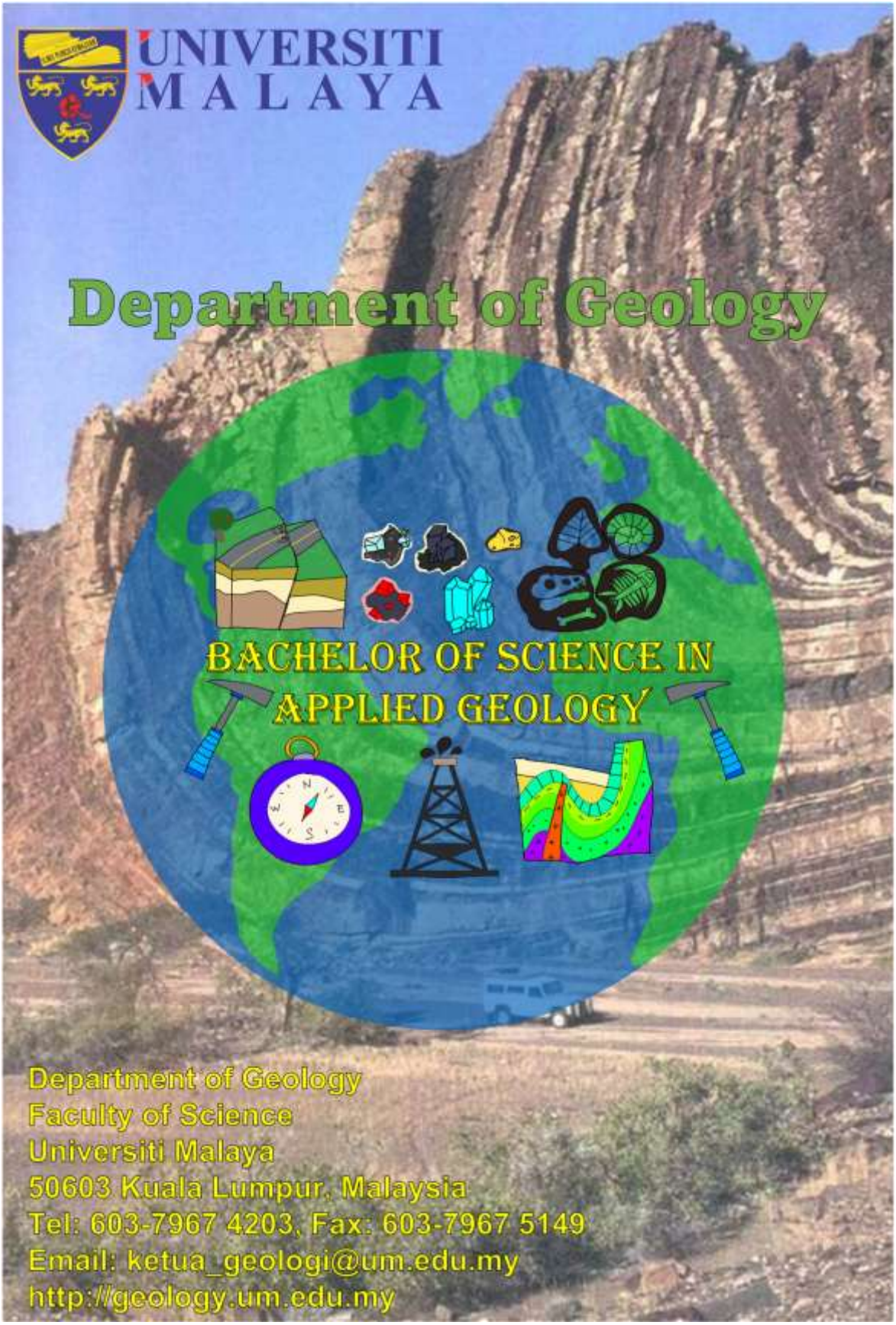
UNIVERSITI
MALAYA
Department of Geology
BACHELOR OF SCIENCE IN
APPLIED GEOLOGY
Department of Geology
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BACHELOR OF SCIENCE IN APPLIED GEOLOGY
ACADEMIC SESSION 2022/2023
(134 CREDITS)

1. UNIVERSITY COURSES (14 CREDITS)

COURSE CODE	COURSE NAME	CREDIT
GIG1012/ GLT1017	Philosophy and Current Issues/ Basic Malay Language (only for international students)	2
GIG1013	Appreciation of Ethics and Civilisations	2
GIG1003	Basic Entrepreneurship Culture	2
GLT^{xxxx}	English Language	4
GKA/GKI/GKK/ GKP/GKS/GKU 1001	Co-Curriculum	4

2. CORE PROGRAMME COURSES (80 CREDITS)

(I) FACULTY CORE COURSES (8 CREDITS) [TF]

COURSE CODE	COURSE NAME	PRE-REQUISITE	CREDIT
SIC1006	Computer Programming for the Sciences		3
SIX1015	Science, Technology and Society		2
SIX1016	Statistics		3

(II) PROGRAMME CORE COURSES (72 CREDITS) [TP]

LEVEL 1 (14 CREDITS)

COURSE CODE	COURSE NAME	PRE-REQUISITE	CREDIT
SII1001	Introduction to the Earth		2
SII1002	Earth surface processes		2
SII1003	Geological Structures and Maps		3
SII1004	Mineralogy		3
SII1005	Fundamental of Field Geology		2
SII1006	Safety and Geology Code of Practice		2
LEVEL 2 (36 CREDITS)			
SII2002	Applied Geology Field Course	*SII1005*	8
SII2003	Structural Geology	*SII1003*	3
SII2004	Sedimentology	*SII1002*	4
SII2005	Igneous and Metamorphic Petrology	*SII1004*	3
SII2006	Palaeontology	*SII1001 & SII1002*	3
SII2007	Introduction to Geophysics	*SII1001 & SII1002*	3
SII2008	Geology and Community	*SII1001 & SII1002*	3
SII2009	Geochemistry	*SII1001 & SII1004*	3
SII2010	GIS Applications in Geosciences	*SII1003*	3
SII2011	Geology Laboratory Analytical Techniques	*SII1004*	3
LEVEL 3 (22 CREDITS)			
SII3009	Mineral Resources	*SII1004*	3
SII3010	Geology Research Project	*SII2002 & SII2011*	8
SII3011	Geology of Malaysia	*SII1001*	3
SII3012	Industrial Attachment	*SII2002 & SII2011*	8

3. ELECTIVE COURSES (40 CREDITS)

(I) ELECTIVE STUDENT HOLISTIC EMPOWERMENT (8 CREDITS)
**** ONE course MUST be taken from each cluster**

CLUSTER		COURSE CODE	CREDIT
Cluster 1	Thinking Matters: Mind & Intelect		2
Cluster 2	Emotional & Spiritual Intelligence: Heart & Soul		2
Cluster 3	Technology/Artificial Intelligence and Data Analytics: I-technie		2
Cluster 4	Global Issue and Community Sustainability: Making the World A Better Place		2

(II) PROGRAMME ELECTIVE COURSES (32 CREDITS) [EP]			
LEVEL 2			
COURSE CODE	**COURSE NAME**	**PRE-REQUISITE**	**CREDIT**
SII2012	Geological Data Analysis	*SIX1016*	3
SII2013	Marine Geology	*SII1002*	2
SII2014	Karst Geomorphology and Conservations	*SII1002*	2
SII2015	Climate Change and Adaptation	*SII1002*	3
SII2016	Engineering Geology	*SII1003*	3
SII2017	Earth Water Resources	*SII1002*	3
SII2018	Environmental Geology	*SII1001*	3
LEVEL 3			
SII3013	Advanced Geophysics	*SII2007*	3
SII3014	Geohazard	*SII1001*	3
SII3015	Quaternary Geology	*SII1002*	3
SII3016	Stratigraphic Methods	*SII2004*	3
SII3017	Geology of South East Asia	*SII3017*	2
SII3018	Petroleum Geology	*SII2004*	4
SII3019	Organic Petrology	*SII2004*	3
SII3020	Industrial Minerals	*SII3009*	2
SII3021	Tectonics and Earth History	*SII2006*	2
SII3022	Mineral and Mining Exploration	*SII2009*	3
SII3023	Geological Site Investigation	SII2016	2
SII3024	Unconventional Oil and Gas Resources	SII2004	3
SIM1001	Basic Mathematics		4
SIM1002	Calculus I		4

PROGRAM EDUCATION OBJECTIVE

The education objectives of B.Sc. in Applied Geology program are to produce graduates who are:

1. Professional in the practice of geology and related fields.
2. Involved in lifelong learning activities for the development of personal knowledge whether in the academic or industrial field.
3. Contribute to the development and well-being of society.

