
2. Parks, C. F. & R. A. MacDiarmid (1964). *Ore Deposits.*

Geol 4104 PHOTOGEOLOGY AND REMOTE SENSING

1. Scope and Historical Background.
2. Different types of Aerial Photographs; Geometry of Vertical Aerial photographs; Definitions.

3. Basic Photogrammetry: scale; relief displacement; determination of ground co–ordinate; parallax; parallax equation; determination of slope.
4. Air–photo Interpretation: identification and interpretative criteria; interpretation of unconsolidated and consolidated materials; structural interpretation; preparation of photoGeological maps and stereo–pairs.
5. Introduction to Remote Sensing
6. Introduction to Geographic Information System

Practical Work

PhotoGeological interpretation of the aerial photographs from some selected areas of Myanmar.

References

1. Miller, V. C. & C. F. Miller (1961). *Photogeology.*
2. Leuder, D. R. (1959). *Aerial Photographic Interpretation.*
3. Lillesand, T.M. and R.W. Kiefer (1994). *Remote Sensing and Image Interpretation* (3rd Ed.)

Geol 4105 APPLIED GEOLOGY I (Engineering Geology & Hydrogeology)

Engineering Geology

1. Application of geology in field of engineering
2. Engineering properties of soil and rock for construction materials
3. Site investigation (Dam, Road, Building, Tunnel, Bridge)
4. Geological consideration on tunneling
5. Environmental consideration on construction of large dam, bridge & tunnel

Tutorial / Practical Work

Exercises on engineering geological problems

HydroGeology

1. Hydrologic cycle and individual hydrological processes
2. Origin and occurrence of groundwater
3. Geologic formation as aquifers

4. Rock properties affecting groundwater
5. Groundwater movement
6. Chemical characteristics of groundwater
7. Groundwater exploration

Tutorial /Practical Work

Exercises on hydrogeologic problems

References

1. Krynine, P. P., and W. R. Judd (1957). *Engineering Geology and Geotechnics*
2. Ringers, R. (1981). *Principles of Engineering Geology.* ITC Handbook, Enschede
3. Davis, S.N., and R. J. M. Dewest (1967). *HydroGeology*
4. Fletcher G Driscoll (1986) *Groundwater and Wells* (2nd Ed.)
5. M. L. Jat and S. R. Bhaker (2009) *Groundwater Hydrology*
6. David Keith Todd (2005) *Groundwater Hydrology* (3rd Ed.)

Geol 4106 HISTORICAL GEOLOGY

1. Definition and Scope
2. Stratigraphic chart
3. Beginning of Life and Precambrian Fossils
4. Historical Geology of Paleozoic Era
5. Historical Geology of Mesozoic Era
6. Historical Geology of Tertiary Period
7. Historical Geology of Quaternary Period

Tutorial

Tutorials on selected lecture and related topics

References

1. Stokes, W. L. (1966). *Essentials of Earth History: an introduction to historical Geology* (2nd Ed.)
2. Dunbar, C. O. (1963). *Historical Geology* (2nd Ed.)

Geol 4107 STATISTICAL GEOLOGY

1. Frequency Distributions: Histogram and frequency polygons; Relative frequency distributions; Cumulative frequency distribution

2. Analysis of variance
3. Correlation and regression; Dendrograms
4. The Chi–Square Test
5. Markov Chain Analysis

Tutorial

Tutorials on selected lecture and related topics

References

Spiegel, M. R. (1961) *Geostatistics,* Schaum's Outline Series

Geol 4108 MINERAL DEPOSITS OF MYANMAR

1. Mineral belts and mineral epochs of Myanmar
2. Tin–tungsten deposits
3. Lead–zinc–silver deposits
4. Nickel–chromium deposits
5. Copper deposits
6. Antimony deposits
7. Iron deposits
8. Gold deposits
9. Gemstone deposits
10. Major oil and gas fields
11. Coal deposits

Practical Work / Tutorial

Tutorials on selected lecture and related topics

References

1. Clegg, E. L. G., (1944). *Mineral Deposits of Burma*
2. Bender, F., (1983). *Geology of Burma*
3. United Nations., (1996). *Geology and Mineral Resources of Myanmar.* Atlas of Mineral Resources of the ESCAP Region V. 12
4. Win Swe (2012). *A brief outline Geology and mineral resources of Myanmar*

Geol 4109 GEOLOGY OF MYANMAR II

1. Mesozoic stratigraphy

2. Tertiary stratigraphy
3. Quaternary stratigraphy
4. Geological evolution of Myanmar

Practical Work

Systematic study and descriptions of Geological maps of selected areas in Myanmar

References

1. Chhibber, H. L. (1934). *Geology of Burma.*
2. Bender, F. (1984). *Geology of Burma.*
3. Maung Thein (2010). *Summary of the Geological History of Myanmar*
4. De Terra, H., (1943). *Pleistocene of Burma*
5. Chit Saing (1998) *Mesozoic and Tertiary Stratigraphy of Myanmar*
6. Win Swe (2012). *A brief outline Geology and mineral resources of Myanmar*

Geol 4110 EXPLORATION GEOLOGY

1. Exploration Sequences; Methods and techniques in mineral exploration; Exploration stages; Ore guides
2. Geological prospecting and exploration
3. Geochemical prospecting and exploration
4. Geophysical prospecting and exploration

Practical Work

Exercises on the uses, calculations and interpretations of Geological, geochemical, and geophysical data and information

References

1. Peters, W., (1985). *Exploration and Mining Geology*
2. Rose, A., H. E. Hawkes and J. S. Webb (1984). *Geochemistry in mineral exploration.*
3. Parasnis (1986) *Principles of Applied Geophysics* (4th Ed.)

Geol 4111 FIELD TRAINING COURSE

21–day compulsory field training in the designated field areas. Examination paper for the Geology of the field area is required.

Geol 4112 APPLIED GEOLOGY II (Petroleum Geology)

1. The Scope of Petroleum Geology
2. Physical and Chemical Properties of Petroleum
3. Methods of Exploration
4. Transformation of Hydrocarbons (Petroleum Systems): Origin; Migration; Petroleum accumulation
5. Traps and Seals: Seal and cap; Classification and types of trap; Stratigraphy of the basins
6. Reservoirs: Porosity and permeability; Reservoir correlations; Reserve calculation

Practical Work / Tutorial

Tutorials on selected lecture and related topics

References:

1. R. C. Selley (1998). *Elements of Petroleum Geology.* (2nd Ed.)

Geol 4113 GEMMOLOGY

1. Physical and optical properties of gem materials
2. Theory and use of instruments in gem–testing
3. Various methods used in gem identification
4. Enhancement of gemstones
5. Description of gemstones (with emphasis on precious stones)

Practical Work

1. Hand specimen identification
2. Identification of individual gemstones using various methods

References

1. Hurlbut, Jr., C. S. and R. C. Kammerling (1991) *Gemmology.* (2nd Ed.)

Geol 4114 QUATERNARY GEOLOGY

1. Definition, Scope and Concept of Quaternary Geology
2. Glacial and Interglacial periods; Pluvial and Interpluvial periods

3. European and American Stages
4. Paleoclimatic Phenomena
5. Sea–level Fluctuation
6. Quaternary Deposits
7. Dating for Quaternary Sediments

Tutorial

Tutorials on selected lecture and related topics

References

1. Flint R.F (1971) *Glacial and Quaternary Geology.*
2. Embleton, C. and C. A M King, (1969) *Glacial and Periglacial Morphology.*

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DEPARTMENT OF GEOLOGY

DISTRIBUTION OF MARKS FOR BSc DEGREE COURSE

BSc FIRST YEAR **SEMESTER I**

Sr	Module No.	Name of Module	Marks		
			Exam:	Tuto: / Prac.	Tot:
1	r 1001	Jrefrmpm	80	20	100
2	Eng 1001	English	80	20	100
3	Geol 1101	Principles of Geology I	80	20	100
4	Elective (1)	*	80	20	100
5	Elective (2)	*	80	20	100
6	Elective (3)	Aspects of Myanmar	80	20	100

BSc FIRST YEAR **SEMESTER II**

Sr	Module No.	Name of Module	Marks		
			Exam:	Tuto: / Prac.	Tot:
1	r 1002	Jrefrmpm	80	20	100
2	Eng 1002	English	80	20	100
3	Geol 1102	Principles of Geology II	80	20	100
4	Elective (1)	*	80	20	100
5	Elective (2)	*	80	20	100
6	Elective (3)	Aspects of Myanmar	80	20	100

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DEPARTMENT OF GEOLOGY

DISTRIBUTION OF MARKS FOR BSc DEGREE COURSE

BSc SECOND YEAR **SEMESTER I**

Sr	Module No.	Name of Module	Marks		
			Exam:	Tuto: / Prac.	Tot:
1	Eng 2001	English	80	20	100
2	Geol 2101	Elements of Mineralogy	80	20	100
3	Geol 2102	Structural Geology and Tectonics I	80	20	100
4	Geol 2103	Field Geology and Surveying	80	20	100
5	Elective (1)	**	80	20	100
6	Elective (2)	*	80	20	100

BSc SECOND YEAR **SEMESTER II**

Sr	Module No.	Name of Module	Marks		
			Exam:	Tuto: / Prac.	Tot:
1	Eng 2002	English	80	20	100
2	Geol 2105	Optical Mineralogy	80	20	100
3	Geol 2106	Structural Geology and Tectonics II	80	20	100
4	Geol 2107	Field Training Course (15 days)	40	60	100
5	Elective (1)	**	80	20	100

6	Elective (2)	*	80	20	100

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DISTRIBUTION OF MARKS FOR BSc DEGREE COURSE

BSc THIRD YEAR **SEMESTER I**

Sr	Module No.	Name of Module	Marks		
			Exam:	Tuto: / Prac.	Tot:
1	Eng 3001	English	80	20	100
2	Geol 3101	Igneous Petrology I	80	20	100
3	Geol 3102	Sedimentary Petrology I	80	20	100
4	Geol 3103	Invertebrate Paleontology I	80	20	100
5	Geol 3104	Metamorphic Petrology	80	20	100
6	Elective	*	80	20	100

BSc THIRD YEAR **SEMESTER II**

Sr	Module No.	Name of Module	Marks		
			Exam:	Tuto: / Prac.	Tot:
1	Eng 3002	English	80	20	100
2	Geol 3108	Igneous Petrology II	80	20	100
3	Geol 3109	Sedimentary Petrology II	80	20	100
4	Geol 3110	Invertebrate Paleontology II	80	20	100
5	Geol 3111	Field Training Course (21 days)	40	60	100
6	Elective	*	80	20	100

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DISTRIBUTION OF MARKS FOR BSc DEGREE COURSE

BSc FOURTH YEAR **SEMESTER I**

Sr	Module No.	Name of Module	Marks		
			Exam:	Tuto: / Prac.	Tot:
1	Eng 4001	English	80	20	100
2	Geol 4101	Stratigraphic Principles and Practice	80	20	100
3	Geol 4102	Geology of Myanmar I	80	20	100
4	Geol 4103	Economic Geology	80	20	100
5	Geol 4104	Photogeology and Remote sensing	80	20	100
6	Elective	*	80	20	100

BSc FOURTH YEAR **SEMESTER II**

Sr	Module No.	Name of Module	Marks		
			Exam:	Tuto: / Prac.	Tot:
1	Eng 4002	English	80	20	100
2	Geol 4108	Mineral Deposits of Myanmar	80	20	100
3	Geol 4109	Geology of Myanmar II	80	20	100
4	Geol 4110	Exploration Geology	80	20	100

5	Geol 4111	Field Training Course (21 days)	40	60	100
6	Elective	*	80	20	100

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DEPARTMENT OF GEOLOGY

SYLLABUS FOR BSc (HONOURS) DEGREE COURSE

BSc (HONS) FIRST YEAR **SEMESTER I**

Module No.	Module Name	Credit	Hours/week	
			Lecture	Prac/ Tuto
Eng 3001	English	3	2	2
Geol 3201	Igneous Petrology I	4	3	2
Geol 3202	Sedimentary Petrology I	4	3	2
Geol 3203	Invertebrate Paleontology I	4	3	2
Geol 3204	Metamorphic Petrology	4	3	2
Elective	*	3	2	2
Total		22	16	12

Total Credits – 22; Total hours – 28

Foundation Courses

Eng 3001 English

Core Courses

Geol 3201 Igneous Petrology I

Geol 3202 Sedimentary Petrology I

Geol 3203 Invertebrate Paleontology I

Geol 3204 Metamorphic Petrology

Elective Courses (Student may choose any **one** of the elective courses listed below)

Geol 3205 Principles of Geophysics

Geol 3206 Marine Geology I

Geol 3207 Geomorphology

Elective Courses for other specializations

Geol 3001 Paleontology I (for Anthropology)

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DEPARTMENT OF GEOLOGY

CURRICULUM FOR BSc (HONOURS) DEGREE COURSE

BSc (HONS) FIRST YEAR **SEMESTER II**

Module No.	Module Name	Credit	Hours/week	
			Lecture	Prac/ Tuto
Eng 3002	English	3	2	2
Geol 3208	Igneous Petrology II	4	3	2
Geol 3209	Sedimentary Petrology II	4	3	2
Geol 3210	Invertebrate Paleontology II	4	3	2
Geol 3211	Field Training Course (21 days)	4	3	2
Elective	*	3	2	2
Total		22	16	12

Total Credits – 22; Total hours – 28

Foundation Courses

Eng 3002 – English

Core Courses

Geol 3208 Igneous Petrology II

Geol 3209 Sedimentary Petrology II

Geol 3210 Invertebrate Paleontology II

Geol 3211 **Field Training Course** (21 days) (Compulsory for all students and to be conducted in the selected field site(s). Assessment is to be made in the field by judging field conduct, competency, etc. of students.)

Elective Courses (Student may choose any **one** of the elective courses listed below)

Geol 3212 Principles of Geochemistry

Geol 3213 Marine Geology II

Geol 3214 Advanced Surveying

Elective Courses for other specializations

Geol 3002 Paleontology II (for Anthropology)

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DEPARTMENT OF GEOLOGY

CURRICULUM FOR BSc (HONOURS) DEGREE COURSE

BSc (HONS) SECOND YEAR **SEMESTER I**

Module No.	Module Name	Credit	Hours/week	
			Lecture	Prac/ Tuto
Eng 4001	English	3	2	2
Geol 4201	Stratigraphic Principles and Practice	4	3	2
Geol 4202	Geology of Myanmar I	4	3	2
Geol 4203	Economic Geology	4	3	2
Geol 4204	Photogeology and Remote sensing	4	3	2
Elective	*	3	2	2
Total		22	16	12

Total Credits – 22; Total hours – 28

Foundation Courses

Eng 4001 English

Core Courses

Geol 4201 Stratigraphic Principles and Practice

Geol 4202 Geology of Myanmar I

Geol 4203 Economic Geology

Geol 4204 Photogeology and Remote sensing

Elective Courses (Student may choose any **one** of the elective courses listed below)

Geol 4205 Applied Geology I (Engineering Geology and Hydrogeology)

Geol 4206 Historical Geology

Geol 4207 Statistical Geology

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CURRICULUM FOR BSc (HONOURS) DEGREE COURSE

BSc (HONS) SECOND YEAR **SEMESTER II**

Module No.	Module Name	Credit	Hours/week	
			Lecture	Prac/ Tuto
Eng 4002	English	3	2	2
Geol 4208	Mineral Deposits of Myanmar	4	3	2
Geol 4209	Geology of Myanmar II	4	3	2
Geol 4210	Exploration Geology	4	3	2
Geol 4211	Field Training Course (21 days)	4	3	2
Elective	*	3	2	2
Total		22	16	12

Total Credits – 22; Total hours – 28

Foundation Courses

Eng 4002 English

Core Courses

Geol 4208 Mineral Deposits of Myanmar

Geol 4209 Geology of Myanmar II

Geol 4210 Exploration Geology

Geol 4211 **Field Training Course** (21 days) (Compulsory for all students and to be conducted in the selected field site(s). Assessment is to be made in the field by judging field conduct, competency, etc. of students.)

Elective Courses (Student may choose any **one** of the elective courses listed below)

Geol 4212 Applied Geology II (Petroleum Geology)

Geol 4213 Gemmology

Geol 4214 Quaternary Geology

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DEPARTMENT OF GEOLOGY

CURRICULUM FOR BSc (HONOURS) DEGREE COURSE

BSc (HONS) THIRD YEAR **SEMESTER I**

Module No.	Module Name	Credit	Hours/week	
			Lecture	Prac/ Tuto
Geol 5201	Optical Crystallography	4	3	2
Geol 5202	Principles of Petrology I	4	3	2
Geol 5203	Remote Sensing and GIS	4	3	2
Geol 5204	Regional and Global Tectonics	4	3	2
Geol 5205	Research Methodology I and Project Assignment	4	3	2
Geol 5206	Regional Stratigraphy of Selected Regions	4	3	2
Total		24	18	12

Total Credits – 24; Total hours – 30

Core Courses

Geol 5201 – Optical Crystallography

Geol 5202 – Principles of Petrology I

Geol 5203 – Remote Sensing and GIS

Geol 5204 – Regional and Global Tectonics

Geol 5205 – Research Methodology I and Project Assignment (one Assignment. with seminar presentation. Assessment is to be based on the submission of individual assignment paper and oral presentation.)

Geol 5206 – Regional Stratigraphy of Selected Regions

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DEPARTMENT OF GEOLOGY

CURRICULUM FOR BSc (HONOURS) DEGREE COURSE

BSc (HONS) THIRD YEAR **SEMESTER II**

Module No.	Module Name	Credit	Hours/week	
			Lecture	Prac/ Tuto
Geol 5207	Vertebrate Paleontology and Micropaleontology	4	3	2
Geol 5208	Principles of Petrology II	4	3	2
Geol 5209	Mining Geology	4	3	2
Geol 5210	Applied Geology III (Gemmology and Seismology)	4	3	2
Geol 5211	Research Methodology II & Project Assignment	4	3	2
Geol 5212	Field Training Course (30 days)	4	3	2
Total		24	18	12

Total Credits – 24; Total hours – 30

Core Courses

Geol 5207 – Vertebrate Paleontology and Micropaleontology

Geol 5208 – Principles of Petrology II

Geol 5209 – Mining Geology

Geol 5210 – Applied Geology III (Gemmology and Seismology)

Geol 5211 – Research Methodology II and Project Assignment (one Assignment. with seminar presentation. Assessment is to be based on the submission of individual assignment paper and oral presentation.)

Geol 5212 – **Field Training Course** (30 days) (Compulsory for all students and to be conducted in the selected field site(s). Assessment is to be made in the field by judging field conduct, competency, etc. of students.)

N.B. Term/Project paper must be submitted by each group not more than 10 students. Group paper presentation must be included.

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DEPARTMENT OF GEOLOGY

CURRICULUM FOR MSc (QUALIFYING) COURSE

MSc (QUALIFYING) **SEMESTER I**

Module No.	Module Name	Credit	Hours/week	
			Lecture	Prac/ Tuto
Geol 5201	Optical Crystallography	4	3	2
Geol 5202	Principles of Petrology I	4	3	2
Geol 5203	Remote Sensing and GIS	4	3	2
Geol 5204	Regional and Global Tectonics	4	3	2
Geol 5205	Research Methodology I and Project Assignment	4	3	2
Geol 5206	Regional Stratigraphy of Selected Regions	4	3	2
Total		24	18	12

Total Credits – 24; Total hours – 30

Core Courses

Geol 5201 – Optical Crystallography

Geol 5202 – Principles of Petrology I

Geol 5203 – Remote Sensing and GIS

Geol 5204 – Regional and Global Tectonics

Geol 5205 – Research Methodology I and Project Assignment (one Assignment. with seminar presentation. Assessment is to be based on the submission of individual assignment paper and oral presentation.)

