

Mineral Resources Engineering

Academic Session : Semester 1 2020/2021

Revision : 001/2020

EBS209 – MINERALOGY (For Staff)

<p>Lecture Time : Monday (11.00am-1.00 pm) Tuesday (2.00-3.00 pm)</p>	<p>Lecturer: 1) Assoc. Prof. Dr. Kamar Shah Ariffin (KSA) 2) Dr. Suhaina Ismail (SI) 3) Dr. Zakaria Endut (ZE)</p>
<p>Contribution of Assessments: Final Examination: 60% Coursework: 40%</p> <ul style="list-style-type: none"> • Test (10%) • Assignment (30%) 	

COURSE OUTCOME	
CO 1	Able to describe fundamental concept of mineral definition, mineral classification and mineral naming.
CO 2	Able to describe processes of minerals formation, mineral stability in phase diagram, and mineral classification into different crystallographic system.
CO 3	Able to apply fundamental concept related to mineral identification into specified physical and chemistry characteristics, chemical composition and formula calculation.
CO 4	Able to explain the advantages and limitation of characterization techniques/ instrumentation available for mineral identification.
ACTION FOR IMPROVEMENT FROM ACADEMIC YEAR 2019/2020	
Comment :	Action for Improvement :

CO	LT	PO	Measuring Tools						Total marks		WP / EA	SLT
			Test (10%)		Assignment (30 %)				Exam (60 %)	Total marks		
			1	2	1	2	3	4				
CO1	C2	PO1	5		5				15	25	WP1&3	
CO2	C2	PO1		3		7			15	25	WP1&3	
CO 3	C3	PO2	2				13		15	30	WP1&3	
CO 4	C2	PO5					5		15	20	WP1&3	

WEEK	LECTURER	TOPICS	ACTIVITY / ASSESSMENTS	COURSE OUTCOME	OTHER CLASS ACTIVITY
1 (1 week)	KSA F2F <i>/Asynchronous</i>	Definition of mineral. Important of mineralogical study to other fields and Mineral formation Mineral definition. Important of mineralogical information to scientist and engineer. Mineralogy in other fields (Processing, mining, geophysics and materials) Introduction to Earth Materials, Composition of earth crust. Major processes and Conditions	Assignment 1 (Individual) & Test 1	CO1	Online Activity
2-3 (2 weeks)	KSA F2F <i>/Asynchronous</i>	Physical Properties of Minerals Physical Properties of Minerals Crystal Habit - Individual Crystals and Groups of Distinct Crystals Cleavage, Parting, and Fracture Hardness, Tenacity, Density (Specific Gravity) Color, Streak, Luster - <i>Metallic and Non-metallic</i>		CO3	Online Activity
	KSA F2F <i>/Asynchronous</i>	Physical Properties of Minerals Fluorescence and Phosphorescence Magnetism, Other Properties - chatoyancy, asterism, piezoelectricity, taste. Tables for Identification of Minerals Luster - Metallic or Submetallic and Nonmetallic			
4-5 (2 weeks)	KSA F2F <i>/Asynchronous</i>	Mineral Classification (Silicate and non-silicate (metallic minerals)) How minerals are classified and naming The Berzelian classification system for minerals (native element, oxide, sulphides etc.), Silicate Structures and Structural Formula Mineral naming methodology SiO ₄ ⁴⁻ tetrahedrons, e.g Nesosilicates (Island Silicates) Naming system		CO1	Online Activity
6-7 (2 weeks)	ZE F2F <i>/Asynchronous</i>	Mineral Crystallography – Crystal Symmetry, Symmetry operation and Crystal morphology 1. Introduction to symmetry, Symmetry Operations and Rotoinversion, Combinations of Symmetry Operations 2. Steno's Law: The angle between crystal faces Crystallographic Axes and Unit Cells. Rotational Symmetry, Mirror Symmetry, Center of Symmetry 3. Axial Ratios, Intercepts of Crystal Faces (Weiss Parameters) 4. Miller Indices and Miller Bravais Indices. 5. Crystal Forms - General Forms and Special Forms, Open Forms and Closed Forms, , Form Symbols, and Forms, Zones and Zone Symbols	CO2	Online Activity	
8	Mid Semester Break				
9 (1 week)	F2F <i>/Asynchronous</i>	Mineral Crystallography – Crystal Symmetry, Symmetry operation and Crystal morphology 1. Vectorial Properties : Continuous and Discontinuous Vectorial Properties, Crystal Habit and polymorph. Hermann-Mauguin (International) Symbols 2. The 32 Crystal Classes, e.g Triclinic system, Monoclinic system, Orthorhombic System, Tetragonal System etc.	Assignment 2 (individual) & Test 2	CO2	Online activity /laboratory

10 (1 week)	ZE F2F /Asynchronous)	Phase Diagrams; Coupled Substitution, Solid Solution, Exsolution, Graphical Representation of mineral Composition. Phase Diagrams, Definitions – <i>System- Phase - Component</i> The Phase Rule, Equilibrium and Thermodynamics, Solid - Solid Reactions			Online activity
11-13 (3 weeks)	SI F2F /Asynchronous)	Mineral Chemistry and Calculation Compositional Variation in Minerals, oxides & S.G calculation and. Formula calculation Atoms : <i>Protons -Electrons -Neutrons</i> Bohr Atom : Planck, Electronegativity Chemical Bonding, Ionic Bonds, Covalent Bonds, Metallic Bonds Residual Bonds	Assignment 3	CO3	Online activity/Active learning
14-15 (2 weeks)	SI F2F /Asynchronous)	Techniques in mineral analysis - instrumentation and Wet Analysis Methods of Chemical Analysis, Wet Chemical Analyses Inductively Coupled Plasma - Mass Spectrometry (ICP-MS) X-ray Fluorescence (XRF) Spectrometry, Electron Microprobe (EMP) Analysis X-rays and the Production of X-rays Continuous and Characteristic X-ray Spectra X-ray Diffraction and Bragg's Law The X-ray Powder Method Crystallographic calculation	Assignment 4	CO4	Online Activity / active learning
16	REVISION WEEK				
17-19	EXAMINATION				

*Other class activity: Online Quiz, Active learning, etc. with no marks allocation

Synchronous-Online streaming, Webex, MT online)

Asynchronous-Recorded video.

Teaching staffs	Contact hours	Teaching weeks	No. of Exam Qs	CO	Format Exam Qs (7 Qs)			
					Part A (Compulsory)	Part B (Choose any 1 Qs)	Part C (Choose any 1 Qs)	Part D (Choose any 1 Qs)
Assoc. Prof. Dr. Kamar Shah Ariffin (KSA)	15 hrs	5	2 and ½	CO 1 & CO 3	Q1 - CO 1		Q4 -CO3 Q5- CO3 (1/2)	
Dr. Zakaria Endut	12 hrs	4	2	CO2		Q2 - CO 2 Q3 - CO 2		
Dr. Suhaina Ismail (SI)	15 hrs	5	2 and ½	CO 3 & CO 4			Q5-CO3 (1/2)	Q6 Q7
Total	42 hrs	14	7 Qs	CO 1, CO 2, CO 3, CO4	1 Qs	2 Qs	2 Qs	2 Qs



School of Materials and Mineral Resources Engineering

**Delivery and
Assessment Plan**

**Mineral Resources
Engineering**

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Prepared by:	Endorsed by:	Approved by:
Course Coordinator	Program Chairman	Deputy Dean (Academic)
Date:	Date:	Date: