Syllabus
IInd Semester Courses in
BSc
Department of Geology
(November 2023 onwards)

- Core Course:
  - USGEO4502CR1: Basics of Mineralogy and Petrology.
  - USGEO4502CR1PR: Mineral and Rock Identification.

- Vocational Skill Course
  - USGEO4501VS1: Cartography - The science of Maps, their creation and interpretation.

- Skill Enhancement Course
  - USGEO4502SE1: Climatology – Ocean-Atmosphere Linkage.

- Open Elective Course:
  - USGEO4501OE1: Gemmology – The art and science of gem identification.
  - USGEO4502OE1: Geoheritage of Mumbai.

- Evaluation and Assessment guidelines.

ST. XAVIER'S COLLEGE AUTONOMOUS MUMBAI-400 001

PRINCIPAL
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001.

APPROVED SYLLABUS

B.Sc. Geology		
Course Title: Basics of Mineralogy and Petrology. **Course Code:** USGEO4502CR1 Credits 3: Theory - 45 hr		
No.	**Course Objectives**	
1	To develop basic knowledge about how to identify various minerals based on their physical properties	
2	Learn about the composition of the minerals that makeup the earth's material.	
3	To be able to identify and describe types of rocks found on earth based on their origin of formation, composition.	
CO	**Course Outcomes** **On completing the course, the learner will be able to**	**Bloom's Taxonomy Level (BT level)**
1	Define and describe the basic chemical compositions, physical properties, and classification of minerals, including key concepts like isomorphism, polymorphism, and pseudomorphism.	Remembering
2	Explain the processes involved in the rock cycle, including the formation and characteristics of igneous, metamorphic, and sedimentary rocks, as well as the concepts of magmatic differentiation and metamorphism.	Understanding
3	Utilise knowledge of mineralogical and petrological properties to identify and classify various minerals and rocks based on their physical characteristics and origin of formation.	Applying
4	Analyse the textures and structures of rocks to infer their formation processes and environmental conditions, distinguishing between intrusive and extrusive igneous forms, metamorphic textures, and sedimentary structures.	Analysing
5	Assess the suitability of specific rocks for various applications, including construction and historical architecture, based on their physical properties and durability.	Evaluating

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UNIT I		**Mineralogy:**	**(15)**
		Chemical bonds and formation of compounds. Minerals: definition, chemical compositions and classification. Physical properties of minerals: colour, streak, luster, diaphaneity, form, habit, cleavage, fracture, hardness, specific gravity, and electrical and magnetic properties. Isomorphism, polymorphism and pseudomorphism.	
UNIT II		Rocks: definition, their classification. Rock cycle.	**(15)**
	1.	**Igneous Petrology**	
		Magma: definition, composition, origin, Bowen's reaction series, magmatic differentiation and assimilation. Mode of occurrences, Intrusive and Extrusive forms. Textures and structures. Classification based on : granularity (texture), mineral composition, colour index.	
	2.	**Metamorphic Petrology**	
		Metamorphism: definition, agents and types of metamorphism. Metamorphic minerals, textures and structures.	
UNIT III			**(15)**
	1.	**Sedimentary Petrology**	
		Sediments: weathering, transport, deposition, consolidation, diagenesis. Textures and structures. Classification: Terrigenous and Chemical sedimentary rocks.	
	2.	**Applications of Petrology**	
		Use of specific rocks in construction. Rocks conducive to : Construction of caves, forts and ancient Indian architecture.	

List of recommended reference books:

1. Dana J.D. and Ford W.E. (rev. ed.) (2010), Dana's Manual of Mineralogy, J. Wiley & Sons.
2. INTACH (2016): A Monograph on National Geoheritage Monuments of India.
3. Klein C and Philpotts A., (2012), Earth Materials: Introduction to Mineralogy and Petrology., Cambridge University Press
4. Perkins D (2010). Mineralogy (3rd Edition), Prentice-Hall of India

5. Read H.H. (Rev. ed. C.D. Gribble) (1988), Rutley's Elements of Mineralogy" (27TH Edition), CBS Publications.
6. Tyrell G.W. (1980), Principles of Petrology: An Introduction to the Science of Rocks., 1st Indian Edn., B.I. Publn. India.