Geol 5206 – Regional Stratigraphy of Selected Regions

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DEPARTMENT OF GEOLOGY

CURRICULUM FOR MSc (QUALIFYING) COURSE

MSc (QUALIFYING) **SEMESTER II**

Module No.	Module Name	Credit	Hours/week	
			Lecture	Prac/ Tuto
Geol 5207	Vertebrate Paleontology and Micropaleontology	4	3	2
Geol 5208	Principles of Petrology II	4	3	2
Geol 5209	Mining Geology	4	3	2
Geol 5210	Applied Geology III (Gemmology and Seismology)	4	3	2
Geol 5211	Research Methodology II & Project Assignment	4	3	2
Geol 5212	Field Training Course (30 days)	4	3	2
Total		24	18	12

Total Credits – 24; Total hours – 30

Core Courses

Geol 5207 – Vertebrate Paleontology and Micropaleontology

Geol 5208 – Principles of Petrology II

Geol 5209 – Mining Geology

Geol 5210 – Applied Geology III (Gemmology and Seismology)

Geol 5211 – Research Methodology II and Project Assignment (one Assignment. with seminar presentation. Assessment is to be based on the submission of individual assignment paper and oral presentation.)

Geol 5212 – Field Training Course (30 days) (Compulsory for all students and to be conducted in the selected field site(s). Assessment is to be made in the field by judging field conduct, competency, etc. of students.)

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DEPARTMENT OF GEOLOGY

SYLLABUS FOR BSc (HONOURS) DEGREE COURSE

BSc (HONS) FIRST YEAR

Geol 3201 IGNEOUS PETROLOGY I

1. Introduction
2. Magmatic processes: stages in magmatic consolidation; fractional crystallization and Bowen's reaction series
3. Igneous structures and field relationships
4. Textures and microstructures of igneous rocks
5. IUGS classifications of igneous rocks

Practical Work

1. Megascopic petrography of igneous rocks of Myanmar.
2. Textures and microstructures of igneous rocks in thin section.

References

1. Williams, H, F. J. Turner & C. M. Gilbert (1954). *Petrography.*
2. Hatch, F. H., A.K. Wells & M. K. Wells (1972). *Petrology of the Igneous Rocks* (3rd Ed.)
3. Hyndman, D. W., (1985). *Petrology of Igneous and Metamorphic Rocks.* (2nd Ed.)
4. Winter, J. D. (2001). *An Introduction to Igneous and Metamorphic Petrology.*

Geol 3202 SEDIMENTARY PETROLOGY I

1. Introduction; Scope; History; Uses
2. Processes of sedimentation; Weathering; Erosion; Transportation; Deposition and Depositional Environments; Post–depositional Changes.
3. Properties of sediments: Composition; Textures; Structures; Mass properties
4. Products of sedimentation; Classification of sedimentary rocks

Practical Work

1. Megascopic petrography of common sedimentary rocks
2. Size frequency distribution
3. Microscopic study of clastic sedimentary rocks

References

1. Pettijohn, F. J. (1975). *Sedimentary Rocks* (3rd Ed.)
2. Williams, H., F.J. Turner & C.M. Gilbert (1954). *Petrography*
3. Reineck, H. E. and I. B. Singh (1980). *Depositional Sedimentary Environment with References to Terrigeneous clastics*. (Second Revised and Update Edition)
4. Blatt, H., G. Middleton, R. Murray (1980) *Origin of Sedimentary Rocks* (2nd Ed.)
5. Tucker, H. E. (1991) *Sedimentary Petrology* (2nd Ed.)

Geol 3203 INVERTEBRATE PALEONTOLOGY I

1. Introduction, meaning and scope.
2. Fossils and fossilization.
3. Systematics and Nomenclature
4. Systematic study of phyla Protozoa, Porifera, Coelenterata, Bryozoa, Graptolithina, mentioning general features, morphological characteristics, classification, paleoecology, and stratigraphic significance.

Practical Work

1. Types of fossilization
2. Identification and systematic description of selected important genera of phyla Protozoa, Porifera, Coelenterata, Bryozoa and Graptolithina.

References

1. Shrock , R. R., & W. H. Twenhofel (1953). *Principles of Invertebrate Paleontology*
2. Moore, R. C., C. G. Lalicker & A. G. Fischer, (1952). *Invertebrate Fossils*
3. Easton, W. H. (1960). *Invertebrate Paleontology*
4. Clarkson, E. N. K. (1993). *Invertebrate Paleontology and Evolution* (3rd Ed.)

Geol 3204 METAMORPHIC PETROLOGY

1. Introduction: Scope; History
2. Metamorphism: Agents; Processes; Types
3. Textures and structures of metamorphic rocks
4. Classification of metamorphic rocks
5. Metamorphic grades, zones and facies

6. Metamorphism of pelitic, quartzo–feldspathic, calcareous, magnesian, and basic rocks
7. Relationship between regional metamorphism and tectonism
8. Metamorphic belts and epochs of Myanmar

Practical works

1. Megascopic petrography of common metamorphic rocks
2. Textures of metamorphic rocks
3. Microscopic petrology of common metamorphic rocks

References

1. Williams, H, F. J. Turner & C. M. Gilbert (1954). *Petrography.*
2. Winter, J. D. (2001). *An Introduction to Igneous and Metamorphic Petrology.*
3. Hyndman, D. W., (1985). *Petrology of Igneous and Metamorphic Rocks* (2nd Ed.)
4. Raymond, L. A (1995). *Petrology (Igneous, Sedimentary, Metamorphic Rocks).*
5. Yardley, B. W. D (1983). *An Introduction to Metamorphic Petrology.*

Geol 3205 PRINCIPLES OF GEOPHYSICS

1. Introduction to Geophysics: Physical properties of rocks and minerals; Classification of geophysical methods; The geophysical model; Direct and indirect applications; Ambiguity in interpretation.
2. The basic principles and practices in gravity method, Magnetic method, Electrical method, Resistivity methods, Electromagnetic methods, Induced Polarization method, Radioactive method, Seismic method.

Tutorial / Practical Work

Tutorial on subfields of geophysics; Petrophysical properties; Principles of geophysics; Geophysical methods.

References

1. Parasnis (1986). *Principles of Applied Geophysics.* (4th Ed.)
2. Howell, A. K. *Introduction to Geophysics*

Geol 3206 MARINE GEOLOGY I

1. Overview and history of marine geology; Internal structures of the earth; The earth's gravity field; The earth's magnetic field.

2. Ocean Morphology and Geophysics: The continental margin; The oceanic ridges; Fracture zones; The ocean–basin floor; Marginal trenches; Seismic reflection; Seismic refraction.
3. Ocean Basin Tectonics: Principal features of ocean spreading centres; Principal features of ocean subduction zones.
4. Study of continental margins: passive continental margins (Rift); Active continental margins (Accretionary prisms).
5. Submarine and Island arc volcanoes.

Tutorial

Ocean morphology, Ocean basin tectonics, Continental margins

References

1. Kennet, J. P. (1982). *Marine Geology*. (2nd Ed.) New York, Prentice Hall
2. Seibold, E., and Berger, W. H., (1996). *The Sea Floor : An Introduction to Marine Geology*, Springer–Verlag. (3rd Ed.)
3. Duxbury A. C. and A. B. Duxbury (1984). *An Introduction to World's Oceans*. (2nd Ed.)
4. Erickson. J. (2003). *Marine Geology: Exploring the New Frontiers of the Ocean.*

Geol 3207 GEOMORPHOLOGY

1. Basic concepts of geomorphology: Scale; processes; Structural influences; Climate; People as geomorphic agents.
2. Fluvial processes and their landforms: Streams and valleys; Drainage patterns; Stream meandering; Fluvial cycles; River terraces; Peneplain concept.
3. Tectonic and structural landforms; Landforms controlled by faults; Landforms controlled by folds.
4. Karst landforms: Surface landforms; Subsurface caves and springs; Karst evolution.
5. Coastal processes and landforms: Tides, waves and currents; Eustatic sea–level changes; Erosional and depositional landforms of coasts; Deltas and estuaries; Continental shelves and submarine canyons.
6. Paleogeomorphology: Relict landforms; Burried landforms; Exhumed landforms.

7. Applied geomorphology: Application to hydrology; Application to economic geology; Application to engineering projects; Application to oil exploration.

Practical Work

1. Interpretation of topographic maps for the purpose of geologic information.
2. Interpretation of air–photographs and geological maps.

References

1. Thornbury, W.D. (1969). *Principles of Geomorphology* (2nd Ed.)
2. Selby, M.J. (1985). *Earth's Changing Surface; An Introduction to Geomorphology.*

Geol 3208 IGNEOUS PETROLOGY II

1. Petrography of various clans of the acid, intermediate, basic and ultramafic groups, pyroclastic rocks and lamprophyres
2. Igneous associations at various plate boundaries
3. A brief account of igneous activity in Myanmar
4. Major granitoid belts of Myanmar
5. The Central Igneous Belt

Practical Work

Microscopic petrology of igneous rocks of Myanmar.

References

1. Williams, H, F. J. Turner & C. M. Gilbert (1954). *Petrography.*
2. Hatch, F. H., A.K. Wells & M. K. Wells (1972). *Petrology of the Igneous Rocks* (3rd Ed.)
3. Winter, J. D. (2001). *An Introduction to Igneous and Metamorphic Petrology.*

Geol 3209 SEDIMENTARY PETROLOGY II

1. Clastic sedimentary rocks: Conglomerates and breccias; Sandstones; Siltstones; Shales.
2. Chemical and organic sedimentary rocks: Limestones; Dolomites and dolomitization; Chert; Evaporites; Iron formations
3. Depositional environments and facies of alluvial, deltaic, shallow marine (with tempestite and tsunamites), deep sea, and pelagic sedimentation.

