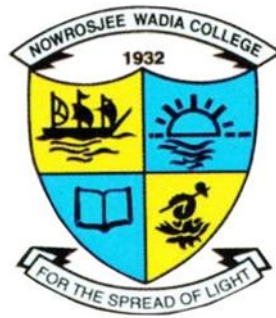


MODERN EDUCATION SOCIETY'S

NOWROSJEE WADIA COLLEGE, PUNE

**(An Autonomous College Affiliated to
Savitribai Phule Pune University)**




Framework of Syllabus For

B.SC. GEOLOGY


(Based on NEP 2.0 framework)

S.Y.B.Sc. Semester – III


2025-26

	MODERN EDUCATION SOCIETY'S Nowrosjee Wadia College, Pune (Autonomous) Bachelor of Science (Hons.) with research in GEOLOGY	Academic Year 2025-2026
	Geology Major Subject	
Year 2025	GLMJ 231 Igneous and Metamorphic Petrology	Credits 2
Semester- III		Hours 30
Course specific outcomes: This course will upgrade the basic knowledge of students in igneous and metamorphic petrology. Introduction to advance concepts in igneous petrology will enhance their understanding in the evolution and generation of different types of magmas, their tectonic association. The detailed knowledge of different rock types will be beneficial for them while pursuing future studies. Students will gain knowledge of metamorphism, different types of metamorphism and factors controlling them.		
UNITS	COURSE CONTENT / SYLLABUS	No. of Lectures
UNIT 1	Characteristics, Generation and Crystallization of the magma a) The physico-chemical nature of magma-density, viscosity, chemical constituents and temperature-pressure. b) Role of magma in Geological processes: melting of rocks and generation of magmas, temperature-pressure conditions and volatile constituents. c) Generation of magmas in different tectonic settings. d) Types of magmas- Primary and derivative Crystallization of magmas: a) Unicomponent magma b) Bicomponent magma: Eutectic crystallization, Solid solution series (Plagioclase) c) Binary system of incongruent melting compounds: Leucite-Silica system d) Ternary System- Albite-Anorthite-Diopside system Magmatic evolution: a) Magmatic Differentiation: Crystal fractionation, Liquid immiscibility, Liquid fractionation, Contamination, Mixing of magmas, Assimilation b) Role of volatile constituents in differentiation of magma	8
UNIT 2	Classification, tectono-magmatic association and description of igneous rock types Classification of igneous rocks:	7


<p>UNIT 3</p> <p>UNIT 4</p>	<p>a) Shand's classification b) CIPW classification c) IUGS (plutonic, volcanic) classifications d) TAS classification Concept of tectono-magmatic association Description of rock types with regard to their characteristics, composition, Origin and occurrence in relation to their tectonic setting: Peridotite clan rocks, Basalt, Anorthosite, Granite, Pegmatite, Alkaline rocks (Kimberlite, Lamprophyres, Lamproite) and Carbonatite.</p> <p>Introduction to Advanced Metamorphic Petrology a) Types of metamorphism and their controlling factors b) Metamorphic facies, facies series, isograds c) Introduction to mineralogical phase rule- system, component and phase d) Introduction to phase diagrams of metamorphic rocks- ACF, AKF and AFM diagrams e) Prograde and retrograde metamorphism, metasomatism f) Deformation textures and textures related to recrystallization, Metamorphic reactions, elemental exchange and P-T conditions of isograds</p> <p>Types of Metamorphism and its products a) Regional and thermal metamorphism of pelitic rocks b) Regional and thermal metamorphism of Basic and Ultrabasic igneous rocks c) Regional and thermal metamorphism of impure, siliceous, carbonate rocks d) Metamorphism of Granitoids, Charnokites and Migmatites e) Thermal metamorphism, Aureoles of thermal</p>	<p>7</p> <p>8</p>
<p>Reference</p>	<p>1. Bruce Yardley and Clare Warren (2022) An Introduction to Metamorphic Petrology (2nd edition) 2. John D. Winter (2014) Principles of Igneous and Metamorphic Petrology (2nd edition) 3. Philpotts and Ague (2009) Principles of Igneous and Metamorphic Petrology (2nd edition)</p>	
<p>Learning outcomes</p>	<p>The students will be able to understand and learn about the process of formation, evolution, classification of igneous rocks along with recognition of different igneous rock types. Besides, they will get familiarize themselves with metamorphic processes, metamorphic reactions, types of metamorphism, their products and identify metamorphic rocks.</p>	