PROGRAM LEARNING OUTCOME

At the end of the program, the graduate with a B.Sc. in Applied Geology degree will be able to: -

1. Acquire and apply basic geological concepts and principles in geological practice.
2. Demonstrate intellectuality and professionalism in the application of knowledge in solving geological problems.
3. Use appropriate methods and practical skills in the planning and implementation of geological projects.
4. Manage and deliver information clearly and effectively, orally and in written form, as well as be a responsible and productive team member.
5. Use digital technology and mathematical knowledge to improve the quality of geological practice.
6. Demonstrate leadership, independence and responsibility in the workplace and in the classroom.
7. Engage effectively in community activities or explore entrepeneurial opportunities.
8. Ethical and maintain integrity in geological practice.

LIST OF COURSES ACCORDING TO SEMESTER
(PLANNING OF COURSES)
BACHELOR OF SCIENCE IN APPLIED GEOLOGY

COMPONENT	YEAR 1						TOTAL CREDIT
	SEMESTER 1			SEMESTER 2			
	CODE	COURSE NAME	CREDIT	CODE	COURSE NAME	CREDIT	
University Courses	GIG1012/ GLT1017	Philosophy and Current Issues / Basic Malay Language*	2	GKA/GKI/ GKK/ GKP/GKS/ GKU1001	Co-Curriculum	2	**12**
	GIG1013	Appreciation of Ethics and Civilisations	2	GIG1003	Basic Entrepreneurship Culture	2	
	GLT^{xxxx}	English Language	2	GLT^{xxxx}	English Language	2	
Core Courses	SIX1016	Statistics	3	SIX1015	Science, Technology and Society	2	**22**
	SII1001	Introduction to the Earth	2	SIC1006	Computer Programming for the Sciences	3	
	SII1002	Earth surface processes	2	SII1004	Mineralogy	3	
	SII1003	Geological Structures and Maps	3	SII1005	Fundamental of Field Geology	2	
				SII1006	Safety and Geology Code of Practice	2	
Elective Courses		Student Holistic Empowerment (SHE) Cluster 1: Thinking Matters: Mind & Intellect	2				**2**
TOTAL CREDIT			**18**			**18**	**36**

COMPONENT	YEAR 2						TOTAL CREDIT
	SEMESTER 1			SEMESTER 2			
	CODE	COURSE NAME	CREDIT	CODE	COURSE NAME	CREDIT	
University Courses	GKA/GKI/ GKK/ GKP/GKS/ GKU1001	Co-Curriculum	2				**2**
Core Courses	SII2002	Applied Geology Field Course	4	SII2002	Applied Geology Field Course	4	**36**
	SII2003	Structural Geology	3	SII2006	Palaeontology	3	
	SII2004	Sedimentology	4	SII2008	Geology and Community	3	
	SII2005	Igneous and Metamorphic Petrology	3	SII2009	Geochemistry	3	
	SII2007	Introduction to Geophysics	3	SII2010	GIS Applications in Geosciences	3	
				SII2011	Geology Laboratory Analytical Techniques	3	
Elective Courses							
TOTAL CREDIT			**19**			**19**	**38**

COMPONENT	YEAR 3						TOTAL CREDIT
	SEMESTER 1			SEMESTER 2			
	CODE	COURSE	CREDIT	CODE	COURSE	CREDIT	
University Courses							
Core Courses	SII3009	Mineral Resources	3	SII3010	Geology Research Project	4	**10**
	SII3011	Geology of Malaysia	3				
Elective Courses		Student Holistic Empowerment (SHE) Cluster 2: Emotional & Spiritual Intelligence: Heart & Soul	2		Student Holistic Empowerment (SHE) Cluster 3: Technology/ Artificial Intelligence and Data Analytics: I-technie	2	**4**
		Program Electives	10		Program Electives	12	**22**
TOTAL CREDIT			**18**			**18**	**36**

COMPONENT	YEAR 4						TOTAL CREDIT
	SEMESTER 1			SEMESTER 2			
	CODE	COURSE	CREDIT	CODE	COURSE	CREDIT	
University Courses							
Core Courses	SII3010	Geology Research Project	4	SII3012	Industrial Attachment	8	**12**
Elective Courses		Student Holistic Empowerment (SHE) Cluster 4: Global Issue and Community Sustainability: Making the World a Better Place	2				**2**
		Program Electives	10				**10**
TOTAL CREDIT			**16**			**8**	**24**

DEPARTMENT OF GEOLOGY

The Department of Geology, UM is the oldest Department of Geology in the country. It was founded in Singapore in 1956 and relocated to The Kuala Lumpur Campus in 1960. From its modest beginning with only 4 academic staff and 2 final-year students in 1962, the Department has expanded and evolved in terms of staff, facilities, and students in line with the development of our nation and the increase in demand of earth science graduates. In the last 15 years, the Department produces about 50 graduates with Bachelor of Science in Geology and Applied Geology (introduced in 1968) annually. Presently there are 13 academic staffs, and 20 support staffs in the Department.

Objectives

As a main centre for earth science studies in a rapidly developing nation, the Department is aware of its responsibility to train graduates of high quality in terms of academic excellence and communication skills. The Department constantly reviews and introduces new relevant courses from time to time, to fulfil the requirements of both the public and private sectors.

Degree Programs

The Department of Geology offers two undergraduate degree programs, namely Bachelor of Science in Geology and Bachelor of Science in Applied Geology based on semester system. This system provides students the chance to complete the course in a minimum of 7 semesters. Students who apply for the undergraduate course should have some background in Physics, Chemistry & Mathematics in the STPM level, Matriculation, or other equivalent qualification. The medium of instruction is English.

The Department has an excellent program of research training leading to a Master of Science (MSc) or a Doctor of Philosophy (PhD) Degree. These postgraduate programs are based on supervised research and preparation of dissertation. The Department also offers Master of Science in Petroleum Geology by coursework. For admission to the Master Degree program, the candidate must possess a Bachelor of Science degree with Honours, while for the PhD program the candidate must possess a Master's degree.

Academic and Research Activities

The staff of the Department are actively involved in studies and research in all aspects of geosciences in Malaysia. To fulfil the needs of the private sectors, research on economic mineral deposits, engineering and environmental geology, and aspects related to petroleum exploration have been emphasised. Publications by the academic staff have contributed significantly to understanding of general geology, mineralogy, petrology, geophysics, stratigraphy, palaeontology, sedimentology, structural geology and tectonics of Malaysia and the region.