Practical Work

1. Megascopic petrography of common sedimentary rocks
2. Microscopic petrology of clastic and carbonate sedimentary rocks

References

1. Pettijohn, F. J. (1975). *Sedimentary Rocks.* (3rd. Ed.)
2. Williams, H., F.J. Turner & C.M. Gilbert (1954). *Petrography*
3. Reineck, H. E. and I. B. Singh (1980). *Depositional Sedimentary Environment with References to Terrigeneous clastic* (Second Revised and Update Edition)
4. Blatt, H., G. Middleton, R. Murray (1980). *Origin of Sedimentary Rocks* (2nd Ed.)
5. Tucker, H. E. (1991) *Sedimentary Petrology* (2nd Ed.)

Geol 3210 INVERTEBRATE PALEONTOLOGY II

1. Systematic study of phyla Echinodermata; Arthropoda; Brachiopoda; and Mollusca; mentioning general features; morphological characteristics; classification; paleoecology; and stratigraphic importance.
2. Introduction to trace fossils.

Practical Work

Study of morphological features, identification and systematic description of selected important genera of phyla Echinodermata, Arthropoda, Brachiopoda and Mollusca.

References

1. Shrock, R. R., & W. H. Twenhofel (1953). *Principles of Invertebrate Paleontology*
2. Moore, R. C., C. G. Lalicker & A. G. Fischer, (1952). *Invertebrate Fossils*
3. Easton, W. H. (1960). *Invertebrate Paleontology*
4. Clarkson, E. N. K. (1993). *Invertebrate Paleontology and Evolution*, (3rd Ed.)

Geol 3211 FIELD TRAINING COURSE

21–day compulsory field training in the designated field areas. Examination paper for the Geology of the field area is required.

Geol 3212 PRINCIPLES OF GEOCHEMISTRY

1. Composition of the earth and its relation to the universe

2. Some thermodynamics and crystal and isotopes chemistry
3. The role of geochemical processes in magmatism; Sedimentation and metamorphism;
4. The geochemical nature of the atmosphere, hydrosphere, and biosphere
5. The geochemical cycle
6. Introduction to exploration geochemistry

Tutorial Work

Tutorial works on crystal and isotopes chemistry, Geochemical processes, Atmosphere, Hydrosphere, and Biosphere, Geochemical cycle, Exploration geochemistry.

References

1. Mason, B., (1990). *Principles of Geochemistry*. (4th Ed.)

Geol 3213 MARINE GEOLOGY II

1. The oceanic crust: Structure; Petrology and sources of oceanic crust; Deep–sea drilling data, Evidence from ophiolite complexes.
2. Sea–level history and seismic stratigraphy
   - The Importance of sea–level change and its causes
   - Quaternary sea–level history
   - Sedimentary cycles
   - Seismic stratigraphy
3. Coastal geology; Marine sedimentation and erosional processes.
4. Introduction to ocean sediments: Calcareous sediments; Siliceous sediments; Nature and distribution of sediments in continental Shelf, Slope and abyssal plain.

Tutorial

Tutorials on the oceanic crust, Sea–level history and seismic stratigraphy, Coastal geology, and ocean sediments

References

1. Kennet, J. P. (1982). *Marine Geology*. (2nd Ed.). New York, Prentice Hall
2. Seibold, E., and, W. H. Berger, (1996). *The Sea Floor: An Introduction to Marine Geology*. (3rd Ed.)

3. Duxbury, A, C. and A. B. Duxbury (1984). *An Introduction to World's Oceans*. (2nd Ed.)
4. Erickson. J. (2003). *Marine Geology: Exploring the New Frontiers of the Ocean.*

Geol 3214 ADVANCED SURVEYING

1.Surveying fundamentals
2.Tape and offset surveying
3.Levelling
4.The theodolite and its use
5.Electromagnetic distance measurement
6.Satellite positioning systems
7.Survey methods
8.Orientation and position
9.Analysis and adjustment of measurements
10. Areas and volumes
11. Controls and precision
12. Hydrographic surveying

Practical Work

Tape and offset surveying, Levelling, theodolite, Satellite positioning systems, Survey methods (Traversing, Triangulation, Total station instruments), Orientation and position, Areas and volumes

References

1. Davis, R. E., Foote, F., Kelly, J. W. (1966). *Surveying.* McGraw Hill Book Co., New York.
2. Bannister, A. and Raymond, S. (1998). *Surveying.* (7th Ed.) Longman Scientific & Technical, England.

PYAY UNIVERSITY

DEPARTMENT OF GEOLOGY

SYLLABUS FOR BSc (HONOURS) DEGREE COURSE

BSc (HONS) SECOND YEAR

Geol 4201 STRATIGRAPHIC PRINCIPLES AND PRACTICE

1. Introduction: Scope; Historical development and principles; Uses.
2. Geologic Time and Geochronology: Development of Geologic time scale; Radiometric dating; Stratigraphic stages.
3. Stratigraphic procedures: Outcrop procedures; Subsurface procedures.
4. Stratigraphic Classification and Nomenclature: Dual classification; Modern classification; Code of stratigraphic nomenclature.
5. Sedimentary facies: Definitions; Concepts; Classification; Analysis; Importance.
6. Stratigraphic correlation: Principles and problems of lithostratigraphic and chronostratigraphic correlation
7. Stratigraphic maps: Classification; Procedures; Isopach and lithofacies maps; uses.

Practical Work and/or Tutorial

Practicals and/or Tutorials on selected lecture and related topics

References

1. Krumbein, W.C. & L. L. Sloss, (1963). *Stratigraphy and Sedimentation* (2nd. Ed.).
2. Stokes, W. L. (1966). *Essentials of Earth History: an introduction to historical Geology* (2nd Ed.)
3. Lemon, R. (1990). *Principles of Stratigraphy.*
4. Doyle, P. & M. R. Bennett (eds.) (1999). *Unlocking the Stratigraphic Records*

Geol 4202 GEOLOGY OF MYANMAR I

1. History of Geological investigation in Myanmar
2. Tectonic provinces and subprovinces
3. Neotectonics and earthquakes
4. Precambrian Geology
5. Lower Paleozoic Stratigraphy

6. Upper Paleozoic Stratigraphy

Practical Work

1. Exercises on stratigraphic symbols and chronographic colours
2. Systematic study and descriptions of Geological maps of selected areas in Myanmar

References

1. Chhibber, H. L. (1934). *Geology of Burma.*
2. Bender, F. (1984). *The Geology of Burma.*
3. Win Swe (2012). *A brief outline Geology and mineral resources of Myanmar*
4. Mg Thein (2010). *Summary of Geological History of Myanmar*

Geol 4203 ECONOMIC GEOLOGY

1. Brief history of Economic Geology.
2. Petrology of mineral deposits: Magmas, solutions and sediments.
3. Classification of mineral deposits.
4. Processes of formation of mineral deposits (with examples)
5. Occurrence of mineral deposits in relation to plate–tectonic settings.

Practical Work

Practicals on ore minerals

References

1. Jensen, M. L. & A. M. Bateman (1981). *Economic Mineral Deposits* (3rd Ed.)
2. Parks, C. F. & R. A. MacDiarmid (1964). *Ore Deposits.*

Geol 4204 PHOTOGEOLOGY AND REMOTE SENSING

1. Scope and Historical Background.
2. Different types of Aerial Photographs; Geometry of Vertical Aerial photographs; Definitions.
3. Basic Photogrammetry: scale; relief displacement; determination of ground co–ordinate; parallax; parallax equation; determination of slope.
4. Air–photo Interpretation: identification and interpretative criteria; interpretation of unconsolidated and consolidated materials; structural interpretation; preparation of photoGeological maps and stereo–pairs.
5. Introduction to Remote Sensing

6. Introduction to Geographic Information System

Practical Work

PhotoGeological interpretation of the aerial photographs from some selected areas of Myanmar.

References

1. Miller, V. C. & C. F. Miller (1961). *Photogeology.*
2. Leuder, D. R. (1959). *Aerial Photographic Interpretation.*
3. Lillesand, T.M. and R.W. Kiefer (1994). *Remote Sensing and Image Interpretation* (3rd Ed.)

Geol 4205 APPLIED GEOLOGY I (Engineering Geology & Hydrogeology)

Engineering Geology

1. Application of geology in field of engineering
2. Engineering properties of soil and rock for construction materials
3. Site investigation (Dam, Road, Building, Tunnel, Bridge)
4. Geological consideration on tunneling
5. Environmental consideration on construction of large dam, bridge & tunnel

Tutorial / Practical Work

Exercises on engineering geological problems

HydroGeology

1. Hydrologic cycle and individual hydrological processes
2. Origin and occurrence of groundwater
3. Geologic formation as aquifers
4. Rock properties affecting groundwater
5. Groundwater movement
6. Chemical characteristics of groundwater
7. Groundwater exploration

Tutorial /Practical Work

Exercises on hydrogeologic problems

References

1. Krynine, P. P., and W. R. Judd (1957). *Engineering Geology and Geotechnics*

2. Ringers, R. (1981). *Principles of Engineering Geology.* ITC Handbook, Enschede
3. Davis, S.N., and R. J. M. Dewest (1967). *HydroGeology*
4. Fletcher G Driscoll (1986) *Groundwater and Wells* (2nd Ed.)
5. M. L. Jat and S. R. Bhaker (2009) *Groundwater Hydrology*
6. David Keith Todd (2005) *Groundwater Hydrology* (3rd Ed.)

Geol 4206 HISTORICAL GEOLOGY

1. Definition and Scope
2. Stratigraphic chart
3. Beginning of Life and Precambrian Fossils
4. Historical Geology of Paleozoic Era
5. Historical Geology of Mesozoic Era
6. Historical Geology of Tertiary Period
7. Historical Geology of Quaternary Period

Tutorial

Tutorials on selected lecture and related topics

References

1. Stokes, W. L. (1966). *Essentials of Earth History: an introduction to historical Geology* (2nd Ed.)
2. Dunbar, C. O. (1963). *Historical Geology* (2nd Ed.)

