

FY BSc Semester I and Semester II (NEP 2020)

Course	Paper title	Code
SEMESTER I		
Major P-I	Fundamentals of Earth Processes	GLM 2001C
Major P-II	Introduction to Minerals and Fossils	GLM 2011C
Minor	Fundamentals of Earth Processes and Mineral Science	GLE2001C
SEC	Mineral Science Lab	SEC 2181C
MDC	Mineral Science	MDC2221C
IKS	Geoheritage	2161C
SEMESTER II		
Major P-I	Introduction to Rock Science	GLM2002C
Major P-II	Applications of Geoscience	GLM2012C
Minor	Fundamentals of Rock Science and Historical Geology	GLE2002C
SEC	Rock Science Lab	SEC2162C
MDC	Geospatial Technology	MDC2222C

FS B.Sc. – I (Major/Minor/MDC)

		<div>The Maharaja Sayajirao University of Baroda</div> <div>Faculty of Science</div> <div>Department of Geology</div> <div>Sayajigunj, Vadodara, 390002</div>			<div>ACADEMIC</div> <div>YEAR</div> <div>2023-2024</div>	
<div>B.Sc. (Geology): Regular Programme</div>						
YEAR	I	<div>Major (Compulsory)</div> <div>GLM 2001C Fundamentals of Earth Processes</div>			CREDIT	4
Semester	I				HOURS	75
OBJECTIVES:		The objective of this course is to provide the students an understanding of the geological characteristics of the planet earth, its surface morphology, stratigraphic principles and minerals.				
<div>COURSE CONTENT / SYLLABUS</div>						
UNIT-I		Definition, scope, and branches of geo-science; Solar system: origin and important theories – Evolutionary and catastrophic theories; Age of the Earth: Relative methods– from organic evolution, rate of sedimentation, salinity of sea water and rate of cooling and absolute methods of dating - radiometric dating; Earth’s internal structure; Concept of isostasy – Pratt’s and Airy’s Hypothesis.				15 hrs.
UNIT-II		Fundamental concepts of geomorphology; Endogenic and exogenic processes; Weathering – Physical, Chemical, and biological; Soil – its development and profile, Drainage patterns				15 hrs.
UNIT-III		Definition and importance of stratigraphy in geology; Geological time scale; Brief idea about stratotypes; imperfection of geological records; Principles of Stratigraphy; Stratigraphic units - Lithostratigraphy, biostratigraphy and chrono stratigraphy.				15 hrs.
UNIT-IV		Study of physical properties of minerals in hand specimen. (Lab)				30 hrs.
<div>REFERENCES</div>						
1) Leet, L. D., Judson, S., & Kauffman, M. E. (1954). Physical geology. Prentice-Hall. 2) Jain, S. (2014). Fundamentals of physical geology. Springer India. 3) Thornbury, W. D. (1954). Principles of geomorphology (Vol. 78, No. 2, p. 157). LWW. 4) Kale, V. S., & Gupta, A. (2001). Introduction to geomorphology. Orient Longman. 5) Weller, M.J. Stratigraphic principles, and practice. 6) International Commission on Stratigraphy https://stratigraphy.org/						

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B.Sc. (Geology): Regular Programme						
YEAR	I	Major (Compulsory) GLM 2011C Introduction to Minerals and Fossils			CREDIT	4
Semester	I				HOURS	75
OBJECTIVES:		The objective of this course is to develop an understanding of the crystals and minerals through models and hand specimens. The course will also help in introducing the students to the subject of palaeontology.				
COURSE CONTENT / SYLLABUS						
UNIT-I		Crystal - Crystallization, morphology (faces, edge, solid angle), elements of symmetry (Plane, axis and centre); Crystallographic axes & Crystal systems; Weiss parameters and Miller indices; Interfacial angles and open & closed crystal forms.				15 hrs.
UNIT-II		Minerals – definition, nature; chemistry and classification - rock forming and ore-forming minerals; physical properties of minerals; Basic idea about the rock forming mineral groups (silicates) and their gem varieties.				15 hrs.
UNIT-III		Palaeontology - Fossils Definition; Preservations of fossils (nature of hard parts, modes of preservation) occurrences of Fossils; Types of Fossils – Body fossil - Mega and Micro Fossils; Living Fossils; Resin Fossils; Pseudo-fossils; derived and transported fossils; Trace Fossils; Concept of index fossils; Utility of Fossils.				15 hrs.
UNIT-IV		Study of symmetry elements of normal classes of six crystal systems, Euler’s theorem. (Lab)				30 hrs.
REFERENCES						
1) Hurlbut, C. S., & Klein, C. (1977). Manual of mineralogy (after James D. Dana). Wiley. 2) Perkins, D. (1998). Mineralogy. Begin, 17, 17-38. 3) Rutley, F. (2012). Rutley’s elements of mineralogy. Springer Science & Business Media 4) An Introduction to Palaeontology, Amal Dasgupta. The World Press Private Limited 5) Palaeontology evolution and animal distribution, P.C. Jain. 6) Black, R. M. (1999) Elements of Palaeontology, Cambridge University Press						

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B.Sc. (Geology): Regular Programme						
YEAR	I	Minor			CREDIT	4
Semester	I	GLE2001C Fundamentals of Earth Processes and Mineral Science			HOURS	60
OBJECTIVES:		The course is meant to introduce the students to planet earth, its surface processes, minerals and crystals.				
COURSE CONTENT / SYLLABUS						
UNIT-I		Definition, scope and branches of geo-science; Solar system: origin and important theories – Evolutionary and catastrophic theories; Age of the Earth: Relative methods– from organic evolution, rate of sedimentation, salinity of sea water and rate of cooling and absolute methods of dating - radiometric dating; Earth’s internal structure; Concept of isostasy – Pratt’s and Airy’s Hypothesis.				15 hrs.
UNIT-II		Fundamental concepts of geomorphology; Endogenic and exogenic processes; Weathering – Physical, Chemical, and biological; Soil – its development and profile; Marine, Fluvial, Aeolian, and Glacial processes and resulting landscapes.				15 hrs.
UNIT-III		Crystal - Crystallization, morphology (faces, edge, solid angle), elements of symmetry (Plane, axis and centre); Crystallographic axes & Crystal systems; Weiss parameters and Miller indices; Interfacial angles and open & closed crystal forms.				15 hrs.
UNIT-IV		Minerals – definition, nature; chemistry and classification - rock forming and ore-forming minerals; physical properties of minerals; Basic idea about the rock forming mineral groups and their gem varieties– Silicates structures.				15 hrs.
REFERENCES						
1) Leet, L. D., Judson, S., & Kauffman, M. E. (1954). Physical geology. Prentice-Hall. 2) Jain, S. (2014). Fundamentals of physical geology. Springer India. 3) Thornbury, W. D. (1954). Principles of geomorphology (Vol. 78, No. 2, p. 157). LWW. 4) Kale, V. S., & Gupta, A. (2001). Introduction to geomorphology. Orient Longman. 5) Weller, M.J. Stratigraphic principles, and practice. 6) International Commission on Stratigraphy https://stratigraphy.org/ 7) Hurlbut, C. S., & Klein, C. (1977). Manual of mineralogy (after James D. Dana). Wiley. 8) Perkins, D. (1998). Mineralogy. Begin, 17, 17-38. 9) Rutley, F. (2012). Rutley’s elements of mineralogy. Springer Science & Business Media.						

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B.Sc. (Geology): Regular Programme					
YEAR	I	Minor SEC 2181C Mineral Science Lab (SEC)		CREDIT	2
Semester	I			HOURS	60
OBJECTIVES:		The objective of this laboratory course is to develop hands on skill in the students to identify and characterize crystals and minerals.			
COURSE CONTENT / SYLLABUS					
UNIT-I	Study of symmetry elements of normal classes of six crystal systems, Euler’s theorem.				30 hrs.
UNIT-II	Study of physical properties of minerals in hand specimen.				30 hrs.

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<div>B.Sc. (Geology): Regular Programme</div>					
YEAR	I	<div>Multidisciplinary Course (MDC-I)</div> <div>MDC2221C Mineral Science</div>		CREDIT	4
Semester	I			HOURS	75
OBJECTIVES:		This course will provide information about the multiple facets of minerals and their uses.			
<div>COURSE CONTENT / SYLLABUS</div>					
UNIT-I		Minerals- Introduction, classification, basic physical properties; Mineral chemistry and structure of common occurring minerals; Mineral, Man and Environment-health hazards from natural minerals, Impact of Mining and Mineral Industry on environment, concept of medicinal mineralogy.			15 hrs.
UNIT-II		Basic idea and occurrences of economic minerals - Non-metallic, metallic, mineral fuels in Gujarat. Minerals and corresponding industries - ceramics and refractories, electronics, paint, and coatings and other industrial applications;			15 hrs.
UNIT-III		Gemstones- Introduction, qualities of gemstones, geological distribution, gem testing techniques, gems, and jewelry; contribution of gems in medical science.			15 hrs.
UNIT-IV		Study of physical properties of minerals in hand specimen. (Lab)			30 hrs.
<div>REFERENCES</div>					
1) Rutley, F. (2012). Rutley’s elements of mineralogy. Springer Science & Business Media. 2) Ciullo, P. A. (1996). Industrial minerals and their uses: a handbook and formulary. William Andrew. 3) Mukherjee, S. (2012). Applied mineralogy: applications in industry and environment. Springer Science & Business Media. 4) Karanth, R. V. (2000). Gems and gem industry in India (No. 45). Geological Society of India. 5) Prasad, U. (2006). Economic Geology: Economic Mineral Deposits. CBS Pub.					

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B.Sc. (Geology): Regular Programme						
YEAR	I	Major (Compulsory)			CREDIT	4
Semester	II				GLM2002C Introduction to Rock Science	
OBJECTIVES:		The objective of this course is to provide theoretical and practical knowledge to the students for identifying and describing various rock types and structures.				
COURSE CONTENT / SYLLABUS						
UNIT-I		Rocks as natural mineral aggregates; types of rocks and concept of rock cycle; Magma definition, composition, types and origin; Major forms and structures of igneous rocks; Tabular classification of igneous rocks; Ideas about diversity in igneous rocks – differentiation and assimilation, Bowen’s reaction series; Occurrences of Granite, Granodiorite, Rhyolite, Syenite, Nepheline syenite, Phonolite, Diorite, Gabbro, Basalts, Carbonatites in India.				15 hrs.
UNIT-II		Sedimentary rocks- Processes of formation, Concept of grain size and shape, common primary sedimentary structures, Basic classification of sediments and sedimentary rocks; Metamorphic rocks- Agents and types of metamorphism, structures and classification, Concept of index minerals and grade of metamorphism; Occurrences of common sedimentary and metamorphic rocks in India.				15 hrs.
UNIT-III		Definition and types of deformation in rocks; planer and linear structures; attitudes of planer and linear structures - its measurements and related symbols; Basic understanding of folds, faults, joints and unconformity; Basic Geological tools – hammer, clinometer, Brunton compass and topographical maps; Working principle of GPS.				15 hrs.
UNIT-IV		Megascopic studies of common igneous, sedimentary, and metamorphic rocks. (Lab)				30 hrs.
REFERENCES						
1) Tyrrell, G. W. (2012). The principles of petrology: an introduction to the science of rocks. Springer Science & Business Media.						
2) Sengupta, S. (2017). Introduction to sedimentology. Routledge.						
3) Billings, M. P. Structural Geology, Prentice Hall, 1977						
4) Mathur, S. M. (2001). Guide to Field Geology. PHI Learning Pvt. Ltd.						