	MODERN EDUCATION SOCIETY'S Nowrosjee Wadia College, Pune (Autonomous)	Academic Year 2025-2026
	Bachelor of Science (Hons.) with research in Geology	
Geology Major Subject		
Year 2025	GLMJ 232 Structural Geology	Credits 2
Semester- III		Hours 30
Course specific outcomes: The course is designed for the students to understand the geometry and mechanics of the various geological structures that result through the deformative processes operative within the earth. The course will provide students a basic knowledge of various operative forces within the earth, deformations caused due to them, formation mechanism and classification of structural features associated with them.		
UNITS	COURSE CONTENT / SYLLABUS	No. of Lectures
UNIT 1	Introduction to Structural Geology Definition of Structural Geology, Relation of Structural Geology with other branches of Geology, Tectonic and non-tectonic structures, Scale of Tectonic structures (Micro, Meso, Macro and Regional), Planar and linear structures, Attitude of Planar structure, Outlier and Inlier, Brunton Compass	7
UNIT 2	Stress and Strain Definition and concept of Stress and Strain, Three stages of deformation (Hooke's Law), Understanding stress and strain with reference to elastic and plastic deformation, Factors controlling rock deformation (Confining Pressure, temperature, time, solution), Brittle and Ductile deformation, Introduction to Stress and Strain diagram, Recrystallization with and without change in shape (Reckie's principle)	7
UNIT 3	Introduction to Structural features –I A) Joints: General characteristics, Rupturing under tension, Rupturing under Compression, Classification of Joints B) Unconformities: Introduction, The importance of unconformity, Classification of unconformities, Structural classification, Recognition of an unconformity in the field C) Faults: Terminologies associated with fault plane, Nature of movement along faults (Translational and Rotational), Effects on disrupted strata, Separation (Horizontal and	8


UNIT 4	<p>Vertical), Concept of throw and heave, Classification of faults (Geometric and Genetic)</p> <p>Introduction to Structural Features – II</p> <p>A) Folds: Definition and parts of fold, Types of fold (On the basis of appearance in cross section, attitude of axial plane, attitude of fold axis, Miscellaneous), Concept of fold system (Salient and Recess, En'echelon fold), Methods to determine the Depth of folding, Recognition of folds and plotting attitude of beds on a map.</p> <p>B) Landform Associated with Tectonic Structures: Introduction, Structural landforms associated with inclined beds, Landforms associated with folds, Landform associated with joints, Landform associated with faults, Determination of the top of the beds by using Primary sedimentary and Igneous structures.</p>	8
References	<ol style="list-style-type: none"> 1. Jain, A.K., (2014), An introduction to structural geology. Text Book series in Geological Sciences for Graduate Students. Geological Society of India, Bangalore. 2. Fossen, H., (2010) Structural Geology. Cambridge University Press. 3. Davis, G.R., (1984) Structural Geology of Rocks and Region. John Wiley 4. Ramsay, J.G., (1984) Folding and fracturing of rocks. McGraw-Hill, New York. 5. Billings, M.P., (1972) Structural Geology. Prentice Hall. 	
Learning outcomes	<p>The course deals with geological structures resulting from the action of forces on rocks. The student will gain knowledge of the geometry of the rock structures, understand the mechanism of the evolution of rock structures and its application in the field.</p>	