The staff of the Department are actively involved in the promotion and advancement of geosciences in Malaysia and the South-East Asia countries through cooperation and linkages with various organisations such as the Minerals and Geoscience Department of Malaysia, Geological Society of Malaysia, AGID (*Association of Geoscientists for International Development*), IUGS (*International Union of Geological Sciences*), AAPG (*American Association of Petroleum Geologists*), UNESCO, and PETRONAS. Members of the Department have played important and pioneering roles in organising activities that are beneficial to the nation and region, such as organising conferences, training courses and field work.

The Department has established cooperation in research with geoscientists, universities, and research laboratories from developed and developing countries in fields of common interest. The Department also has good rapport with agencies in the public and private sector in activities related to research and consultancy.

Facilities

The Department is equipped with a wide range of laboratory and field facilities for both teaching and research purposes. Facilities for the preparation of rock slabs, rock thin-sections and polished sections are available and include rock saws of various diameters and an automatic polishing. Excellent teaching petrological, reflected, and transmitted light microscopes, as well as stereoscopes and a large reference collection of topographic and geological maps, rocks, minerals, and fossils are available for undergraduates and postgraduate students.

The Department of Geology has one of the most advanced organic geochemistry laboratories in Malaysia. The laboratory is equipped with state-of-the-art facilities such as hydrocarbon Source Rock Analyser (SRA), GC, GC-MS, Pyrolysis-GC, ATR-FTIR and microscope photometry system.

Other major teaching and research equipment include LiDAR (Light Detection and Ranging), ICP (Inductively Coupled Plasma), XRD (X-ray Diffractometer), XRF (X-Ray Fluorescence Spectro-meter), AAS (Atomic Absorption Spectrometer), seismograph, magnetometer, and particle size analyser. Macro- and micro-photography and image analysis facilities are also available within the Department.

A well-equipped computer laboratory with internet support, complete with geological and geophysical modelling software are also available for students who are encouraged to use computer techniques for analysis of their data. There is also a workstation laboratory with software for geological, geophysical, petrophysical, structural and reservoir analysis, modelling, visualization, and simulation that are widely used in the industry.

The Department library, known as the Klompe Reading Room, is well stocked with a wide variety of recent geological books and literature and has access to the Main Library of the University which has the largest collection of books and journals in the region.

Career Opportunities

In our rapidly developing nation, graduates in geology have excellent career opportunities. Graduates from the Department have excelled in their career in both the public and private sectors, in various fields such as academic, mining, petroleum industry, engineering geology and the construction sector. There is an increase in demand for geology graduates. Expertise in geology is also required in the construction of infrastructures, the chemical industries, mitigation of natural hazards and environmental monitoring.

ACADEMIC STAFF

HEAD:

Assoc. Prof. Dr. Meor Hakif Amir Hassan, *BSc, MSc (Mal). PhD (Lond), DIC.* Sedimentology.

PROFESSOR:

Prof. Dr. Azman Abdul Ghani, *BSc (Mal), PhD (Liverpool).* Mineralogy, Igneous Petrology.

Prof. Dr. Ismail Yusoff, *BSc (Mal), MSc (Norwich), PhD (Norwich)* Hydrogeology.

ASSOCIATE PROFESSOR:

Assoc. Prof. Dr. Masatoshi Sone, *BSc (Deakin), PhD (New England)* Palaeontogy, Micropalaeontology & Regional Geology.

Assoc. Prof. Dr. Ng Tham Fatt, *BSc, MPhil, PhD (Mal),* Structural Geology, Engineering Geology.

SENIOR LECTURER:

Dr. Ros Fatihah Hj. Muhammad, *BSc, PhD (Mal).* Geomorphology, Environmental Geology.

Dr. Jasmi Hafiz Abdul Aziz, *BSc, MSc (Mal). PhD (Clausthal)*. Economic Geology.

Dr. Ahmad Farid Abu Bakar, *BSc, MSc, PhD (Mal)*. Environmental Geology.

Dr. Noer El Hidayah Ismail, *BSc, MSc, PhD (USM).* Geophysics

Dr. Khairul Azlan Bin Mustapha, *BSc, MSc, PhD (Mal)*. Petroleum Geology.

Dr. Lin Chin Yik, *BSc (UMS), MSc (UMS). PhD (Cambridge),* Carbonate Sedimentology

Dr. Hijaz Kamal Hasnan, *BEng, MEng (Adelaide). PhD (Mal/ANU),* Petroleum Geology, Digital Rock Physics

Dr. Muhammad Hatta Roselee, *BSc, MSc (Mal). PhD (UKM)*. Igneous Petrology, Geochemistry, Geochronology

Latest information about the Department, including research activities and publications of the academic staff can be obtained through the web site: http://geology.um.edu.my

COURSE SYNOPSIS

LEVEL 1 COURSES

SII1001 INTRODUCTION TO THE EARTH

Origins and structure of the Earth. Mineral and rocks. Rock cycle and geological time. Plate tectonics as a force in the formation of earthquakes, volcanoes, mountain ranges and continental drift.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:

1. Skinner and Porter (2020), The Dynamic Earth: An Introduction to Physical Geology (5th Ed.), John Wiley and Sons Inc.
2. Lutgens and Tarbuck Lutgens and Tarbuck (2017). Essentials of Geology (13th Ed.), Pearson Prentice Hall
3. Marsak, S. (2015) Earth: Portrait of a Planet (5th ed), W.W. Norton & Company, 984 p.
4. Prost G.J. & Prost B.P., (2018) The Geology Companion: Essentials for Understanding the Earth. CRC Press, 469 p.

SII1002 EARTH SURFACE PROCESSES

Processes that change the earth's surface. Weathering. Erosion and deposition by natural agents. Rock cycle. Diagenesis and sedimentary rocks. Principles of stratigraphy, correlation, and facies.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:

1. Lutgens, F. et al. (2017) Essentials of Geology (13th ed), Pearson, 608 pp.
2. Marshak, S. (2015) Earth: Portrait of a Planet (5th ed), W.W. Norton & Company, 984 p.
3. Boggs, S. (2016) Principles of Sedimentology and Stratigraphy (5th ed). Pearson, 600 pp.
4. Nichols, G. (2009). Sedimentology and Stratigraphy Second Edition. Wiley-Blackwell, 432 pp.
5. Prost G.J. & Prost B.P., (2018) The Geology Companion: Essentials for Understanding the Earth. CRC Press, 469 p.

SII1003 GEOLOGICAL STRUCTURES AND MAPS

The principles of structural geology and geological map interpretation. Nature and morphology of geologic structures, including folds, faults, foliations, and igneous bodies. Description, identification, and interpretation of structures on geologic maps. Construction of cross-sections and interpretations of geologic history

Assessment Methods:
Continuous assessment : 60%
Examination : 40%

References:

1. Clarke, S.M., Stimpson, I & Leslie, G, (2020) Advanced Geological Mapping: A Field Guide. Hoboken, ISBN 9781119084587
2. Mukherjee, S. & Bose, N., (2017) Map Interpretation for Structural Geologist, Elsevier, ISBN 9780128096819
3. Kruhl, J.H. (2017) Drawing Geological Structures. Wiley Blackwell, ISBN 9781119387244
4. Bennison, G.M., Olver, P.A. & Moseley, K.A. (2012) An Introduction to Geological Structures and Maps. (5th Ed.), Springer-Verlag, ISBN 9781461596325.
5. Weijermars, R., (2011). Structural Geology Map Interpretation (e-book). Available at http://ocw.tudelft.nl/courses/applied-earth-sciences/structural-geology-map-interpretation/readings/2015.
6. Fossen, H., (2016). Structural Geology, 2nd Ed. Cambridge University Press, 463 p.

SII1004 MINERALOGY

Examination of mineral hand specimens. The study of primary characteristics of minerals such as crystal systems, crystal habits, hardness, lustre, colour etc.
The use of petrographic microscope for the identification of minerals based on optical properties. The course introduces some of the concepts used in crystallography, and some of the chemistry behind mineralogy. Students are also introduced to the rock forming minerals in a systematic way and learn to identify them using the petrographic microscope and standard reference texts.

Assessment Methods:
Continuous assessment : 100%

References:
1. Neese, W.D. (2017) Introduction to Mineralogy. Oxford Uni. Press, ISBN 9780190618353.
2. Pellant, H., (2020) Rocks and Minerals, Princeton University Press, ISBN 9780691204062.
3. Deer, W.A. Howie, R.A. & Zussman J. (2013) *An introduction to the Rock Forming Minerals*, 3rd ed., Mineralogical Society, ISBN 9780903056274
4. Perkins, D. & Henke, K.R. (2003). *Minerals in Thin Section*. Prentice Hall, 176 pp. ISBN 978-0131420151
5. Neese, W.D. (2013) Introduction to Optical Mineralogy. Oxford Uni. Press, ISBN 9780199846283.
6. Perkins, D. (2013). *Mineralogy*. Pearson, 568 pp. ISBN 978-1292039114

SII1005 FUNDAMENTAL OF FIELD GEOLOGY

Introduction to geological fieldwork, field equipment and basic field safety. Field methods and techniques used in geological mapping and data acquisition. Preparation of geological map, cross-sections, and report.

Assessment Methods:
Continuous assessment : 100%

References:
1. Clarke, S.M., Stimpson, I & Leslie, G, (2020) Advanced Geological Mapping: A Field Guide. Hoboken, ISBN 9781119084587
2. Genge, M.J. (2019) Geological Field Sketches and Illustrations: A Practical Guide, Oxford University Press, ISBN 978-0-198-83592-9
3. Geikie, A. (2017) Outlines of Field Geology. Hansebooks, ISBN 978-3-337-31146-9
4. Lisle, R.J., Brabham, P.J. & Barnes, J.W. (2012) Basic Geological Mapping. Fifth Edition, Wiley-Blackwell, ISBN: 978-0-470-68634-8
5. Coe, A.L. (ed.) (2010) Geological Field Techniques. Wiley-Blackwell, ISBN 978-1-444-33062-5
6. Compton, R.R. (2016) Geology in the Field, Earthspun Books, ISBN 978-620-70842-5

SII1006 SAFETY AND GEOLOGY CODE OF PRACTICE

This course is designed to expose students to the importance of ethics and safety in the practice of geology. Students will be introduced to the concept of geoethics, the responsibilities of geologists to the public, and ethics in research and professional practice. This course also covers safety in the practice of geology including in the field, laboratory and workplace.

Assessment Methods:
Continuous assessment : 100%

References:
1. Bohle, M. (ed.) (2019) Exploring Geoethics: Ethical Implications, Societal Contexts, and Professional Obligations of the Geosciences. Springler Nature, ISBN 978-3-030-12009-2.
2. Gunderson, L.C. (ed.) (2017) Scientific Integrity and Ethics with Applications to the Geosciences. Special Publication American Geophysical Union, John Wiley and Sons. ISBN 978-1-119-06778-8
3. Anderson, A. et al. (2015) Laboratory and Field Safety Guidelines, South Dakota School of Mines and Technology. (e-book)
4. Wyss, M. & Peppoloni, S. (eds.) (2014) Geoethics: Ethical Challenges and Case Studies in Earth Sciences. Elsevier, ISBN 978-0-127-99935-7
5. Government of Malaysia, (2008) Laws of Malaysia, Act 689 Geologists Act 2008. Percetakan Nasional Malaysia Berhad.
6. US National Academy of Sciences, (2010). Promoting chemical laboratory safety and security in developing countries. National Academies Press, Washington DC (e-book)

LEVEL 2 COURSES

SII2002 APPLIED GEOLOGY FIELD COURSE

Principles and techniques of geological fieldwork and field data acquisition. Preparing geological maps using manual and digital methods. The course involves four weeks of fieldwork covering general geological mapping, structural geology, sedimentology, and economic geology.

Assessment Methods:
Continuous assessment : 100%

References:
1. Clarke, S.M., Stimpson, I & Leslie, G, (2020) Advanced Geological Mapping: A Field Guide. Hoboken, ISBN 9781119084587
2. Compton, R.R. (2016) Geology in the Field, Earthspun Books, ISBN 978-620-70842-5
3. Geikie, A. (2017) Outlines of Field Geology. Hansebooks, ISBN 978-3-337-31146-9
4. Lisle, R.J., Brabham, P.J. & Barnes, J.W. (2012) Basic Geological Mapping. Fifth Edition, Wiley-Blackwell, ISBN: 978-0-470-68634-8
5. Coe, A.L. (ed.) (2010) Geological Field Techniques. Wiley-Blackwell, ISBN 978-1-444-33062-5
6. Saiful-Islam, S. (2014) Aerial Photography, Photogeology, GIS, R.S. and Image Processing. Lambert Academic Publishing. 978-3-659-30987-8

SII2003 STRUCTURAL GEOLOGY

Principles of deformation. Morphology and classification of geological structures. Mechanism of faulting, folding and related structures. Stereographic projections of geological data. Description, interpretation and analysis of geological structures and structural geology maps.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:
1. Fossen, H., (2016). Structural Geology, 2nd Ed. Cambridge University Press, 463 p.
2. Hobbs, B.E. (2017). Structural Geology: The Mechanics of Deforming Metamorphic Rocks. Elsevier, 680 p.
3. Ragan, D.M., (2011). Structural Geology: An Introduction to Geometrical Techniques. Cambridge, 632 p.
4. Van der Pluijm, B.A. & Marshak, S., (2003). Earth Structure: An Introduction to Structural Geology and Tectonics, 2nd Ed. McGraw-Hill, 495 p.
5. Rowland, S.M., Duebendorfer, E.M. & Schiefelbein, I.M., (2007). Structural Analysis and Synthesis. A Laboratory Course in Structural Geology. Blackwell Publ., 304 p.
6. Allison, D.T. (2015) Structural Geology Laboratory Manual (e-book). 4th Ed.

SII2004 SEDIMENTOLOGY

This course touches on methods of describing and classifying sediments and sedimentary rocks, including siliciclastic,

carbonates etc. This course also discusses the origin and processes of formation, transportation and deposition of sediments, and the process of transformation of sediments into sedimentary rocks via diagenesis. The method of interpretation of interpreting past depositional history using facies analysis is also taught.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:
1. Nichols, G. (2009). Sedimentology and Stratigraphy Second Edition. Wiley-Blackwell, 432p.
2. Reading, H.G. (1996). Sedimentary Environments: Processes, Facies and Stratigraphy. Blackwell Science, 688p.
3. James, N.P. & Dalrymple, R.W. (2010). Facies Models. Geological Association of Canada, 586p.
4. Scholle, P.A., Ulmer-Scholle, D.S. (2003). A Color Guide to the Petrography of Carbonate Rocks: Grains, Textures, Porosity, Diagenesis. AAPG Memoir 77, 474p.
5. Flügel, E. (2004). Microfacies of Carbonate Rocks: Analysis, Interpretation and Application. Springer, 976p.

SII2005 IGNEOUS AND METAMORPHIC PETROLOGY

Classification of igneous rocks. Magma evolution and petrogenetic processes. Diversity of igneous rock. Definition, Types of metamorphism and their limitations. Depth zones, facies, and reaction in metamorphism. Microscope study of Igneous and metamorphic rock.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:
1. Philpotts A.R., and Ague J.J. 2009. Principles of Igneous and metamorphic petrology (2nd ed). Cambridge Uni. Press.
2. Gill, R., 2010. Igneous Rocks and Processes: A Practical Handbook. Wiley Blackwell.
3. Winter, J.D., 2011. Principles of Igneous and Metamorphic Petrology. Pearson Education Limited.
4. Shelly, D. 1992. Igneous and metamorphic rocks under microscope: classification, textures, microtextures and mineral preferred orientation. Chapman & Hall 445 pp
5. Raymond L.A. 1995. Metamorphic. WCB, 742 pp.

SII2006 PALEONTOLOGY

Study of invertebrate macrofossils, trace fossils, and plant fossils in terms of morphology, taxonomy, palaeoecology, biostratigraphy, evolution and palaeobiogeography.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:
1. Doyle, P. (1996) Understanding Fossils. Wiley & Sons, Chichester, 409 pp.
2. Clarkson, E.N.K. (1998) Invertebrate Palaeontology and Evolution (4th Ed.). Blackwell Science, Oxford. 452 pp.
3. Benton,M. (1997). Basic Palaeontology. Longman, Hong Kong. 342 pp.

SII2007 INTRODUCTION TO GEOPHYSICS

Theory of geophysical methods (seismic gravity magnetic and electrical). Data acquisition and reduction of data. Problems in data acquisition and reduction. Sources of geophysical anomalies. Analysis and interpretation of anomalies and modeling. Application in exploration and industries.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:
1. William Lowrie (2018): Geophysics: A very short introduction. Oxford University Press
2. M. Dentith & S. T. Mudge (2014): Geophysical for the mineral exploration geoscientist. Cambridge University Press.
3. William Lowrie (2015): A student's guide to geophysical equations, Cambridge University Press.
4. M. E. Everett (2013): Near-surface Applied Geophysics, Cambridge, Cambridge University Press.
5. W. J. Hinze et al, (2018): Gravity and Magnetic Exploration: Principles, Practices & Applications, Cambridge University Press.

SII2008 GEOLOGY AND COMMUNITY

This course exposes students to community service related to geological field. Students need to plan and implement community engagement programs related to geology in groups. Students are also required to create a reflection journal to record self-transformation before, during and after the community engagement program as well as group reports and presentations based on experiences with the communities.

Assessment Methods:
Continuous assessment : 100%

References:
1. Lina D. Dostilio, 2017. The Community Engagement Professional in Higher Education: A Competency Model for an Emerging Field, Campus Compact.
2. Julia Preece, 2017. University Community Engagement and Lifelong Learning: The Porous University, Springer.
3. Lutgens, F. et al. (2017) Essentials of Geology (13th ed), Pearson, 608 pp.
4. Marshak, S. (2015) Earth: Portrait of a Planet (5th ed), W.W. Norton & Company, 984 p.

SII2009 GEOCHEMISTRY

The course begins with a general overview of geochemistry, and a review of concepts the student should have come across already, such as cosmology, nuclear reactions, and calculations involving atomic mass, equilibrium constants, and reactions involving minerals. Then, two and three dimensional chemographies are introduced, together with their association with phase diagrams, and their uses within metamorphic petrology and understanding weathering processes. Radiometric dating, and the use of stable isotopes conclude the course.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:
1. Krauskopf, K.B. (2003). Introduction to Geochemistry, 3rd Ed. McGraw Hill, 668 pp.
2. Brownlow, A.H. (1995). Geochemistry. 2nd Ed. Prentice-Hall, 498 pp.
3. Faure, G. and Mensing, T.M. (2004) Isotopes: Principles and Applications. 3rd Ed. John Wiley, 928 pp.
4. Sharp, Z. (2006). Principles of Stable Isotope Geochemistry.Prentice-Hall, 360 pp. ISBN-13: 978-0130091390.
5. Marshak, S. (2012). Essentials of Geology (Fourth Edition). W. W. Norton & Company, 648 pp. ISBN-13: 978-0393919394.
6. White, W.M. (2013). Geochemistry. Wiley-Blackwell 668 pp. ISBN-13: 978-0470656686.
7. White, W.M. (2015). Isotope Geochemistry. Wiley-Blackwell, 496 pp. ISBN-13: 978-0470656709.

SII2010 GIS APPLICATIONS IN GEOSCIENCES

Fundamentals of GIS theory and data formats. Importance of map projection, scale, resolution, accuracy, and precision. Techniques in preparing, locating, acquiring, inputting, and translating geological data into a GIS system. Web resources for acquiring GIS data and tools. Visualization, query, and analysis of geospatial data.

Assessment Methods:
Continuous assessment : 100%

References:
1. Bolstad, P. (2019) GIS Fundamentals: A First Text on Geographic Information Systems. 6th ed. ZanEdu Publishing, ISBN 978-1593995522
2. Chang, K. (2018) ISE Introduction to Geographic Information Systems. 8th Edition. McGraw Hill, ISBN 9781260092585
3. Longley, P.A., Goodchild, M.F., Maguire, D.J. & Rhind, D.W. (2015) Geographic Information Systems and Science. 4th Edition. John Wiley & Sons, ISBN 9781118676950
4. Burrough, P.A., McDonnell, R.A. & Lloyd, C.D. (2015) Principles of Geographical Information Systems. Oxford University Press, ISBN 9780198742845

SII2011 GEOLOGY LABORATORY ANALYTICAL TECHNIQUES

This is a practical course teaching chemical analysis technique which are widely used to solve problems in geology and hydrogeology. Students will use up-to-date scientific instruments and techniques such as X-Ray Diffraction (XRD), X-Ray Fluorescence (XRF), Inductively Coupled Plasma (ICP) and Gas Chromatography-Mass Spectrometry (GCMS) to conduct analyses on a range of samples often encountered in geochemistry, hydrogeology, and organic geochemistry.

Assessment Methods:
Continuous assessment : 100%

References:
1. Potts, P.J. (2013). A Handbook of Silicate Rock Analysis, Blackie, 622 p.
2. Eglinton, G., and Murphy, M.T.J. (2013). Organic Geochemistry — Methods and Results. Spinger-Verlag.
3. Hach Water Analysis Handbook 2013

SII2012 GEOLOGICAL DATA ANALYSIS

In this course, student will learn how to use the different method of data analysis, and how to use ITC, graphics software and programing software to analyze geological and geoscience data.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:
1. Y.Z. Ma (2019): Quantitative geoscience: Data analytics, geostatistics, Reservoir characterization & modeling. Springer nature Switzerland.
2. J. Hair et al., (2018): Multivariate data analysis (8th edition). Cengage Learning EMEA.
3. Ricardo a Valls P. Geo (2017): Exploring geological data. Createspace Independent Publishing Platform.
4. M.A Oliver & R. Webster (2015): Basic steps in geostatistics: The variogram and Kriging. Springer Briefs in Agriculture.
5. M.E. Hohn (2013): Geostatistics and Petroleum Geology (2nd edition). Springer Netherlands.
6. Haining, R. (2003). Spatial Data Analysis: Theory and Practice 1st Edition. Paperback.

SII2013 MARINE GEOLOGY

Many of the processes that impact the Earth system occur completely or partly below the oceans. Some of these processes act on geologic time scales, affecting mountain belts and their shapes, forming ore deposits, changing Earth's climate, and depositing rock units that we use as aquifer or that trap hydrocarbons. Other processes act more quickly, causing earthquakes and tsunamis, or possibly affecting Earth's climate on the timescale of a human lifespan.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:
1. Seibold, E. & Berger, W. (2018) The Sea Floor: An Introduction to Marine Geology, Springer, ISBN 9783319846439
2. Finkl, C.W. & Makowski, C. (2017) Diversity in Coastal Marine Sciences: Historical Perspectives and Contemporary Research of Geology, Physics, Chemistry, Biology, and Remote Sensing, Springer, ISBN 9783319575766
3. Dawson, A. (2018) Introducing Sea Level Change, Dunedin Academic Press, ISBN 9781780460871
4. Burdige, D.J. (2006) Geochemistry of Marine Sediments, Princeton Univ Press, ISBN 9780691095066.