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<div>B.Sc. (Geology): Regular Programme</div>						
YEAR	I	<div>Major (Compulsory)</div> <div>GLM2012C Applications of Geoscience</div>			CREDIT	4
Semester	II				HOURS	75
OBJECTIVES:		The objective of this course is to give an idea about the fundamental aspects of applied geology and provide outdoor training for carrying out geological studies.				
<div>COURSE CONTENT / SYLLABUS</div>						
UNIT-I		Role of geo-science and geo-scientists in society- industrial and economic significance; Mining – introduction and terminologies; preliminary idea about open cast and underground mining;				15 hrs.
UNIT-II		Concepts and principles of environmental geology; Natural environmental hazards-Causes and preventive measures of floods, mass-movement, earthquakes, tsunamis, and cyclones.				15 hrs.
UNIT-III		Groundwater – hydrological cycle, societal relevance, vertical distribution; hydrogeological classification – aquifer, aquitard, aquiclude, aquifuge; WHO and BIS standards of water quality. Role of different rocks as construction material - Building stones, Roofing and facing stones, Armour-stone, concrete aggregate, road aggregate.				15 hrs.
UNIT-IV		Study of SOI topographic maps. Methods and techniques of extracting geological information and interpretation from topographic maps to identify geomorphic and structural features. Hands on training of basic geological tools such as Hammer, Brunton compass and GPS in lab. Outdoor practicals in igneous, sedimentary and metamorphic terrains and use of basic geological tools. (Lab)				30 hrs.
<div>REFERENCES</div>						
1) Arogyaswamy, R. N. P. (1980). Courses in mining geology. Oxford and IBH. 2) Todd, D. K., & Mays, L. W. (2004). Groundwater hydrology. John Wiley & Sons. 3) Keller, E. A. (2007). Introduction to environmental geology. Prentice-Hall, Inc. 4) Prentice John Edward (1982). Geology of construction materials, Chapman and Hall, London 5) Compton, R. R. (1962). Manual of field geology. Soil Science, 93(4), 295.						

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B.Sc. (Geology): Regular Programme						
YEAR	I	Minor GLE2002C Fundamentals of Rock Science and Historical Geology			CREDIT	4
Semester	II				HOURS	60
OBJECTIVES:		This course will enable students to identify various types of rocks, structures, fossils and understanding stratigraphic principles.				
COURSE CONTENT / SYLLABUS						
UNIT-I		Rocks as natural mineral aggregates; types of rocks and concept of rock cycle; igneous rock-origin, forms, structures and classification; Sedimentary rock – process of formation, classification, texture -concept of grain size and shape, common primary structures; Metamorphic rocks- Agents and types of metamorphism, structures and classification.				15 hrs.
UNIT-II		Definition and types of deformation in rocks; planer and linear structures; attitudes of planer and linear structures - its measurements and related symbols; Basic understanding of folds, faults, joints and unconformity; Basic Geological tools – hammer, clinometer, Brunton compass and topographical maps; Working principle of GPS.				15 hrs.
UNIT-III		Definition and importance of stratigraphy in geology; Geological time scale; Brief idea about stratotypes; imperfection of geological records; Principles of Stratigraphy; Stratigraphic units - Lithostratigraphy, biostratigraphy and chronostratigraphy.				15 hrs.
UNIT-IV		Paleontology - Fossils Definition; Preservations of fossils (nature of hard parts, modes of preservation) occurrences of Fossils; Types of Fossils – Body fossil - Mega and Micro Fossils; Living Fossils; Resin Fossils; Pseudo-fossils; derived and transported fossils; Trace Fossils; Concept of index fossils; Utility of Fossils.				15 hrs.
REFERENCES						
<div>1) Tyrrell, G. W. (2012). The principles of petrology: an introduction to the science of rocks. Springer Science & Business Media.</div> <div>2) Sengupta, S. (2017). Introduction to sedimentology. Routledge.</div> <div>3) Billings, M. P. Structural Geology, Prentice Hall, 1977</div> <div>4) Mathur, S. M. (2001). Guide to Field Geology. PHI Learning Pvt. Ltd.</div> <div>5) Weller, M.J. Stratigraphic principles and practice</div> <div>6) International Commission on Stratigraphy https://stratigraphy.org/</div> <div>7) An Introduction to Palaeontology, Amal Dasgupta, The World Press Private Limited</div> <div>8) Black, R. M. (1999) Elements of Palaeontology, Cambridge University Press</div> <div>9) Palaeontology evolution and animal distribution, P.C. Jain.</div>						