	MODERN EDUCATION SOCIETY'S Nowrosjee Wadia College, Pune (Autonomous)	Academic Year 2025-2026
	Bachelor of Science (Hons.) with research in GEOLOGY	
Geology Major Subject		
Year 2025	GLMJ 233 Practicals Based on Igneous and Metamorphic Petrology	Credits 2
Semester- III		Hours 60
Course specific outcomes: The course is designed for the students to introduce fundamental aspects of igneous and metamorphic petrology. The designed practicals will act as a bridge to complement both the subjects. Students will get to learn the various igneous and metamorphic rocks in hand as well as under the microscope. Students will also be able to calculate mineralogical percentage of rocks and plot them on diagrams.		
Sr. No.	COURSE CONTENT / SYLLABUS	No. of Practicals
Practicals related to Igneous petrology		
1	Megascope petrology of Igneous rocks (Hand specimens of Norite, Serpentinite, Anorthosite, Carbonatite, Rhyolite, Troctolite)	2
2	Megascope structures of Igneous rocks (Vesicular, Amygdaloidal, Blocky, Pillow, Ropy and Columnar joints)	1
3	Microscopic textures of Igneous rocks (Ophitic, Sub-ophitic, Porphyritic, Trachytic, Glomero-porphyritic, Intergranular, Intersertal, Graphic, Poikilitic)	2
4	Microscopic study of following igneous rocks (Basalt, Gabbro, Granite, Olivine Basalt, Peridotite, Andesite)	2
5	Calculation of CIPW Norms	1
Practicals related to Metamorphic Petrology		
6	Megascope study of following rocks with regard to their texture/structure, mineral composition, colour, type of metamorphism, grade facies and the original rocks Quartzite, Phyllite, Chlorite schist, Staurolite schist, Kyanite schist, Talc – tremolite schist, Sillimanite gneiss,	3

7	<p>Augen gneiss, Eclogite, Charnokite, Fuschite quartzite, Banded Haematite Quartzite, Skarn (any 9)</p> <p>Microscopic study of following rocks with regard to their texture/structure, mineral composition, colour, type of metamorphism, grade facies and the original rocks</p> <p>Hornblende schist, Actinolite schist, Mica garnet schist, Marble, Quartzite</p>	3
8	<p>Plotting of chemical composition of Metamorphic rocks on ACF diagrams</p>	1
Total: 15		
References	<ol style="list-style-type: none"> 1. Bruce Yardley and Clare Warren (2022) An Introduction to Metamorphic Petrology (2nd edition) 2. John D. Winter (2014) Principles of Igneous and Metamorphic Petrology (2nd edition) 3. Philpotts and Ague (2009) Principles of Igneous and Metamorphic Petrology (2nd edition) 	
Learning outcomes	<p>Upon completion of the course, student will be able to identify different igneous and metamorphic rocks, textures, structures and their mineralogy. The microscopic study of igneous and metamorphic rocks will enhance their knowledge in understanding of how these rocks are formed.</p>	


	MODERN EDUCATION SOCIETY'S Nowrosjee Wadia College, Pune (Autonomous)	Academic Year 2025-2026
	Bachelor of Science (Hons.) with research in GEOLOGY	
Vocational Skill Course (VSC)		
Year 2025	GLVSC 234 Practicals Based on Structural Geology	Credits 2
Semester-III		Hours 60
Course specific outcomes: The course provides a detailed insight into concepts of description of topographical features, construction of geological map sections involving structural complexities. Completion of an outcrop with the help of given topographic & lithological data.		
Sr. No.	COURSE CONTENT / SYLLABUS	No. of Practicals
1.	Study of Geological Maps: Description of topography & geology of the map. Drawing vertical section of the map along given direction. (Note: Geological maps should contain different topographic patterns & all possible structural complexities like unconformities, vertical faults (strike /dip) & vertical dykes).	5
2.	Completion of outcrops: Completion of an outcrop with the help of given topographic & lithological data. Note: One junction line may be partly shown or location of one junction line at three Non collinear points may be given along with geologic / stratigraphic column.	2
3.	Structural problems: a) Problems involving hill slope (hill slope given/ hill slope to be determined), true dip, true thickness, true width of outcrop and vertical thickness of the bed. b) Problems involving true and apparent Dip, true and apparent thickness, true and apparent width of outcrop and vertical thickness of the bed (True dip & true thickness/ Vertical thickness/ width of the outcrop given). c) Problems involving true and apparent dip of the bed- True dip of the bed given-	2 2