SII2014 KARST GEOMORPHOLOGY AND CONSERVATIONS

Karst characteristics from scientific and management perspective. Karst geomorphology and lithological control that gives karst landscape its specific characteristics including the global distribution. Issues pertaining karst area such as sinkholes and rockfalls, and engineering problems associated with karst are emphasized. Geochemistry of karst waters are studied in conjunction with environmental issues. Karst landscape and deposit are used to examine for the evidence of environmental and climatic change. Case studies are used throughout the course and emphasis is placed on the

challenges faced by people living in karst areas and conservation value of karst landscapes.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%
References:

1. Otonicar, B. et al. (2020) Karstology in the Classical Karst. Springer Nature, ISBN 9783030268268.
2. Ford D. C. & White W. B. (2007) Karst Hydrogeology and Geomorphology. John Wiley & Sons; Rev. Ed edition (16 Mar 2007)
3. Methods in Karst Hydrogeology (IAH International Contributions to Hydrogeology) Nico Goldscheider and David Drew Taylor & Francis Ltd; 1 edition (1 Sep 2007)
4. Fairchild I. J & Baker A. (2012). Speleothem Science: From process to past environments. John Wiley & Sons.

SII2015 CLIMATE CHANGE AND ADAPTATION

This course provides a fundamental insight on our global climate systems. The concept of climate models and the role of Earth's carbon cycle on climate will be introduce. This course also explores why climate change adaptation is important to human development, case study of Bangladesh, Europe US and Africa will be discussed. The course ends with discussing the consequences of climate change to our society, and relates the linkage between the world's economy, politics and ethics so that the students may appreciate and have a good knowledge/update on the urgency of solving the current and future climate issues.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:

1. Pelling, M., (2011). Adaptation to Climate Change: from resilience to transformation. Routledge, Taylor and Fracis Group, New York.
2. IPCC, (2014). Climate Change 2014: Synthesis Report. Contribution of working groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. IPCC, Geneva, Switzerland, 151pp.
3. Dessler, A., (2015). Introduction to modern climate change. Cambridge University Press. UK.
4. Bonan, G., (2016) Ecological Climatology – Concepts and applications. Cambridge University Press. UK.
5. Huq, S., Chow, J., Fenton, A., Stott, C., Taub, J., Wright, H., (2019). Confronting climate change in Bangladesh – Policy strategies for adaptation and resilience. Springer Nature, Switzerland.
6. Kabisch, N., Korn, H., Stadler, J., Bonn, A., (2017). Nature-based solutions to climate change adaptation in urban areas. Springer Nature, Switzerland.
7. Eggleton, T., (2013). A short introduction to climate change. Cambridge University Press, New York.
8. Johansen, B.E., (2017). Climate change – An encyclopedia of science, society, and solutions. ABC-CLIO, LLC, California, USA.
9. Moser, S.C. and Boykoff, M.T., (2013). Successful adaptation to climate change. Linking science and policy in a rapidly changing world. Routledge, Taylor and Fracis Group, New York.
10. OECD/IEA, (2014). Energy, climate change and environment. International Energy Agency. Paris, France

SII2016 ENGINEERING GEOLOGY

Engineering geological characterization of earth materials and masses. Unified soil classification system. Compaction and consolidation of soil. Shear strength of soil. Physical and mechanical properties of rock materials. Description of rock mass. Weathering and quantitative description of discontinuities. Rock slope stability. Geomechanics classification of rock masses. Engineering geological characterization of earth materials and masses. Unified soil classification system. Compaction and consolidation of soil. Shear strength of soil. Physical and mechanical properties of rock materials. Description of rock mass. Weathering and quantitative description of discontinuities. Rock slope stability. Geomechanics classification of rock masses.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:

1. Griffiths, J.S. & Bell, F.G. (2020) Environmental and Engineering Geology: Beyond the Basics, Whittles Publishing, ISBN 9781849954013
2. Watson, T.L., (2018) Engineering Geology, Franklin Classics, ISBN 9780341967842
3. Barnes, G.E. (2018) Soil Mechanics. 4th ed. MacMillan. ISBN 9781137512208
4. de Vallejo, L.I. & Ferrer, M. (2011) Geological Engineering. CRC Press. ISBN 9780415413527
5. Bell F.G. (2007) Engineering Geology. Second Edition, London, Elsevier, 581 p. ISBN 9780750680776
6. Waltham, T. (2009) Foundations of Engineering Geology. Taylor & Francis. ISBN 9780415469609

SII2017 EARTH WATER RESOURCES

This subject presents an overview of current understanding of the earth water resources that circle around the interaction of ground water and surface water, in terms of both quantity and quality, as applied to a variety of geological condition. It is apparent that developments of water resources combined with water pollution affect the quantity and quality of the other. Thus, effective water management requires a clear understanding of the linkages between ground water and surface water as it applies to any given hydrologic setting.

Assessment Methods:
Continuous Assessment: 100%

References:

1. Shaw, E.M., (2010): Hydrology in Practice (4th Edition), Taylor and Francis, UK; 590pp
2. Fetter, C.W. (2014): Applied Hydrogeology (4th Edition), Prentice Hall, New Jersey; 691pp.
3. Todd, D.K. and Mays L.W., (2004): Groundwater Hydrology. (3rd Edition). John Wiley & Sons, New York

SII2018 ENVIRONMENTAL GEOLOGY

Geological features associated with man's physical environment, including landforms as well as internal and external geological processes. Impacts of man's activities and structures on the dynamic earth. Environmental Impact Assessments. Exposure to students on aspects of sampling and analysis of environmental geological samples.

Assessment Methods:
Continuous assessment : 100%

References:
1. Montgomery, C.W. (2020): Environmental Geology (10th Ed.). MG Hill Publishers, U.S.A. 496 p.
2. Reichard J. (2018): Environmental Geology (4th Ed.). MG Hill Publishers, U.S.A 550 p.
3. Tank, R.W. (Ed.) (1975): Focus on Environmental Geology. Oxford Univ. Press, New York. 474 p.

LEVEL 3 COURSES

SII3009 MINERAL RESOURCES

Evolution of important ore deposits and geological environment including lithology, stratigraphy and tectonic. Study of ore minerals. Usage and principles of reflectance microscope. Ore mineral identification (optical and physical properties). Interpretation of paragenesis with certain texture.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:
1. Decree, S. & Robb, L. (2019) Ore Deposits: Origin, Exploration, and Exploitation. John Wiley, ISBN 9781119290537
2. Taylor, R. (2016). Ore Textures (Recognition and Interpretation), Springer, ISBN 9783662502136
3. Bastin, E. S. (2018) Interpretation of Ore Textures. Palala Press, ISBN 9781379005353
4. McCaffrey, K.J.W., Lenergan, L. and Wilkinson, J.J. (2014). Fractures, Fluid Flow and Mineralization, Geological Society, ISBN 9781423711445
5. Moores, E.M. & Twiss, R.J. (2014) Tectonics. Waveland Press, ISBN 978-1-4786-2199-7
6. Kearey, P, Klepeis, K.A. and Vine F.J. (2009). Global Tectonics, 3rd edition. Wiley-Blackwell, 482 p.

SII3010 GEOLOGY RESEARCH PROJECT

Some 3 weeks of fieldwork in a specified area followed by laboratory studies and submission of a report containing a geological map and cross-section as well as relevant illustrations and literature reviews. Prior to fieldwork, a research proposal must be submitted and approved. In some cases, there can be laboratory-based studies on a specific geological problem or topic. Results of the field and/or laboratory studies and interpretation will be presented at an initial viva and seminar, as well as defended at a final viva.