Evaluation (Theory, USGEO4502CR1): Total marks per course – 100
Formative Assessment 'for' Learning
(continuous internal assessment - CIA to improve learning).

CIA - 40 marks

CIA 1: Written test - 20 marks.

CIA 2: Fieldwork* /Assignment / Presentations / Infographics / Quiz / as prescribed - 20 marks.

Summative Assessment 'of' Learning
(focus on outcomes, quantitative data for outcomes of instruction)

End Semester Examination - 60 marks

One question from each unit for 20 marks, with internal choice.

Total marks per question with choice 30 - 40 marks.

Distribution of Bloom's Taxonomy levels for the course assessment

Learning Levels	Remember	Understand	Apply	Analyze	Evaluate
*Percentage	0-5%	15-20%	20-30%	20-30%	10-20%

Field work assessment rubric*

St. Xavier's College, Mumbai **Course: US01GEO4502CR1**

Department of Geology

UID Number:_____

MARKS:____/20

Date:_____

Assessment Grid Field Work

Parameters Category	Details of Assessment	80 – 100 % Excellent	60 – 80 % Good	40 – 60 % Satisfactory	20 –40 % Poor	0 - 20 % Very Poor
Field Work (30 %)	1. Equipment – field diary, hammer, chisel, hand lens, map, Field discipline.(02)					
	2. Sample Collection and Instrument handling (01)					

	3. Prior Preparation (03)					
Field Report (60 %)	1. Field Diary (04)					
	2. Content, Presentation and Technical correctness (08)					
Viva Voce (10 %)	1. Ability to answer questions. (02)					
Total Marks/20						

Name, Signature of Course Instructor

Date:

APPROVED SYLLABUS

B.Sc. Geology		
Course Title: Mineral and Rock Identification. **Course Code:** USGEO4502CR1PR		
Credits 1: Practical - 30 hr		
No.	**Course Objectives**	
1	To provide students with a thorough understanding of the physical properties and chemical compositions of common minerals, enabling them to accurately identify and classify these minerals through hands-on examination and analysis.	
2	To equip students with the skills necessary to identify and describe various rock types based on their origin, composition, and textural features, with a focus on the processes that lead to their formation and the characteristics that distinguish igneous, sedimentary, and metamorphic rocks.	
3	To develop the ability to interpret and analyse the structural and textural features of rocks, enhancing students' understanding of geological processes and their applications in fields such as construction, resource exploration, and environmental geology.	
CO	**Course Outcomes** **On completing the course, the learner will be able to**	**Bloom's Taxonomy Level (BT level)**
1	Identify and classify common minerals and rocks based on their physical properties and megascopic features during hands-on practical sessions.	Applying
2	Differentiate between various textures and structures in igneous, sedimentary, and metamorphic rocks to infer their formation processes and environmental conditions.	Analysing
3	Assess the quality and properties of different minerals and rocks to determine their potential applications and suitability for various geological purposes.	Evaluating
4	Develop a comprehensive classification scheme for a given set of mineral and rock samples, integrating observations of physical properties and structural features to create a laboratory journal.	Creating

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		Practical: (one practical session of two hours per week)	
		Study of physical properties of below listed minerals: Quartz (and its varieties – amethyst, smoky, rose, milky, citrine, rock crystal), Agate (banded, moss), Chalcedony, Flint, Opaline silica, Talc, Gypsum, Calcite (colour varieties), Fluorite, Apatite, Orthoclase, Microcline, Albite, Labradorite, Mica (muscovite, biotite), Gypsum, Corundum, Augite, Hornblende, Haematite, Magnetite, Limonite, Pyrite, Galena. Identification of group characteristics of below listed rocks and their classification into major rock groups. Identification and systematic description of the megascopic features of these rocks. Igneous rocks: Basalt, Dolerite, Gabbro, Trachyte, Rhyolite, Syenite, Diorite, Spilite, Granite, Pyroclastite. Sedimentary rocks: Sandstone, Limestone, Shale (Intertrappean shale from Mumbai), Grit, Conglomerate, Breccia, Mudstone, Claystone, Laterite. Metamorphic rocks and their structures: Slate, Phyllite, Schist, Gneiss, Quartzite. Igneous textures and structures: Phaneritic, Porphyritic, Vesicular, Amygdaloidal, Ropy lava, Pillow structure in spilite, columnar structure in basalt, trachyte, rhyolite. Sedimentary structures: Lamination, Stratification, Graded bedding, Ripple marks, Cross bedding.	