	<ol style="list-style-type: none"> 1. To find out apparent dip amount in the given apparent dip direction. 2. True dip of the bed given- To determine apparent dip direction for given apparent dip amount. 3. Two apparent dip amounts in two different directions given- To find out strike direction, true dip direction and true dip amount. 	<p>2</p> <p>2</p> <p>Total: 15</p>
References	<ol style="list-style-type: none"> 1. Jain, A.K., (2014), An introduction to structural geology. Text Book series in Geological Sciences for Graduate Students. Geological Society of India, Bangalore. 2. Fossen, H., (2010) Structural Geology. Cambridge University Press. 3. Davis, G.R., (1984) Structural Geology of Rocks and Region. John Wiley 4. Ramsay, J.G., (1984) Folding and fracturing of rocks. McGraw-Hill, New York. 5. Billings, M.P., (1972) Structural Geology. Prentice Hall. 	
Learning outcomes	On completion of the course, the students will be able to learn and understand various structural features on the basis of geometrical data, interpretation of given geological map of an area and construction of a cross section.	


	MODERN EDUCATION SOCIETY'S Nowrosjee Wadia College, Pune(Autonomous)	Academic Year 2025-2026
	Bachelor of Science (Hons.) with research in Geology	
Geology Major Subject		
Year 2025	GLFP 235 Field Project	Credits 2
Semester- III		
Course specific outcomes: This course is devised to provide students on field experience about studying and identifying different geological features, effectively collect and analyze data, demonstrate professional conduct in a field setting, foster collaboration and communication skills, and build self-awareness through reflection on experiences within the field environment, structures and rocks.		
Sr. No.	COURSE CONTENT / SYLLABUS	No. of Practicals
1	Geological Fieldwork A Geological field tour to be conducted in an area of geological interest for at least five to eight days and geological report to be submitted for the same. In addition to the requisite number of lectures and practicals, students are required to undertake geological excursion to study at first hand geological structures and lithology under the guidance of a teacher. The fieldwork helps in developing individual skills of observation, description and interpretation of geological features. Each student shall maintain a field – diary for this purpose and shall write area-wise report.	Total: 15
Learning outcomes	Students should be able to use and handle various geological instruments and apply various geological methods like mapping and geological surveying, etc. The students shall develop the ability to apply theoretical knowledge in real-world situations, develop practical skills relevant to the field of study, enhance critical thinking and observation abilities.	

	MODERN EDUCATION SOCIETY'S Nowrosjee Wadia College, Pune (Autonomous)	Academic Year 2025-2026
	Bachelor of Science (Hons.) with research in Geology	
Geology Minor Subject		
Year 2025	GLMN 236 Introduction to Structural Geology	Credits 2
Semester- III		Hours 30
Course specific outcomes: The course is designed for the students to understand the geometry and mechanics of the various geological structures that result through the deformative processes operative within the earth.		
UNITS	COURSE CONTENT / SYLLABUS	No. of Lectures
UNIT 1	Introduction to Structural Geology a) Definition of Structural Geology b) Relation of Structural Geology with other branches of Geology c) Planar and linear structures d) Attitude of Planar structure e) Clinometer Compass Stress and Strain: Definition and concept & Three stages of deformation (Hooke's Law)	8
UNIT 2	Folds a) Introduction and Definition of fold b) Parts of a fold c) Types of fold (On the basis of appearance in cross section, attitude of axial plane)	7
UNIT 3	Faults a) Definition of fault b) Terminologies associated with fault plane c) Types of Faults (Normal Fault, Reverse Fault, Step Fault, Horst and Graben)	7
UNIT 4	Joints and Unconformities a) General characteristics b) Classification of Joints	8