Geol 4207 STATISTICAL GEOLOGY

1. Frequency Distributions: Histogram and frequency polygons; Relative frequency distributions; Cumulative frequency distribution
2. Analysis of variance
3. Correlation and regression; Dendrograms
4. The Chi–Square Test
5. Markov Chain Analysis

Tutorial

Tutorials on selected lecture and related topics

References

Spiegel, M. R. (1961) *Geostatistics,* Schaum's Outline Series

Geol 4208 MINERAL DEPOSITS OF MYANMAR

1. Mineral belts and mineral epochs of Myanmar
2. Tin–tungsten deposits
3. Lead–zinc–silver deposits
4. Nickel–chromium deposits
5. Copper deposits
6. Antimony deposits
7. Iron deposits
8. Gold deposits
9. Gemstone deposits
10. Major oil and gas fields
11. Coal deposits

Practical Work / Tutorial

Tutorials on selected lecture and related topics

References

1. Clegg, E. L. G., (1944). *Mineral Deposits of Burma*
2. Bender, F., (1983). *Geology of Burma*
3. United Nations., (1996). *Geology and Mineral Resources of Myanmar.* Atlas of Mineral Resources of the ESCAP Region V. 12
4. Win Swe (2012). *A brief outline Geology and mineral resources of Myanmar*

Geol 4209 GEOLOGY OF MYANMAR II

1. Mesozoic stratigraphy
2. Tertiary stratigraphy
3. Quaternary stratigraphy
4. Geological evolution of Myanmar

Practical Work

Systematic study and descriptions of Geological maps of selected areas in Myanmar

References

1. Chhibber, H. L. (1934). *Geology of Burma.*
2. Bender, F. (1984). *Geology of Burma.*
3. Maung Thein (2010). *Summary of the Geological History of Myanmar*
4. De Terra, H., (1943). *Pleistocene of Burma*
5. Chit Saing (1998) *Mesozoic and Tertiary Stratigraphy of Myanmar*

6. Win Swe (2012). *A brief outline Geology and mineral resources of Myanmar*

Geol 4210 EXPLORATION GEOLOGY

1. Exploration Sequences; Methods and techniques in mineral exploration; Exploration stages; Ore guides
2. Geological prospecting and exploration
3. Geochemical prospecting and exploration
4. Geophysical prospecting and exploration

Practical Work

Exercises on the uses, calculations and interpretations of Geological, geochemical, and geophysical data and information

References

1. Peters, W., (1985). *Exploration and Mining Geology*
2. Rose, A., H. E. Hawkes and J. S. Webb (1984). *Geochemistry in mineral exploration.*
3. Parasnis (1986) *Principles of Applied Geophysics* (4th Ed.)

Geol 4211 FIELD TRAINING COURSE

21–day compulsory field training in the designated field areas. Examination paper for the Geology of the field area is required.

Geol 4212 APPLIED GEOLOGY II (Petroleum Geology)

1. The Scope of Petroleum Geology
2. Physical and Chemical Properties of Petroleum
3. Methods of Exploration
4. Transformation of Hydrocarbons (Petroleum Systems): Origin; Migration; Petroleum accumulation
5. Traps and Seals: Seal and cap; Classification and types of trap; Stratigraphy of the basins
6. Reservoirs: Porosity and permeability; Reservoir correlations; Reserve calculation

Practical Work / Tutorial

Tutorials on selected lecture and related topics

References:

2. R. C. Selley (1998). *Elements of Petroleum Geology.* (2nd Ed.)

Geol 4213 GEMMOLOGY

1. Physical and optical properties of gem materials
2. Theory and use of instruments in gem–testing
3. Various methods used in gem identification
4. Enhancement of gemstones
5. Description of gemstones (with emphasis on precious stones)

Practical Work

1. Hand specimen identification
2. Identification of individual gemstones using various methods

References

1. Hurlbut, Jr., C. S. and R. C. Kammerling (1991) *Gemmology.* (2nd Ed.)

Geol 4214 QUATERNARY GEOLOGY

1. Definition, Scope and Concept of Quaternary Geology
2. Glacial and Interglacial periods; Pluvial and Interpluvial periods
3. European and American Stages
4. Paleoclimatic Phenomena
5. Sea–level Fluctuation
6. Quaternary Deposits
7. Dating for Quaternary Sediments

Tutorial

Tutorials on selected lecture and related topics

References

1. Flint R.F (1971) *Glacial and Quaternary Geology.*
2. Embleton, C. and C. A M King, (1969) *Glacial and Periglacial Morphology.*

PYAY UNIVERSITY

DEPARTMENT OF GEOLOGY

SYLLABUS FOR BSc (HONOURS) DEGREE COURSE

BSc (HONS) THIRD YEAR

Geol 5201 OPTICAL CRYSTALLOGRAPHY

1. Review of optical properties of minerals under the orthoscope
2. Optical properties of minerals under the conoscope
3. Uniaxial Minerals Wave–velocity surfaces, optical indicatrix, interference figures, optic sign
4. Biaxial Minerals: Wave velocity surfaces, optical indicatrix, interference figures, optic sign, and optic angle.
5. Interference colours in relation to thickness and optical orientation; Uses of colour chart.
6. Optical orientation of biaxial minerals; Construction of orientation diagrams.

Practical Work

1. Orthoscope and conoscope.
2. Uniaxial minerals under the conoscope : interference figures, determination of optic sign.
3. Biaxial minerals under the conoscope: interference figures, determination of optic sign and optic angle.
4. Exercise on optical orientation diagrams.

References

1. Kerr, P.F. (1977). *Optical Mineralogy* . (4th Ed.).
2. Wahlstrom, E.E. (1969). *Optical Crystallography*. (4th Ed.).

Geol 5202 PRINCIPLES OF PETROLOGY I

Igneous Petrology

1. Modern classifications of igneous rocks
2. Heterogeneous equilibria (Phase diagrams and magmatic crystallization)
3. Petrographic modal analysis
4. Norms and Norm Calculation
5. Genetic types of granite
6. Granitoid Rocks of Myanmar

7. Ophiolite Belts of Myanmar

Metamorphic Petrology

1. Review on metamorphic facies
2. Metamorphic facies and facies series
3. Plate tectonics and metamorphism
4. Some examples of metamorphic regions in Myanmar
   - Mogok Metamorphic Belt
   - Shantaung U–Thandawmyat Range

Practical Work

1. Modal analysis by point counting
2. Norm calculation
3. Exercises on lithologic associations
4. Systematic microscopic petrography of selected igneous and metamorphic rocks from Myanmar

References

1. Hyndman, D. W. (1985). *Petrology of Igneous and Metamorphic Rocks.* (2nd Ed.)
2. Winkler H.G.F(1979). *Petrogenesis of Metamorphic Rocks*

Geol 5203 REMOTE SENSING AND GIS

1. Historical background; Means of obtaining remote–sensing information
2. Basic principles: Spectrum and spectral characteristics; Passive and active remote sensing
3. Sensors and Sensor platforms
4. The Landsat system; Application and results
5. Spectral signatures of the terrain objects
6. Spectral analysis of the terrain objects from black–and–white images and false–colour images
7. Remote–sensing application in mineral exploration
8. Analysis of Geological structures from satellite images
9. Geographic Information System: Basic principles and procedures

Practical Work

1. Interpretation of satellite images and preparation of Geological maps.

2. Exercises on G.I.S

References

1. Lillesand, T.M. and R.W. Kiefer (1994). *Remote Sensing and Image Interpretation* (3rd Ed.)
2. Barett, E.C and L.F Curtis (1976) *Introduction to Environmental Remote Sensing*

Geol 5204 REGIONAL AND GLOBAL TECTONICS

1. New developments in plate–tectonic theory
2. Types of continental margins
3. Concept of accreted terranes
4. Plate tectonics and mineralization
5. A brief account of tectonics of Southeast Asia
6. Geodynamics of India–Asia Collision

Tutorial Work

Tutorials on selected lecture and related topics

References

1. Cox, A. and R. B. Hart, (1986). *Plate Tectonics: How It Works*
2. Shia, J. H. (Ed.) (1985). *Plate Tectonics.*
3. Hutchison, C.S. (1989). *Geological Evolution of Southeast Asia.*
4. GIAC (1999). Report on Geodynamics of India– Asia Collision

Geol 5205 RESEARCH METHODOLOGY I AND PROJECT ASSIGNMENT

Research Methodology I

1. Basic concepts and Approaches
2. Data collection and Analysis

Project Assignment

Project assignment for each student to write papers on the assigned topics in the following fields of study: Mineralogy, Igneous and Metamorphic Petrology, Sedimentology, Paleontology, Structural Geology, Economic Geology, Myanmar Geology. Seminar presentations and examination for the papers submitted are required.

References

1. Myanmar Academy of Art and Science (2002). *Research Method in Art and Science.*

Geol 5206 REGIONAL STRATIGRAPHY OF SELECTED REGIONS

1. Regional stratigraphy of South India and the Himalayas.
2. Regional stratigraphy of Thailand
3. Regional stratigraphy of Yunnan
4. Tertiary stratigraphy of Assam and Indonesia

Practical/Tutorial Work

Systematic study and descriptions of selected Geological maps from the neighboring countries/ Tutorials on selected lecture and related topics

References

1. Wadia, D. N. (1966). *Geology of India*
2. Hutchison, C. S. (1989). *Geological Evolution of Southeast Asia* (2nd Ed.)

Geol 5207 VERTEBRATE PALEONTOLOGY AND MICROPALEONTOLOGY

Vertebrate Paleontology

1. Definition; Evolution of the vertebrates; Lower vertebrates (Ostracoderms); Fishes (Chondrichthyes, Ostichthyes); Amphibians;
2. Reptiles; Mammals; Primates (Lower primates, Higher primates); Evolution of Man.