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B.Sc. (Geology): Regular Programme						
YEAR	I	Minor SEC2162C Rock Science Lab (SEC)			CREDIT	2
Semester	II				HOURS	60
OBJECTIVES:		The objective of this course is to provide training to the students to identify and describe various types of rocks.				
COURSE CONTENT / SYLLABUS						
UNIT-I	Megascopic studies of common igneous, sedimentary and metamorphic rocks.				60 hrs.	

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B.Sc. (Geology): Regular Programme						
YEAR	I	Multidisciplinary Course (MDC-II) MDC2222C Geospatial Technology			CREDIT	4
Semester	II				HOURS	75
OBJECTIVES:		The objective of this course is to provide the students knowledge of geospatial technology and use of remote sensing data.				
COURSE CONTENT / SYLLABUS						
UNIT-I	Introduction, purpose and importance of geospatial technology; Maps-importance, scale, types, elements, indexing, coordinate system, interpretation; GPS-Overview, function, segments and application.					15 hrs.
UNIT-II	Concept of remote sensing, EM-spectrum, energy sources and radiation principles, energy interaction in the atmosphere, energy interactions with earth surface features, spectral reflectance curve of vegetation, soil and water, spectral response patterns, data acquisition and interpretation, ideal and real remote sensing system. Applications of remote-sensing.					15 hrs.
UNIT-III	Development of important Indian Space Programmes					15 hrs.
UNIT-IV	Study of SOI maps, satellite imageries and GPS data (Lab).					30 hrs.
REFERENCES						
1) T. M. Lillesand and P. W. Kiefer, 2016, Remote Sensing and Image Interpretation. Wiley 2) V Emayavaramban, K Kannadasan, S Vinothkanna; Geospatial Technology: Fundamentals & Applications: Fundamentals & Applications; New India Publishing Agency 3) Bradley Shellito Introduction to Geospatial Technologies W.H. Freeman & Company 4) Bhatta, B. (2008). Remote sensing and GIS.						

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B.Sc. (Geology): Regular Programme					
YEAR	I	Indian Knowledge System IKS2161C Geoheritage		CREDIT	2
Semester	I			HOURS	50
OBJECTIVES:		The purpose of this course is to develop concept of geoparks and preservation of geo-sites and geo-heritage among the students.			
COURSE CONTENT / SYLLABUS					
UNIT-I		Introduction and importance of geo-heritage. Concept, geo-conservation, guideline for selection and development strategies. Types of geoparks: fossil parks, rock monuments, geological marvels, stratigraphic and economic. Threats to geodiversity; conservation, protection, and maintenance of geological sites. Geotourism – tourism and geosciences, geological heritage and museums.			15 hrs.
UNIT-II		UNESCO geoparks and national geological monuments. Well-known geoparks and geosites in various states of India. National and global geoheritage and protection laws.			15 hrs.
REFERENCES					
<div>1) A Monograph on National geoheritage monuments of India, Indian National Trust for Art and Cultural Heritage, Natural Heritage Division, New Delhi. 2016.</div> <div>2) Ranawat, P. S., George, S., 2019 Potential Geoheritage & Geotourism Sites in India, International Journal of Scientific & Research Publications, Volume 9 (6). pp. 91-96.</div> <div>3) Ezzoura Errami, Margaret Brocx (Ed.) 2009. Geoheritage, Geoparks and Geotourism Conservation and Management Series, Springer. P 268.</div> <div>4) Geoheritage and Potential Geotourism in Geoparks- Indian Perspective, Wadhawan S. K. in Global Geographical Heritage, Geoparks and Geotourism, Singh, R. B., Wei, D., and Anand S., Springer Nature, 2021.</div>					