	<ul style="list-style-type: none"> a) Introduction and Definition b) Formation of an unconformity c) Types of unconformities 	
References	<ol style="list-style-type: none"> 1. Jain, A.K., (2014), An introduction to structural geology. Text Book series in Geological Sciences for Graduate students. 2. Fossen, H., (2010) Structural Geology. Cambridge University Press. 3. Davis, G.R., (1998) Structural Geology of Rocks and Region. John Wiley 4. Billings, M.P., (1990) Structural Geology. Prentice Hall. 5. Ramsay, J.G., (1984) Folding and fracturing of rocks. McGraw-Hill, New York. 6. Hills, E.S., (1963) Elements of Structural Geology. Farrold and Sons, London 	
Learning outcomes	The course deals with geological structures resulting from the action of forces on rocks. The student will gain knowledge of the geometry of the rock structures, understand the mechanism of the evolution of rock structures and its application in the field.	

	MODERN EDUCATION SOCIETY'S Nowrosjee Wadia College, Pune (Autonomous)	Academic Year 2025-2026
	Bachelor of Science (Hons.) with research in GEOLOGY	
Geology Major Subject		
Year - 2025	GLMN 237 Practicals Based on Structural Geology	Credits 2
Semester- III		Hours 30
<p>Course specific outcomes: This course is devised to provide basic knowledge of Toposheets reading and geological maps, concept of counter and horizontal beds and junction of beds. It also helps in drawing the map section of horizontal beds.</p>		
Units	COURSE CONTENT / SYLLABUS	No. of Lectures
1	Reading of Toposheets: With reference to Toposheet number. Latitude and Longitude, State/District. Scale, Adjacent Toposheet numbers and Conventional Signs.	3
2	System of sheet Numbering: Based on geological survey of India, Significance of Colors in Toposheets (Black, Blue, Green, Yellow, Red); Numerical based on Toposheets.	3
3	Study of Structural Maps: Study of basic contour lines (Isolated hill, Hillock, Valley, Spur, Saddle, High Ground); Preparation of Contour map (included with Gentle, Steep slope maps) (Minimum 2 maps); Drawing of Contours and their cross sections along X-Y or A-B (Min 5 maps).	3
4	Geological Maps. (Max 10 Maps) Study of geological maps with horizontal beds with reference to Section drawing. Description (Topography, Geology of map, Order of Superposition, Thickness of the beds and geological history)	6
		Total 15
Reference	1. Jain, A.K., (2014), An introduction to structural geology. Text Book series in Geological Sciences for Graduate students. 2. Fossen, H., (2010) Structural Geology. Cambridge University Press. 3. Davis, G.R., (1998) Structural Geology of Rocks and Region. John Wiley 4. Billings, M.P., (1990) Structural Geology. Prentice Hall.	
Learning outcomes	Students should able to read toposheets, understand natural and manmade features in the field using toposheets. Student should identify different structures, elevations and beds and also be able to draw a section of the map.	