List of Recommended Reference Books:

1. Blatt, H., Tracy, R. J., & Owens, B. E. (2006). Petrology: Igneous, Sedimentary, and Metamorphic (3rd ed.). W. H. Freeman and Company.

2. Deer, W. A., Howie, R. A., & Zussman, J. (2013). An Introduction to the Rock-Forming Minerals (3rd ed.). Mineralogical Society of Great Britain and Ireland.

3. Klein, C., & Dutrow, B. (2017). Manual of Mineral Science (23rd ed.). John Wiley & Sons.

4. Perkins, D. (2017). Minerals of the World (3rd ed.). Princeton University Press.

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Evaluation (Practical, USGEO4502CR1PR): **Total marks practical course - 50**

End Semester Practical Examination - 30 marks.

Learning Levels	Remember	Understand	Apply	Analyse	Evaluate	Create
*Percentage	NA	NA	25-30%	25-30%	25-30%	25-30%

APPROVED SYLLABUS

B.Sc. Geology		
Course Title: Cartography – The science of maps, their creation and interpretation. **Course Code:** USGEO4501VS1		
Credits 2: Theory + Practical – 15 + 30 hr		
No.	**Course Objectives**	
1	To be able to prepare, read and interpret maps.	
2	To be able to create simple topographical cross sections.	
3	To understand basic survey methods and be able to use the basic instruments used in land surveying including GPS.	
4	To understand various map projection techniques.	
5	To be able to understand the use of the Survey of India map catalogue system for acquiring maps of India, and our National Geospatial Policy 2022.	
CO	**Course Outcomes** **On completing the course, the learner will be able to**	**Bloom's Taxonomy Level (BT level)**
1	Define and explain key cartographic concepts and the historical development of cartography, including Indian contributions and the Survey of India Map Catalogue System.	Remembering
2	Describe the components of topographical maps, including scales, map symbols, grids, and contour patterns, and explain their significance in interpreting landforms and geological features.	Understanding
3	Utilize basic land surveying instruments such as tape and compass, plane table, level, GPS, and drone aerial photography to conduct surveys and gather spatial data.	Applying
4	Interpret topographical maps to recognize landforms, geological features, and drainage patterns, and draw simple topographical cross sections based on contour patterns.	Analysing
5	Assess the accuracy and reliability of various land surveying methods and virtual globes/digital maps in representing geographical and geological information.	Evaluating
6	Develop and produce simple topographical maps and cross sections using basic survey methods and instruments, demonstrating a comprehensive understanding of cartographic principles and techniques	Creating

UNIT I			**(15)**
		What are Maps? Types, Uses. History of Cartography – Indian Maps, Indian Cartography. Survey of India – Map catalogue system, National Geospatial Policy 2022. Reading of Topographical maps: scale, map symbols, grids. Interpretation of topographical maps: understanding contour patterns and its relationship to landforms and geology, drainage pattern recognition. Understanding virtual globes.	
UNIT II		**Practical-** (one practical session of two hours per week for 15 weeks)	
		Understanding Survey of India Map Catalogue System and related numerical problems. Numerical problems on Scale of maps. Interpretation of Topographical maps – Drawing simple topographical cross sections. Demonstration of Land Surveying methods: a. Tape and Compass survey, b. Plane Table survey, c. Levelling d. GPS survey e. drone aerial photography .f. Using virtual globes/digital maps. Introduction to geological mapping.	