Micropaleontology

1. Scope and definition; Brief accounts on various groups of microfossils.
2. The Study of Foraminifers: Morphology and structures of foraminifers; Ecology and paleoecology; Stratigraphic distribution and economic uses;
3. Systematic study of some important foraminifera groups.

Practical Work

1. Systematic study of important vertebrate fossil groups
2. Systematic study of important microfossil groups

References:

1. Romer, A. S. (1966). *Vertebrate Paleontology* (3rd Ed.)
2. Glaessner, M.F. (1974). *Principles of Micropaleontology*

3. Moore, R. C., C. G. Lalicker & A. G. Fischer, (1952). *Invertebrate Fossils*
4. Clarkson, E. N. K. (1993). *Invertebrate Paleontology and Evolution* (3rd Ed.)
5. Robert L. Carroll (1988). *Vertebrate Paleontology and Evolution*.
6. Fleagle, J. G. (1999). *Primate Adaptation and Evolution* (2nd Ed.)
7. Neild, E. W. and Tucker, V. C. T. (1992). *Paleontology: An Introduction.*

Geol 5208 PRINCIPLES OF PETROLOGY II

Sedimentology

1. Common sedimentary environments and facies (Both clastics and Carbonates)
2. Clastic rocks: Petrography and origin of principal sandstone type
3. Sandstone composition, provenances and tectonic setting
4. Carbonate rocks: Petrography
5. Clay minerals
6. Mud rocks

Practical Work

Microscopic study of clastic and carbonate rocks
Mechanical analysis of clastic rocks

References

1. Pettijohn, F. J. (1975). *Sedimentary Rocks* (3rd Ed.)
2. Williams, H., F.J. Turner & C.M. Gilbert (1954). *Petrography*
3. Reineck, H. E. and I. B. Singh (1980) *Depositional Sedimentary Environment with References to Terrigeneous clastics,* (Second Revised and Update Edition)
4. Blatt, H., G. Middleton, R. Murray (1980) *Origin of Sedimentary Rocks* (2nd Ed.)
5. Tucker, H. E. (1991) *Sedimentary Petrology* (2nd Ed.)
6. Wilson (1975) *Carbonate Facies in Geologic History.*

Geol 5209 MINING GEOLOGY

1. Resource and reserve: classification of reserves by U. S. G. S. and Ministry of Mines, Myanmar.
2. Drilling in mineral exploration: types of drills, Geologist's responsibilities.

3. Sampling and ore reserve estimation: sampling techniques; methods of ore reserve estimation.
4. Definitions of mining terms.
5. Introduction to mining methods.
6. Basic principles of mineral dressing

Practical Work and Tutorials

1. Averaging assays.
2. Ore reserve calculations.
3. Tutorials on selected lecture and related topics

References

1. Peters, W. C.(1985). *Exploration and Mining Geology*
2. Rose, A., H. E. Hawkes and J. S. Webb (1984). *Geochemistry in mineral exploration*
3. McKinstry, H. (1960). *Mining Geology.*

Geol 5210 APPLIED GEOLOGY III (Gemmology and Seismology)

Gemmology

1. Definition of Gem Minerals
2. Physical and Optical Properties of Gem Minerals
3. Principles and Applications of Gem Testing Instruments
4. Gem Testing Methods
5. Description and Identification of Gemstones (Precious and Assorted Gems)

Practical Work

1. Identification of rough gemstones with hand lens
2. Identification of gemstones with gem testing instruments

References

1. Hurlbut, Jr., C.S. and Kammerling, R. C. (1991) *Gemmology.* (2nd Ed.)

Seismology

1. History of seismology
2. Earthquake geography and plate tectonics
3. Causes of earthquakes: earthquake sources

4. Seismic waves
5. Measuring earthquakes: epicentre and magnitudes
6. Seismic gap hypothesis
7. Prediction of earthquakes
8. Review of earthquake hazards in Myanmar
9. Mitigation of earthquake hazards in Myanmar
10. Introduction to earthquake engineering

Practical Work/ Tutorial

1. Determination of earthquake epicentre and magnitude
2. Exercises on seismic zoning
3. Tutorials on selected lecture and related topics

References

1. Bolts, B. A. (1993).. **Earthquakes**
2. Yeats, R. S., Seih, K. and Allen, C. R. (1997). *The Geology of Earthquakes.*
3. Kramer, S. L. (1996). *Geotechnical Earthquake Engineering.*
4. Maung Thein (2011). Earthquakes in Myanmar, Vol. 1 & 2.

Geol 5211 RESEARCH METHODOLOGY II AND PROJECT ASSIGNMENT

Research Methodology II

Methods for Geologic Mapping, Petrologic, Stratigraphic and Paleontologic Research.

Project Assignment

Project assignments for each student to write papers on the assigned topics in the following fields of study: Mineralogy, Igneous and Metamorphic Petrology, Sedimentology, Paleontology, Structural Geology, Economic Geology, Myanmar Geology. Seminar presentation and examination for the papers submitted are required.

Geol 5212 FIELD TRAINING COURSE

30–day compulsory field training in the designated field areas. Examination paper for the Geology of the field area is required.

PYAY UNIVERSITY

DEPARTMENT OF GEOLOGY

SYLLABUS FOR MSc (QUALIFYING) COURSE

MSc (QUALIFYING) COURSE

Geol 5201 OPTICAL CRYSTALLOGRAPHY

1. Review of optical properties of minerals under the orthoscope
2. Optical properties of minerals under the conoscope
3. Uniaxial Minerals Wave–velocity surfaces, optical indicatrix, interference figures, optic sign
4. Biaxial Minerals: Wave velocity surfaces, optical indicatrix, interference figures, optic sign, and optic angle.
5. Interference colours in relation to thickness and optical orientation; Uses of colour chart.
6. Optical orientation of biaxial minerals; Construction of orientation diagrams.

Practical Work

1. Orthoscope and conoscope.
2. Uniaxial minerals under the conoscope : interference figures, determination of optic sign.
3. Biaxial minerals under the conoscope: interference figures, determination of optic sign and optic angle.
4. Exercise on optical orientation diagrams.

References

1. Kerr, P.F. (1977). *Optical Mineralogy* . (4th Ed.).
2. Wahlstrom, E.E. (1969). *Optical Crystallography*. (4th Ed.).

Geol 5202 PRINCIPLES OF PETROLOGY I

Igneous Petrology

1. Modern classifications of igneous rocks
2. Heterogeneous equilibria (Phase diagrams and magmatic crystallization)
3. Petrographic modal analysis
4. Norms and Norm Calculation
5. Genetic types of granite
6. Granitoid Rocks of Myanmar

7. Ophiolite Belts of Myanmar

Metamorphic Petrology

1. Review on metamorphic facies
2. Metamorphic facies and facies series
3. Plate tectonics and metamorphism
4. Some examples of metamorphic regions in Myanmar
   - Mogok Metamorphic Belt
   - Shantaung U–Thandawmyat Range

Practical Work

1. Modal analysis by point counting
2. Norm calculation
3. Exercises on lithologic associations
4. Systematic microscopic petrography of selected igneous and metamorphic rocks from Myanmar

References

1. Hyndman, D. W. (1985). *Petrology of Igneous and Metamorphic Rocks.* (2nd Ed.)
2. Winkler H.G.F(1979). *Petrogenesis of Metamorphic Rocks*

Geol 5203 REMOTE SENSING AND GIS

1. Historical background; Means of obtaining remote–sensing information
2. Basic principles: Spectrum and spectral characteristics; Passive and active remote sensing
3. Sensors and Sensor platforms
4. The Landsat system; Application and results
5. Spectral signatures of the terrain objects
6. Spectral analysis of the terrain objects from black–and–white images and false–colour images
7. Remote–sensing application in mineral exploration
8. Analysis of Geological structures from satellite images
9. Geographic Information System: Basic principles and procedures

Practical Work

1. Interpretation of satellite images and preparation of Geological maps.

2. Exercises on G.I.S

References

1. Lillesand, T.M. and R.W. Kiefer (1994). *Remote Sensing and Image Interpretation* (3rd Ed.)
2. Barett, E.C and L.F Curtis (1976) *Introduction to Environmental Remote Sensing*

Geol 5204 REGIONAL AND GLOBAL TECTONICS

1. New developments in plate–tectonic theory
2. Types of continental margins
3. Concept of accreted terranes
4. Plate tectonics and mineralization
5. A brief account of tectonics of Southeast Asia
6. Geodynamics of India–Asia Collision

Tutorial Work

Tutorials on selected lecture and related topics

References

1. Cox, A. and R. B. Hart, (1986). *Plate Tectonics: How It Works*
2. Shia, J. H. (Ed.) (1985). *Plate Tectonics.*
3. Hutchison, C.S. (1989). *Geological Evolution of Southeast Asia.*
4. GIAC (1999). Report on Geodynamics of India– Asia Collision

Geol 5205 RESEARCH METHODOLOGY I AND PROJECT ASSIGNMENT

Research Methodology I

1. Basic concepts and Approaches

2.Data collection and Analysis

Project Assignment

Project assignment for each student to write papers on the assigned topics in the following fields of study: Mineralogy, Igneous and Metamorphic Petrology, Sedimentology, Paleontology, Structural Geology, Economic Geology, Myanmar Geology. Seminar presentations and examination for the papers submitted are required.

References

1. Myanmar Academy of Art and Science (2002). *Research Method in Art and Science.*

Geol 5206 REGIONAL STRATIGRAPHY OF SELECTED REGIONS

1. Regional stratigraphy of South India and the Himalayas.
2. Regional stratigraphy of Thailand
3. Regional stratigraphy of Yunnan
4. Tertiary stratigraphy of Assam and Indonesia

Practical/Tutorial Work

1. Systematic study and descriptions of selected Geological maps from the neighboring countries/ Tutorials on selected lecture and related topics

References

1. Wadia, D. N. (1966). *Geology of India*
2. Hutchison, C. S. (1989). *Geological Evolution of Southeast Asia* (2nd Ed.)