Assessment Methods:
Continuous assessment : 100%

References:
1. Geikie, A. (2017) Outlines of Field Geology. Hansebooks, ISBN 978-3-337-31146-9
2. Compton, R.R. (2016) Geology in the Field, Earthspun Books, ISBN 978-620-70842-5
3. Hart, C., (2018) Doing a Literature Review: Releasing the Research Imagination, Sages Publications Ltd, ISBN 9781526419217
4. Copeland, P., 2011, Communicating Rocks: Writing, Speaking, and Thinking About Geology: Prentice Hall, 160 p.
5. Katz, M.J. (2009) From Research to manuscript: A guide to scientific writing, 2nd ed.: Springer, 210 p.

SII3011 GEOLOGY OF MALAYSIA

The geology of Peninsular Malaysia, Sarawak and Sabah including the stratigraphy, igneous and metamorphic events, structure, tectonics, geologic history, and economic resources of each region.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:
1. Hutchison, C.S. & Tan, D.N.K. (2009) Geology of Peninsular Malaysia.
2. Hutchison, C.S. (2007) Geological Evolution of South-east Asia. Geological Society of Malaysia. 368 pp.
3. Hutchison, C.S. (2005) Geology of North-West Borneo. Elsevier. 421 pp.
4. Lee, C.P.; Leman, M.S.; Hassan, K.; Nasib, B.M. & Karim, R. (2004) Stratigraphic Lexicon of Malaysia. Geological Society of Malaysia. 162 pp.

SII3012 INDUSTRIAL ATTACHMENT

Student will be placed in a geology or related industry of their choice for a duration of 16 weeks. Students will be exposed to everyday working activities as instructed by their supervisor(s) at the industry. Students are required to record their daily activities in a logbook, prepare a presentation and a report for evaluation. The training program will be briefed by the industrial training program supervisor.

Assessment Methods:
Continuous assessment : 100%

References:
1. Copeland, P., (2012), Communicating Rocks: Writing, Speaking, and Thinking About Geology: Prentice Hall, 160 p.
2. Compton, R.R. (2016) Geology in the Field, Earthspun Books, ISBN 978-620-70842-5
3. Government of Malaysia, (2008) Laws of Malaysia, Act 689 Geologists Act 2008. Percetakan Nasional Malaysia Berhad
4. Geikie, A. (2017) Outlines of Field Geology. Hansebooks, ISBN 978-3-337-31146-9

SII3013 ADVANCED GEOPHYSICS

Theory of geophysical methods (seismic reflection, gravity and borehole geophysics). Data acquisition and reduction of data. Problems in data acquisition and reduction. Sources of geophysical anomalies. Analysis and interpretation of anomalies and modeling. Application in exploration and industries.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:
1. J. Dvorkin et al., (2016): Seismic reflections of rock properties. Cambridge University Press
2. M. H. Rider (2018): The geological interpretation of well logs, 3rd revised edition. Rider-French consulting limited, Sutherland, United Kingdom.
3. William Lowrie (2015): A student's guide to geophysical equations, Cambridge University Press.
4. R. Simm & M. Bacon (2014): Seismic amplitude: An interpreter's handbook, Cambridge University Press.

5. W. J. Hinze et al, (2018): Gravity and Magnetic Exploration: Principles, Practices & Applications, Cambridge University Press.

SII3014 GEOHAZARDS

Perspectives on natural disasters such as earthquakes, volcanic activity, tsunamis, landslides, floods and sinking. Steps on how to identify and assess the effects of geological disasters will be discussed. Mitigation measures to reduce the impact of disasters will also be discussed.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:
1. Hyndman, D. & Hyndman, D. (2017): Natural hazards and Disasters. Cengage Learning, 592 p. ISBN 053837522, 9780538737524
2. Coch, N.K. (1995): Geohazards: Natural and Human. Prentice Hall, 481 p. ISBN 0023229926; 9780023229923
3. Natural Hazards. Jour. Int. Soc. for Prevention & Mitigation of Natural Hazards. Springer.
4. Bobrowsky, P.T. (2013). Encyclopedia of Natural Hazards. Springer Science, Dordrecht, 1130 p.
5. Bryant, E. (2005). Natural Hazards. 2nd Ed. Cambridge University Press, 312 p.
6. Keller E. A. & DeVecchio D. E. (2017) Natural Hazards: Earth's Processes as Hazards, Disasters, and Catastrophes. 4th Ed. Taylor & Francis, 554p.

SII3015 QUATERNARY GEOLOGY

Climatic and sea-level changes during the Quaternary Period. Classical models of Quaternary geology and processes that form the landscape. Quaternary record in oceans and oxygen isotope stratigraphy. Classification and dating of Quaternary sediments. Practical classes on identification of Holocene landforms. Interpretation of borehole logs to determine the stratigraphy and physical features of Quaternary sediments in Malaysia.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:
1. Couvering, J. A. V (2004): The Pleistocene Boundary and the Beginning of the Quaternary. Cambridge University Press 320 p.
2. Lowe, J.J. & Walker, M.J.C. (2015): Reconstructing Quaternary Environments. 3rd ed. Longman Scientific & Technical. 389 p.
3. Menzies, J & Meer, J. V. D (2017): Past Glacial Environments (2nd Ed.). Elsevier. 835 p.

SII3016 STRATIGRAPHIC METHODS

This course teaches the principles of chronostratigraphy, seismic stratigraphy and sequence stratigraphy and its application in interpreting, correlating, and mapping subsurface data. Through practical exercises, the students are exposed to the applications of Walther's Law, well log interpretation, well log correlation and seismic interpretation.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:
1. Posamentier, H.W. & Allen, G.P., 1999. Siliciclastic Sequence Stratigraphy: Concepts and Applications. SEPM Concepts in Sedimentology No. 7, 204p.
2. Coe, A.L., Bosence, D.W.J., Church, K.D., Flint, S.S., 2003. The Sedimentary Record of Sea-Level Change. Cambridge University Press, 287p.
3. Nichols, G., 2013. Sedimentology and Stratigraphy Second Edition. Wiley-Blackwell, 432p.
4. Catuneanu, O., 2006. Principles of Sequence Stratigraphy. Elsevier, 387p.
5. James,N.P. & Dalrymple, R.W., 2010. Facies Models. Geological Association of Canada, 586p.
6. Miall A. D., 2015. Stratigraphy: A Modern Synthesis. Springer, 443p.

SII3017 GEOLOGY OF SOUTH EAST ASIA

Systematic learning of South East Asia regional geology, distribution of geological resources, tectonic history through geological time, and the formation of today's South East Asia.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:
1. Hall, R. and Blundell, D.J. (Ed.) (1996). Tectonic Evolution of Southeast Asia. Geol. Soc of Lond. Sp. Publ. no 106.
2. Hutchison, C.S. (2007). Geological Evolution of Southeast Asia. 2nd Ed. Geological Society of Malaysia.
3. Hutchison, C.S. (2005). Geology of North-west Borneo. Elsevier. 421pp.
4. Ridd MF, Barber AJ, Crow MJ. (2011). The Geology of Thailand. GSL. 626 p.
5. Hall, R., Cottam M. A. & Wilson M.E.J. (2011). The SE Asian Gateway: History and Tectonics of the Australia--Asia Collision. Geological Society of London, 373p.