List of recommended reference books:

1. Drone Rules 2022 – Ministry of Civil Aviation: https://www.civilaviation.gov.in/ministry-documents/rules
2. Gupta, K. K. and Tyagi, V. C., (1992), Working with Maps- A book for senior secondary level, 105 (DLI) Printing Group, Survey of India, Department of Science and Technology
3. Map Education, (1993), Survey of India, Department of Science and Technology
4. Maps in Everyday Life- Geo Informatics for Local Level Planning. 2004. Natural Resources Data Management System (NDMS), Department of Science and Technology, Government of India, New Delhi
5. National Geospatial Policy 2022 – Gazette Notification: https://www.surveyofindia.gov.in/webroot/UserFiles/files/National%20Geospatial%20Policy.pdf
6. Robinson. A, Morrison. J, Muehrcke. P, Kimerling. A, Guptill. S., (1995), Elements of Cartography, 6 ed, J. Wiley & Sons

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Evaluation (Theory, USGEO4501VS1): Total marks per course – 50
Formative Assessment 'for' Learning
(continuous internal assessment - CIA to improve learning).
CIA : Written Test / Assignment / Presentations / Infographics / Quiz / as prescribed - 20 marks.

Summative Assessment 'of' Learning (focus on outcomes, quantitative data for outcomes of instruction)

End Semester Examination - 30 marks
One question from each unit for 15 marks, with internal choice.
Total marks per question with choice 20 - 30 marks.

Distribution of Bloom's Taxonomy levels for the course assessment

Learning Levels	Remember	Understand	Apply	Analyze	Evaluate	Create
*Percentage	0-5%	5-10%	15-20%	10-20%	10-20%	10-20%

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B.Sc. Geology		
Course Title: Climatology: Ocean – Atmosphere Linkage. **Course Code:** USGEO4502SE1		
Credits 2: Theory + Practical – 15 + 30 hr		
No.	**Course Objectives**	
1	To understand the origin, composition, and structure of the atmosphere and its role in Earth's climate system.	
2	To gain knowledge about insolation, the heat budget, and the general circulation of the atmosphere.	
3	To develop an understanding of the monsoon, local winds, and their relationship to atmospheric disturbances.	
4	To learn about climate classification, climate change, and the effects of global warming.	
CO	**Course Outcomes** **On completing the course, the learner will be able to**	**Bloom's Taxonomy Level (BT level)**
1	Recall the basic concepts of the atmosphere, including its origin, composition, and structure, as well as key climatic phenomena like monsoons and local winds.	Remembering
2	Demonstrate an understanding of the processes involved in the heat budget, atmospheric circulation, and the impact of climate change on the Earth's climate system.	Understanding
3	Apply knowledge of weather signs, symbols, and numerical calculations related to thermal and precipitation efficiency in practical settings.	Applying
4	Analyze and interpret IMD weather maps, constructing wind roses, climographs, and hythergraphs to evaluate atmospheric conditions.	Analysing
5	Assess various climate classification systems and evaluate the evidence for and implications of global warming.	Evaluating
6	Design and create practical solutions for interpreting weather data, constructing graphical representations of climate data, and solving related numerical problems.	Creating

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UNIT I		The Atmosphere: Origin, Composition and Structure. Insolation and Heat Budget. General Circulation of the Atmosphere. Understanding of the monsoon, local winds and their relationship to atmospheric disturbances. Climate Classification. Understanding climate change with reference to global warming.	**(15)**
UNIT II		**Practical:** (One practical session of two hours per week for 15 weeks)	
		Understanding IMD: weather signs and symbols. Interpretation of IMD weather maps Thermal efficiency, precipitation efficiency and related numerical problems. Numerical problems on Moisture Index. Introduction to construction of: wind rose, climograph and hythergraph.	