Geol 5207 VERTEBRATE PALEONTOLOGY AND MICROPALEONTOLOGY

Vertebrate Paleontology

1. Definition; Evolution of the vertebrates; Lower vertebrates (Ostracoderms); Fishes (Chondrichthyes, Ostichthyes); Amphibians;
2. Reptiles; Mammals; Primates (Lower primates, Higher primates); Evolution of Man.

Micropaleontology

1. Scope and definition; Brief accounts on various groups of microfossils.
2. The Study of Foraminifers: Morphology and structures of foraminifers; Ecology and paleoecology; Stratigraphic distribution and economic uses;
3. Systematic study of some important foraminifera groups.

Practical Work

1. Systematic study of important vertebrate fossil groups
2. Systematic study of important microfossil groups

References:

1. Romer, A. S. (1966). *Vertebrate Paleontology* (3rd Ed.)
2. Glaessner, M.F. (1974). *Principles of Micropaleontology*

3. Moore, R. C., C. G. Lalicker & A. G. Fischer, (1952). *Invertebrate Fossils*
4. Clarkson, E. N. K. (1993). *Invertebrate Paleontology and Evolution* (3rd Ed.)
5. Robert L. Carroll (1988). *Vertebrate Paleontology and Evolution*.
6. Fleagle, J. G. (1999). *Primate Adaptation and Evolution* (2nd Ed.)
7. Neild, E. W. and Tucker, V. C. T. (1992). *Paleontology: An Introduction.*

Geol 5208 PRINCIPLES OF PETROLOGY II

Sedimentology

1. Common sedimentary environments and facies (Both clastics and Carbonates)
2. Clastic rocks: Petrography and origin of principal sandstone type
3. Sandstone composition, provenances and tectonic setting
4. Carbonate rocks: Petrography
5. Clay minerals
6. Mud rocks

Practical Work

1. Microscopic study of clastic and carbonate rocks
2. Mechanical analysis of clastic rocks

References

1. Pettijohn, F. J. (1975). *Sedimentary Rocks* (3rd Ed.)
2. Williams, H., F.J. Turner & C.M. Gilbert (1954). *Petrography*
3. Reineck, H. E. and I. B. Singh (1980) *Depositional Sedimentary Environment with References to Terrigeneous clastics,* (Second Revised and Update Edition)
4. Blatt, H., G. Middleton, R. Murray (1980) *Origin of Sedimentary Rocks* (2nd Ed.)
5. Tucker, H. E. (1991) *Sedimentary Petrology* (2nd Ed.)
6. Wilson (1975) *Carbonate Facies in Geologic History.*

Geol 5209 MINING GEOLOGY

1. Resource and reserve: classification of reserves by U. S. G. S. and Ministry of Mines, Myanmar.
2. Drilling in mineral exploration: types of drills, Geologist's responsibilities.

3. Sampling and ore reserve estimation: sampling techniques; methods of ore reserve estimation.
4. Definitions of mining terms.
5. Introduction to mining methods.
6. Basic principles of mineral dressing

Practical Work and Tutorials

1. Averaging assays.
2. Ore reserve calculations.
3. Tutorials on selected lecture and related topics

References

1. Peters, W. C.(1985). *Exploration and Mining Geology*
2. Rose, A., H. E. Hawkes and J. S. Webb (1984). *Geochemistry in mineral exploration*
3. McKinstry, H. (1960). *Mining Geology.*

Geol 5210 APPLIED GEOLOGY III (Gemmology and Seismology)

Gemmology

1. Definition of Gem Minerals
2. Physical and Optical Properties of Gem Minerals
3. Principles and Applications of Gem Testing Instruments
4. Gem Testing Methods
5. Description and Identification of Gemstones (Precious and Assorted Gems)

Practical Work

1. Identification of rough gemstones with hand lens
2. Identification of gemstones with gem testing instruments

References

1. Hurlbut, Jr., C.S. and Kammerling, R. C. (1991) *Gemmology.* (2nd Ed.)

Seismology

1. History of seismology
2. Earthquake geography and plate tectonics
3. Causes of earthquakes: earthquake sources

4. Seismic waves
5. Measuring earthquakes: epicentre and magnitudes
6. Seismic gap hypothesis
7. Prediction of earthquakes
8. Review of earthquake hazards in Myanmar
9. Mitigation of earthquake hazards in Myanmar
10. Introduction to earthquake engineering

Practical Work/ Tutorial

1. Determination of earthquake epicentre and magnitude
2. Exercises on seismic zoning
3. Tutorials on selected lecture and related topics

References

1. Bolts, B. A. (1993).. **Earthquakes**
2. Yeats, R. S., Seih, K. and Allen, C. R. (1997). *The Geology of Earthquakes.*
3. Kramer, S. L. (1996). *Geotechnical Earthquake Engineering.*
4. Maung Thein (2011). Earthquakes in Myanmar, Vol. 1 & 2.

Geol 5211 RESEARCH METHODOLOGY II AND PROJECT ASSIGNMENT

Research Methodology II

1. Methods for Geologic Mapping, Petrologic, Stratigraphic and Paleontologic Research.

Project Assignment

Project assignments for each student to write papers on the assigned topics in the following fields of study: Mineralogy, Igneous and Metamorphic Petrology, Sedimentology, Paleontology, Structural Geology, Economic Geology, Myanmar Geology. Seminar presentation and examination for the papers submitted are required.

Geol 5212 FIELD TRAINING COURSE

30–day compulsory field training in the designated field areas. Examination paper for the Geology of the field area is required.

PYAY UNIVERSITY

DEPARTMENT OF GEOLOGY

DISTRIBUTION OF MARKS FOR BSc (HONOURS) DEGREE COURSE

BSc (HONS) FIRST YEAR **SEMESTER I**

Sr	Module No.	Name of Module	Marks		
			Exam:	Tuto: / Prac.	Tot:
1	Eng 3001	English	80	20	100
2	Geol 3201	Igneous Petrology I	80	20	100
3	Geol 3202	Sedimentary Petrology I	80	20	100
4	Geol 3203	Invertebrate Paleontology I	80	20	100
5	Geol 3204	Metamorphic Petrology	80	20	100
6	Elective	*	80	20	100

BSc (HONS) FIRST YEAR **SEMESTER II**

Sr	Module No.	Name of Module	Marks		
			Exam:	Tuto: / Prac.	Tot:
1	Eng 3002	English	80	20	100
2	Geol 3208	Igneous Petrology II	80	20	100
3	Geol 3209	Sedimentary Petrology II	80	20	100
4	Geol 3210	Invertebrate Paleontology II	80	20	100
5	Geol 3211	Field Training Course (21 days)	40	60	100
6	Elective	*	80	20	100

PYAY UNIVERSITY

DEPARTMENT OF GEOLOGY

DISTRIBUTION OF MARKS FOR BSc (HONOURS) DEGREE COURSE

BSc (HONS) SECOND YEAR **SEMESTER I**

Sr	Module No.	Name of Module	Marks		
			Exam:	Tuto: / Prac.	Tot:
1	Eng 4001	English	80	20	100
2	Geol 4201	Stratigraphic Principles and Practice	80	20	100
3	Geol 4202	Geology of Myanmar I	80	20	100
4	Geol 4203	Economic Geology	80	20	100
5	Geol 4204	Photogeology and Remote sensing	80	20	100
6	Elective	*	80	20	100

BSc (HONS) SECOND YEAR **SEMESTER II**

Sr	Module No.	Name of Module	Marks		
			Exam:	Tuto: / Prac.	Tot:
1	Eng 4002	English	80	20	100
2	Geol 4208	Mineral Deposits of Myanmar	80	20	100
3	Geol 4209	Geology of Myanmar II	80	20	100
4	Geol 4210	Exploration Geology	80	20	100
5	Geol 4211	Field Training Course (21 days)	40	60	100

6	Elective	*	80	20	100

PYAY UNIVERSITY

DEPARTMENT OF GEOLOGY

DISTRIBUTION OF MARKS FOR BSc (HONOURS) DEGREE COURSE

BSc (HONS) THIRD YEAR **SEMESTER I**

Sr	Module No.	Name of Module	Marks		
			Exam:	Tuto: / Prac.	Tot:
1	Geol 5201	Optical Crystallography	80	20	100
2	Geol 5202	Principles of Petrology I	80	20	100
3	Geol 5203	Remote Sensing and GIS	80	20	100
4	Geol 5204	Regional and Global Tectonics	80	20	100
5	Geol 5205	Research Methodology I and Project Assignment	40	60	100
6	Geol 5206	Regional Stratigraphy of Selected Regions	80	20	100

BSc (HONS) THIRD YEAR **SEMESTER II**

Sr	Module No.	Name of Module	Marks		
			Exam:	Tuto: / Prac.	Tot:
1	Geol 5207	Vertebrate Paleontology and Micropaleontology	80	20	100
2	Geol 5208	Principles of Petrology II	80	20	100
3	Geol 5209	Mining Geology	80	20	100
4	Geol 5210	Applied Geology III (Gemmology and Seismology)	80	20	100
5	Geol 5211	Research Methodology II & Project Assignment	40	60	100

6	Geol 5212	Field Training Course (30 days)	40	60	100

PYAY UNIVERSITY

DEPARTMENT OF GEOLOGY

DISTRIBUTION OF MARKS FOR MSc (QUALIFYING) COURSE

MSc (QUALIFYING) COURSE **SEMESTER I**

Sr	Module No.	Name of Module	Marks		
			Exam:	Tuto: / Prac.	Tot:
1	Geol 5201	Optical Crystallography	80	20	100
2	Geol 5202	Principles of Petrology I	80	20	100
3	Geol 5203	Remote Sensing and GIS	80	20	100
4	Geol 5204	Regional and Global Tectonics	80	20	100
5	Geol 5205	Research Methodology I and Project Assignment	40	60	100
6	Geol 5206	Regional Stratigraphy of Selected Regions	80	20	100