SII3018 PETROLEUM GEOLOGY

Description and discussion of the different elements and processes that constitute the petroleum system. The petroleum industry. Sedimentary basins and depositional systems. Characteristics of source rocks and reservoir rocks. Subsurface mapping, methods, tools and petrophysical evaluation in hydrocarbon exploration & production. Main hydrocarbon provinces and selected case studies.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:
1. Ascroft, W., 2011. A petroleum geologist guide to seismic reflection: Wiley-Blackwell, 176p.
2. Boxlike, K. (2015). Petroleum geoscience: from sedimentary environment to rock physic. 2nd edition. Springer, 517p.
3. Gluyas. J. and Swarbrick, R. (2004) Petroleum Geoscience. Blackwell Publishing, UK.
4. PETRONAS (1999) The petroleum Geology and Resources of Malaysia, Petroliam National Berhad (PETRONAS), 665pp.
5. Hunt, J.M. (1996) Petroleum Geochemistry and Geology, Second Edition, W.H. Freeman & Co., New York.

6. Hantschel, T., and Kauerauf, A. I. (2009). Fundamentals of basin and petroleum systems modeling. New York: Springer, 475 p.
7. Magoon, L.B. and Dow, W.G. (1994) The petroleum system - from source to trap, AAPG Memoir 60.
8. Tissot, B.P. & Welte, D.H. (1984) Petroleum Formation and Occurrence, Second Revised and Enlarged Edition, Springer-Verlag, Berlin Heidelberg.

SII3019 ORGANIC PETROLOGY

Study of organic matter from the perspective of sedimentology and petroleum geology which include coal formation, petrographic composition of coal, origin of macerals, correlation of coal facies with depositional environment, coalification process, vitrinite reflectance analysis and kerogen typing. This also includes studies on visual kerogen typing. Findings of this course will be used for applications in petroleum exploration and coal-related industries.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:
1. Taylor, G.H., Teichmuller, M., Davis, A. Diessel, C.F.K., Littke, P. (1998) Organic Petrology, Gebruder Borntraeger, Berlin & Stuttgart, 704pp.
2. Diessel, C.F.K. (1992) Coal-bearing Depositional Systems, Springer-Verlag, Berlin, 721pp.
3. Stach, E., Mackowsky, M-Th., Teichmuller, M., Taylor, G.H., Chandra, D., and Teichmuller, R., (1982) Stach's Textbook of Coal Petrology, 3rd edn. Gebruder Borntraeger, Berlin & Stuttgard, 535pp.
4. Mendonça Filho, J.G., Menezes, T.R., Mendonça, J.O., Oliveira, A.D., Silva, T.F., Rondon, N.F., and Silva, F.S. (2012). Organic Facies: Palynofacies and Organic Geochemistry Approaches, Geochemistry - Earth's System Processes, Dr. Dionisios Panagiotaras (Ed.)
5. Speight J.G. (2015). Handbook of Coal Analysis. 2nd edition. Wiley, 240p.

SII3020 INDUSTRIAL MINERALS

Knowledge and awareness about the important and development of various industrial mineral and other related mineral-based industries including clay mineral. Broad aspects of industrial mineral in term of geological occurrence, distribution, marketing, economic and application technology.

Assessment Methods:
Continuous assessment : 50%
Examination : 50%

References:
1. Anthony M. Evans, 1992 Ore Geology and Industrial Minerals: An Introduction, Blackwell Science; 3rd edition
2. Peter A. Ciullo. 1996 Industrial Minerals and their Uses, Chem Tech Publishing, 632ppPages:
3. Charles J. Moon, Michael K. G. Whateley, Anthony M. Evans 2006 Introduction to Mineral Exploration, Blackwell Publishing Professional; 2nd edition
4. Kogel J., Trivedi N.C., Barker J.M. krukowski S.T. 2006. Industrial Minerals & Rocks: Commodities, Markets, and Uses.7th edition. Society for Mining, Metallurgy, and Exploration, 1548p.
5. Degryse P. & Elsen J. 2003. Industrial Minerals: Resources, Characteristics, and Applications. 120p.
6. Revuelta M. B. 2018. Mineral Resources: From Exploration to Sustainability Assessment. Springer, 653p.

SII3021 TECTONICS AND EARTH HISTORY

Introduction to the theory of Plate Tectonic. Extensional, compressional and strike-slip tectonic regimes and their associated regional structures.
Evolution of Earth's atmosphere, lithosphere, biosphere, and hydrosphere. Introduction to Archean, Proterozoic and Phanerozoic sequences, and their inferences about the conditions of Earth. The changing paleogeography and the events that occurred during the respective geologic times. The relationship between life and the sediments, the oceans, and the atmosphere of the planet.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:
1. Torsvik, T.H. & Cocks, L.R.M. (2017) Earth History and Palaeogeography. Cambridge University Press. ISBN 9781107105324
2. Wolfgang, F, Meschede, M., & Blakey, R.C. (2016) Plate Tectonics: Continental Drift and Mountain Building. Springer, ISBN 9783662501511
3. Stanley, M.S. & Luczaj, J.A. (2015) Earth System History. 4th Edition. Freeman and Co, ISBN 978-1-4292-5526-4
4. Moores, E.M. & Twiss, R.J. (2014) Tectonics. Waveland Press, ISBN 978-1-4786-2199-7
5. Wicander, R. & Monroe, J.S. (2013) Historical Geology: Evolution of Earth & Life Through Time. 8th ed. Cengage Learning. ISBN: 978-1-305-11956-7

SII3022 MINERAL AND MINING EXPLORATION

In this course, various types of mineral and mining exploration techniques are introduced. The course also covers geochemical prospecting, mining policy and act. Industrial applications are illustrated using case studies.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:
1. Haldar, S.K. (2018) Mineral Exploration: Principles and Applications. Elsevier, ISBN 9780128140222
2. Hawkes H.E. & Webb, J.S. (2014) Geochemistry in Mineral Exploration, Whitefish, ISBN 9781258452001
3. Jain, R. (2015). Environmental Impact of Mining and Mineral Processing: Management, Monitoring, and Auditing Strategies, Butterworth-Heinemann, ISBN 9780128040409
4. Moon, C.J., Whateley, M.E.G. & Evans, A.M. (2006). Introduction to mineral exploration. 2nd edition, Blackwell Publishing, 481 p.
5. Marjoribanks, R. (2010). Geological methods in Mineral Exploration and Mining. 2nd edition, Springer, 238 p.
6. Mineral Development Act 1994 [Act 525], Government of Malaysia.

SII3023 GEOLOGICAL SITE INVESTIGATION

Description, classification and characteristics of rock material, rock mass and aggregates. Methods of engineering geological site investigation. Geological terrain mapping and analysis. Site investigations for various engineering structures and works.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:
1. Griffiths, J.S. & Bell, F.G. (2020) Environmental and Engineering Geology: Beyond the Basics, Whittles Publishing, ISBN 9781849954013
2. Watson, T.L., (2018) Engineering Geology, Franklin Classics, ISBN 9780341967842
3. Fookes, P., Pettifer, G, & Waltham, T. (2015) Geomodels in Engineering Geology: An Introduction, Whittles Publishing, ISBN 9781849951395
4. de Vallejo, L.I. & Ferrer, M. (2011) Geological Engineering. CRC Press
5. Bell. F.G. (2004) Engineering Geology and Construction. Taylor & Francis.
6. Smith, M.R. & Collis, L. (eds.) (2001). Aggregates. Sand, gravel and crushed rock aggregates for construction purposes. 3rd Edition. Geological Society of London Engineering Geology Special Publication 17, 340 p.

SII3024 UNCONVENTIONAL OIL AND GAS RESOURCES

Unconventional resources reside in tight formations and are of lower reservoir quality and more difficult from which to extract hydrocarbons. Unconventional resources represent a variety of geological formations, including tight gas sands, gas shales, heavy oil sands, coalbed methane, oil shales, and gas hydrates.

Assessment Methods:
Continuous assessment : 40%
Examination : 60%

References:
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