List of recommended reference books:

1. Barry, R.G. and Chorley, R.J. (2003): Atmosphere, Weather and Climate; Psychology Press, Hove; East Sussex
2. Chawan S.V. (ed) (2015): Physical Geography, Paper I, Published by Director (I/C), Institute of Distance and Open Learning, University of Mumbai.
3. Lal D.S. (1997): Climatology; Sharda Pustak Bhavan; Allahabad
4. Mather,J.R.(1974): Climatology: Fundamentals and Applications; Mc Craw Hill Book Co., U.S.A.
5. Matthews, W. H., Kellogg, W., Robinson, G.D. (1971): Man's Impact on Climate; M.I.T. Press Design Dept. U.S.A.
6. Oliver, J.E. (1993): Climatology: An Atmospheric Science, Pearson Education India, New Delhi

Evaluation (Theory, USGEO4502SE1): Total marks per course – 50

Formative Assessment 'for' Learning
(continuous internal assessment - CIA to improve learning).
CIA : Written Test / Assignment / Presentations / Infographics / Quiz / as prescribed - 20 marks.

Summative Assessment 'of' Learning (focus on outcomes, quantitative data for outcomes of instruction)

End Semester Examination - 30 marks

One question from each unit for 15 marks, with internal choice.
Total marks per question with choice 20 - 30 marks.

Distribution of Bloom's Taxonomy levels for the course assessment

Learning Levels	Remember	Understand	Apply	Analyze	Evaluate	Create
*Percentage	0-5%	5-10%	15-20%	10-20%	10-20%	10-20%

B.Sc. Geology		
Course Title: Gemmology- The Art and Science of Gem Identification. **Course Code:** USGEO4501OE1		
Credits 2: Theory - 30 hr		
No.	**Course Objectives**	
1 2 3 4 5	To introduce the fundamental concepts of gemmology and the essential characteristics of gemstones. To develop an understanding of the crystallographic properties that define gemstones. To familiarize students with the various physical and optical properties of gemstones. To train students in the use of basic gemmological instruments for gemstone identification. To provide knowledge about the varieties, occurrence, and care of gemstones, particularly in the Indian context.	
CO	**Course Outcomes** **On completing the course, the learner will be able to**	**Bloom's Taxonomy Level (BT level)**
1	Define basic gemmological terms and the essential characteristics of gemstones.	Remembering
2	Explain the crystallographic and physical properties that distinguish different types of gemstones.	Understanding
3	Demonstrate the use of gemmological instruments to identify various gemstones.	Applying
4	Differentiate between natural, synthetic, artificial, and simulant gemstones based on their properties and identification techniques.	Analysing
5	Assess the quality and authenticity of gemstones using standard gemmological techniques.	Evaluating
6	Prepare a comprehensive report on a selected gemstone, detailing its properties, identification methods, and occurrence in India.	Creating

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UNIT I		**Basic Gemmology**	**(15)**
		What is Gemmology? What is a gemstone? Basic crystallography Essential characteristics of gemstones. Hardness, cleavage, fracture, hardness, density/specific gravity, colour, lustre, sheen, transparency, interference, chatoyancy, asterism, iridescence, labradorescence, orient, play of colour, opalescence, aventurescence, adularescence, brilliance, fire, scintillation.	
UNIT II		**Gem instruments and gemstone varieties**	**(15)**
		Basic instruments used for identification of gemstones. Loupe, Chelsea filter, dichroscope, polariscope, spectroscope, UV lamp, refractometer, gem microscope, reflectivity meter, electronic diamond tester Varieties of important gemstones: (natural, synthetic, artificial and simulants). Corundum (ruby and sapphire) varieties, chrysoberyl varieties, beryl varieties, quartz varieties, garnet varieties, feldspar varieties, tourmaline varieties, peridot, spinel, coral, pearl, ivory. Units of weight, Care of gemstones. Occurrence of gem minerals in India Indian gemstone industry – locations and specialty.	

List of recommended reference books:

1. Karanth, R. V. (2000). *Gems and gem industry in India* (Memoir 45). Geological Society of India
2. Matlins, A. L., & Bonanno, A. C. (2016). *Gem identification made easy* (6th ed.). Gemstone Press.
3. O'Donoghue, M. (2006). *Gems* (6th ed.). Elsevier Butterworth-Heinemann.
4. Pedersen, M. C. (2004). *Gem and ornamental materials of organic origin*. Elsevier Butterworth-Heinemann.
5. Read, P. G. (2005). *Gemmology* (3rd ed.). Elsevier Butterworth-Heinemann.
6. Schumann, W. (2009). *Gemstones of the world* (5th ed.). Sterling.
7. Shyamala, F., & Choudhary, G. (2010). *Understanding rough gemstones*. Indian Institute of Jewellery (A division of Modern India Ltd).