MSc (QUALIFYING) COURSE **SEMESTER II**

Sr	Module No.	Name of Module	Marks		
			Exam:	Tuto: / Prac.	Tot:
1	Geol 5207	Vertebrate Paleontology and Micropaleontology	80	20	100
2	Geol 5208	Principles of Petrology II	80	20	100
3	Geol 5209	Mining Geology	80	20	100
4	Geol 5210	Applied Geology III (Gemmology and Seismology)	80	20	100

5	Geol 5211	Research Methodology II & Project Assignment	40	60	100
6	Geol 5212	Field Training Course (30 days)	40	60	100

PYAY UNIVERSITY

DEPARTMENT OF GEOLOGY

FREE ELECTIVE COURSES

OFFERED BY THE DEPARTMENT OF GEOLOGY

(for B.A. / B Sc Degree other than Geology Major)

First Year (B.A. / BSc) Semester I

Geol 1001 – General Geology I (for Physics, Nuclear Physics, Mathematics, Chemistry, Industrial Chemistry, Botany, Zoology, Geography)

Geol 1002 – Introduction to Petrology (for Archaeology)

First Year (B.A. / BSc) Semester II

Geol 1003 – General Geology II (for Physics, Nuclear Physics, Mathematics, Chemistry, Industrial Chemistry, Botany, Zoology, Geography)

Geol 1004 – Vertebrate Paleontology (for Archaeology)

Second Year (B.A.) Semester I

Geol 2001 – Outline Geology of Myanmar I (for Geography and Archaeology)

Second Year (B.A.) Semester II

Geol 2002 – Outline Geology of Myanmar II (for Geography and Archaeology)

Third Year (B.A.) and 1st Year (B.A. Hons.) Semester I

Geol 3001 – Paleontology I: General Vertebrate Paleontology (for Anthropology)

Third Year (B.A.) and 1st Year (B.A. Hons.) Semester II

Geol 3002 – Paleontology II: Human Paleontology (for Anthropology)

PYAY UNIVERSITY

DEPARTMENT OF GEOLOGY

FREE ELECTIVE COURSES

OFFERED FROM THE DEPARTMENT OF GEOLOGY

(for B.A. / BSc Degree other than Geology Major)

FIRST YEAR

Geol 1001 GENERAL GEOLOGY I

1. The Earth: Geology and its uses; The Earth's internal structure and composition, age, and origin.
2. Earth Materials: Minerals and their properties; Common rock–forming minerals; Common ore minerals; Igneous rocks; Sedimentary rocks; Metamorphic rocks; The rock cycle.

Practical Work

Mineral properties; Common rock–forming and ore minerals; Common igneous, sedimentary and metamorphic rocks; Topographic maps

References

1.Skinner, B.J. & S.C. Potter (1992). *The Dynamic Earth* (2nd Ed.)

2.Foster, R.J. (1988). *General Geology* (5th Ed.)

3.a'gufwmOD;odef; (1978)? taxGaxGblrdaA'

Geol 1002 INTRODUCTION TO PETROLOGY (for B.A. Archaeology)

1. Mineral: Definition, Types, Physical properties, Common rock–forming minerals.
2. Igneous rocks: Formation, Mode of occurrence, Structure, Texture, Classification, Common igneous rocks.

3.Sedimentary rocks: Formation, Sedimentary structures, Texture, Classification, Common sedimentary rocks, Sedimentary environments.

4.Metamorphic rocks: Agents and types of metamorphism, Structure, Texture, Classification, Grade of metamorphism, Common metamorphic rocks.

5.Comparison of three major rock types, Rock Cycle, Chemical weathering of rocks.

Practical Work

1. Study of common rock–forming minerals, megascopic petrograpgy of common igneous, sedimentary and metamorphic rocks.

References

1. Williams, H., Turner, F. J. & C. M. Gilbert (1982). *Petrography* (2nd Ed.).
2. Pettijohn, F. J. (1975). *Sedimentary Rocks*. (3rd Ed.).
3.Tarbuck, E. J. & F. K. Lutgens (1990). *The Earth.* (3rd. Ed.)

Geol 1003 GENERAL GEOLOGY II

1.Earth Processes:

External Geological Processes: Weathering; Geological works of running water, groundwater, mass movements, the sea, wind and ice.

Internal Geological Processes: Volcanism; Seismicity; Orogeny; Plate Tectonics.

2. Geological Structures: Folds; Faults; Joints: Unconformities;
3. Earth History: Radiometric Dating; Geologic Time Scale; Fossils and Fossilization; Evolution of life.
4. Earth Resources: Mineral Deposits; Fossil Fuels; Brief account of mineral deposits of Myanmar.

Practical Work

1.Block diagrams; Geological Maps

References

1.Skinner, B.J. & S.C. Potter (1992), *The Dynamic Earth* (2nd Ed.)
2.Foster, R.J. (1988), *General Geology* (5th Ed.)
3.a'gufwmOD;odef; (1978)? taxGaxGblrdaA'

Geol 1004 VERTEBRATE PALEONTOLOGY (for B.A. Archaeology)

1. Introduction, Classification of vertebrates, Geological time scale.

2.Mammals: Primitive mammals, Proboscideans, Rhinocerotidae, Bovidae, Suidae.

3.Human Paleontology: Anthropoid primates of Pondaung, Other anthropoids (*Dryopithecus*, *Sivapithecus*, *Australopithecus*), Human fossils (*Homo habilis*, *Homo erectus, Homo sapiens neanderthalensis, Homo sapiens sapiens*), Evolution of man.

Practical Work

1.Systematic studies of selected vertebrate fossils

References

1. Romer, A. S. (1966) *Vertebrate Paleontology*

SECOND YEAR

Geol 2001 OUTLINE GEOLOGY OF MYANMAR I (for 2nd year B A Geography and 2nd year B A Archaeology)

1.Tectonic provinces and subprovinces of Myanmar.

2.Earthquakes in Myanmar.

3.Brief accounts of Precambrian and Paleozoic Geology of Myanmar.

Practical Work

1. Geological maps, Systematic studies of Geological maps of selected areas of Myanmar.

References

1.Chhibber, H. L. (1934) *Geology of Burma*

2.Bender, F. (1984) *Geology of Burma*

3.United Nations (1996) Geology and Mineral Resources of Myanmar. *Atlas of Mineral Resources of the ESCAP Region,* Vol. 2.

Geol 2002 OUTLINE GEOLOGY OF MYANMAR II (for 2nd year B.A. Geography and 2nd year B.A Archaeology)

1. Brief accounts of Mesozoic and Cenozoic Geology of Myanmar.
2. Brief Geological history of Myanmar
3. Mineral resources of Myanmar: Mineral belts, some well–known mines and major oil and gas fields.

Practical Work

1. Systematic studies of Geological maps of selected areas of Myanmar.

References

1. Chhibber, H. L. (1934). *Geology of Burma.*
2. Bender, F. (1984). *Geology of Burma.*
3.United Nations (1996). Geology and Mineral Resources of Myanmar. *Atlas of Mineral Resources of the ESCAP Region,* Vol. 2.

THIRD YEAR & FIRST YEAR (HONS)

Geol 3001 PALEONTOLOGY I (for Anthropology)

General Vertebrate Paleontology

1. Introduction; Classification of vertebrates; Geological timescale
2. Mammals: Primitive mammals; Proboscideans; Rhinocerotidae; Bovidae; Suidae

Practical Work

1.Systematic studies of selected vertebrate fossils

References

1.Rome, A. S., (1966) *Vertebrate Paleontology*

Geol 3002 Paleontology II (for Anthropology)

Human Paleontology

1. Human Paleontology: Anthropoid primates of Pondaung; Other anthropoids (*Dryopithecus*, *Sivapithecus*, *Australopithecus*), Human fossils (*Homo habilis*, *Homo erectus, Homo sapiens neanderthalensis, Homo sapiens sapiens*); Evolution of man.

Practical Work

1.Systematic studies of Pondaung primate and other anthropoid fossils

References

1.Rome, A. S., (1966) *Vertebrate Paleontology*

PYAY UNIVERSITY

DEPARTMENT OF GEOLOGY

DISTRIBUTION OF MARKS FOR ELECTIVE COURSES FOR OTHER SPECIALIZATIONS

B.A. / BSc FIRST YEAR **SEMESTER I**

Module No.	Name of Module	Marks		
		Exam:	Tuto: / Prac.	Tot:
Geol 1001	General Geology I	80	20	100
Geol 1002	Introduction to Petrology	80	20	100

B.A. / BSc FIRST YEAR **SEMESTER II**

Module No.	Name of Module	Marks		
		Exam:	Tuto: / Prac.	Tot:
Geol 1003	General Geology II	80	20	100
Geol 1004	Vertebrate Paleontology	80	20	100

PYAY UNIVERSITY

DEPARTMENT OF GEOLOGY

DISTRIBUTION OF MARKS FOR ELECTIVE COURSES FOR OTHER SPECIALIZATIONS

B.A. SECOND YEAR **SEMESTER I**

Module No.	Name of Module	Marks		
		Exam:	Tuto: / Prac.	Tot:
Geol 2001	Outline Geology of Myanmar I	80	20	100

B.A. SECOND YEAR **SEMESTER II**

Module No.	Name of Module	Marks		
		Exam:	Tuto: / Prac.	Tot:
Geol 2002	Outline Geology of Myanmar II	80	20	100

PYAY UNIVERSITY

DEPARTMENT OF GEOLOGY

DISTRIBUTION OF MARKS FOR ELECTIVE COURSES FOR OTHER SPECIALIZATIONS

B.A. THIRD YEAR & B.A. (HONS) FIRST YEAR **SEMESTER I**

Module No.	Name of Module	Marks		
		Exam:	Tuto: / Prac.	Tot:
Geol 3001	Paleontology I	80	20	100

B.A. THIRD YEAR & B.A. (HONS) FIRST YEAR **SEMESTER II**

Module No.	Name of Module	Marks		
		Exam:	Tuto: / Prac.	Tot:
Geol 3002	Paleontology II	80	20	100