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Evaluation (Theory, USGEO4501OE1): Total marks per course – 50
Formative Assessment 'for' Learning
(continuous internal assessment - CIA to improve learning).
CIA : Written Test / Assignment / Presentations / Infographics / Quiz / as prescribed - 20 marks.

Summative Assessment 'of' Learning (focus on outcomes, quantitative data for outcomes of instruction)

End Semester Examination - 30 marks
One question from each unit for 15 marks, with internal choice.
Total marks per question with choice 20 - 30 marks.

Distribution of Bloom's Taxonomy levels for the course assessment

Learning Levels	Remember	Understand	Apply	Analyze	Evaluate	Create
*Percentage	0-5%	5-10%	15-20%	10-20%	10-20%	10-20%

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B.Sc. Geology		
Course Title: Geoheritage of Mumbai. **Course Code:** USGEO4521OE1 Credits 2: Theory - 30 hr		
No.	**Course Objectives**	
1 2 3 4	To explore the historical development of Mumbai from seven islands to its current state and understand its pioneering geological work. To identify and appreciate the geoheritage sites in Mumbai through field visits and hands-on learning. To understand the drainage system of Mumbai, including its major rivers and modified drainage patterns. To study the various rock types, rock structures, and secondary minerals found in Mumbai and their classification systems	
CO	**Course Outcomes** **On completing the course, the learner will be able to**	**Bloom's Taxonomy Level (BT level)**
1	Recall the historical development of Mumbai and the significant geological work carried out in the region.	Remembering
2	Demonstrate an understanding of the geoheritage sites, including their significance and geological features.	Understanding
3	Apply their knowledge to identify and describe the major rivers, modified drainage systems, and various rock types and structures in Mumbai.	Applying
4	Analyse the relationships between different rock types, structures, and secondary minerals, and how these features have influenced the geological landscape of Mumbai.	Analysing
5	Evaluate the importance of Mumbai's geoheritage sites and drainage systems in the context of urban development and environmental conservation.	Evaluating
6	Create comprehensive field reports and presentations that document their findings from field visits to geoheritage sites and their analysis of Mumbai's geological features.	Creating

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UNIT I		Introduction History of Mumbai- How Mumbai developed from seven islands to its current state. History of pioneering geological work done in Mumbai. Geoheritage sites in Mumbai (with field visits – 16 hours of fieldwork).	**(15)**
UNIT II		Drainage system of Mumbai- Major rivers and modified drainage system of Mumbai Various rock types of Mumbai and various types of classification systems available for rocks. Various rock structures (dykes, faults, pillow lavas and features of lava flows) Secondary minerals of Mumbai.	**(15)**

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Practical: Field visit

List of recommended reference books:

1. Deshpande, G. G., Pitale U.L., (2014) Geology of Maharashtra (2nd Edition - Revised), Geological Society of India.
2. Dhavalikar, M. K. (2016) Cultural Heritage of Mumbai, Chhatrapati Shivaji Maharaj Vastu Sangrahalaya, Mumbai. ISBN 978-81-908323-6-6
3. Duraiswami, R.A., Jutzeler, M., Karve, A. V., Gadpallu, P., and Kale, M.G., (2019) Subaqueous effusive and explosive phases of late Deccan volcanism: evidence from Mumbai Islands, India, Arabian Journal of Geosciences 12(23), pp. 1-21
4. Pundalik A. and Samant H. (2023) Ratan Nadirshaw Sukheswala: Carbonatite man of India in: Tripathi, P. M., Sharma, N. K, Paramanik, V. and Singh, V. P (Eds) Descendants of Kaṇāda: Life sketches of some Indian scientists, Indira Gandhi National Tribal University and Scientific Publishers, Jodhpur, New Delhi pp. 138-149. ISBN 978-81-962465-1-8 (H/B)
5. Samant, H., Pundalik, A., D'souza, J., Sheth, H., Lobo, K. C., D'souza, K., and Patel, V. (2017) Geology of the Elephanta Island fault zone, western Indian rifted margin, and its significance for understanding the Panvel flexure., J. Earth Syst. Sci. 126:9 pp.1-14. https://doi.org/10.1007/s12040-016-0793-8.
6. Sheth, H. Pal, I., Patel, V., Samant, H. and D'Souza, J. (2017) Breccia-cored columnar rosettes in Rubbly Pahoehoe Lava Flow, Elephanta Island, Deccan Traps, and a Model for their Origin., Geoscience Frontiers 8 pp. 1299-1309, https://dx.doi.org/10.1016/j.gsf.2016.12.004.
7. Sheth, H., Patel, V. and Samant, H. (2017) Control of Early-formed Vesicle Cylinders on Upper Crustal Prismatic Jointing in Compound Pāhoehoe Lavas of Elephanta Island, Western Deccan Traps, India, Bulletin of Volcanology 79:63, pp. 1-12. https://doi.org/10.1007/s00445-017-1147-3.

8. Sheth, H., Samant, H., Patel, V., & D'Souza, J. (2017) The Volcanic Geoheritage of the Elephanta Caves, Deccan Traps, Western India., Geoheritage, Vol. 9: pp. 359 -372 https://doi.org/10.1007/s12371-016-0214-z ISSN 1867-2485
9. Sheth, H., Samant, H., (2016) Field guide to Elephanta Island, Mumbai harbour, India. Field Trip 2 (29 November 2016), International Conference Asian Current Research on Fluid Inclusions (ACROFI) VI.
10. Sukheswala, R. N., Sethna, S. F. (1962) Deccan Traps and associated rocks of the Bassein area. Geological Society of India V.3.
11. Sukheswala, R.N., Poldervaart, A. (1958) Deccan basalts of the Bombay area, India. Bulletin Geological Society of America, v. 69, pp. 1473-1494.
12. Sukheswala, R. N. (1947) A fossil tortoise (*Testudo leithii*) from the intertrappean of the Worli Hill, Bombay. In Proceedings of the Indian Science Congress, 33rd Session, p. 97.

Evaluation (Theory, USGEO4502OE1): Total marks per course – 50

Formative Assessment 'for' Learning
(continuous internal assessment - CIA to improve learning).
CIA : Field visit */ Assignment / Presentations / Infographics / Quiz / as prescribed - 20 marks.

Summative Assessment 'of' Learning (focus on outcomes, quantitative data for outcomes of instruction)

End Semester Examination - 30 marks

One question from each unit for 15 marks, with internal choice.
Total marks per question with choice 20 - 30 marks.

Distribution of Bloom's Taxonomy levels for the course assessment

Learning Levels	Remember	Understand	Apply	Analyze	Evaluate	Create
*Percentage	0-5%	5-10%	15-20%	10-20%	10-20%	10-20%

*As per the Field Work Assessment Rubric.

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***Field work assessment rubric**

St. Xavier's College, Mumbai **Course: US01GEO4502OE1**

Department of Geology

UID Number:_____

MARKS:____/20

Date:_____

Assessment Grid Field Work

Parameters Category	Details of Assessment	80 – 100 % Excellent	60 – 80 % Good	40 – 60 % Satisfactory	20 –40 % Poor	0 - 20 % Very Poor
Field Work (30 %)	1. Equipment – field diary, hammer, chisel, hand lens, map, Field discipline.(02)					
	2. Sample Collection and Instrument handling (01)					
	3. Prior Preparation (03)					
Field Report (60 %)	1. Field Diary (04)					
	2. Content, Presentation and Technical correctness (08)					
Viva Voce (10 %)	1. Ability to answer questions. (02)					
Total Marks/20						

Name, Signature of Course Instructor

Date:

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