	MODERN EDUCATION SOCIETY'S Nowrosjee Wadia College, Pune (Autonomous)	Academic Year 2025-2026
	Bachelor of Science (Hons.) with research in GEOLOGY	
Geology Major Subject		
Year - 2025	GLOE 238 Rocks and Human Evolution	Credits 2
Semester- III		Hours 30
<p>Course specific outcomes: This course is designed for arts stream students to enhance their interest in Geology as a science and make them understand usage of rocks during pre-historic periods till today.</p>		
Units	COURSE CONTENT / SYLLABUS	No. of Lectures
UNIT 1	Introduction to Rocks Importance of Rocks, Classification of Rocks, Study of Important Igneous, Sedimentary and Metamorphic Rocks, Rock Cycle	8
UNIT 2	Human Evolution How did Minerals Influence early Life? Stages of Human Evolution, Concept of Stone Age, Rocks used during Early Stone age, Study of Varieties of Stone tools	7
UNIT 3	Prehistoric use of rocks Uses of Rocks, Lower Paleolithic articles, Tools during Stone age, Prehistoric Art: Petroliths and Rock Paintings, Rocks in buildings and Building materials	7
UNIT 4	Modern age use of Rocks Rocks in Mining, Rocks in Metal Industry, Rocks and Minerals in everyday uses, Industrial Minerals, Rare Earth Elements (REE): Electric and Electronic Industry	8
Reference	1. Ajit Kumar and Raj K. Varma (2019) Art Rupestre: Petroglyphs and Pictographs in Kerala. 2. Brenda Flynn (2015) Complete Guide to Building with Rocks and Stones. 3. Erwin Neumayer (2013) Prehistoric Rocks. 4. D. A. Atwood (2012) The Rare Earth Elements - Fundamentals and applications.	
Learning outcomes	Students should able to identify and describe various types of rocks and correlate them with different historical periods. Students should be able to understand different stages of human evolution.	

	MODERN EDUCATION SOCIETY'S Nowrosjee Wadia College, Pune (Autonomous)	Academic Year 2025-2026
	Bachelor of Science (Hons.) with research in Geology	
Geology IKS (Indian Knowledge System)		
Year 2025	GLIKS 239 Ancient Water System	Credits 2
Semester- III		Hours 30
<p>Course specific outcomes: Students should understand the concept of water resources and its impact, ancient water management systems, identify water sources, analyze water quality, design water treatment processes, understand water distribution systems, calculate water demand, apply relevant regulations, assess environmental impacts, and effectively manage water resources by utilizing relevant engineering principles and methodologies, including practical application through field studies and design projects.</p>		
UNITS	COURSE CONTENT / SYLLABUS	No. of Lectures
UNIT 1	Water Resources Management during Prehistoric Period Water Resources and their impact; Water Resources Management during Prehistoric Period; Bamboo pies and Apatani Structures in Himalayan region.	8
UNIT 2	Ancient Canal Structures Ancient Canal Structures; Ancient Hydraulic structures in Rajasthan Kund, Khadin, Talabs, Johad and Baoli Stepwells, Tanks (Kund) Baolis and other forms of centuries old methods of water storage.	7
UNIT 3	Ancient Hydraulic structures Ancient Hydraulic structures like dams built of stone rubble. Reservoir or lakes, embankments and canals for irrigation; Ancient Artificial lakes; Traditional flood water systems: Ahar pynes in Gujarat.	8
UNIT 4	Water management systems Eri system of water management; Hydraulic linkages between Ancient Indian and Nearby Cultures.	7

References	<ol style="list-style-type: none"> 1. Suresh Chandra Bhatt (2019) Eri a system of rain water harvesting fed by channels that divert river water 2. L. mays by Vernon L. Scarborough (2010) Ancient Water Technologies 3. Kalyan Kumar Chakravarty, Gyani Lal Basam and Vijay Paranjpe and Pradeep P. Mujumdar (2003), The Flow of Power: Ancient Water Systems and Landscape 4. Pushpendra Kumar Singh, Pankaj Dey, Sharad Kumar Jain (2003) Hydrology and water resources management in ancient India, Landscapes (School for Advanced Research Resident Scholar Book) 5. Orjan Wikander (2000) Handbook of Ancient water Technologies.
Learning outcomes	<p>Students should be able to understand ancient water systems, Understand the water as resource and its impact, Water resources management during Prehistoric Period. Students should be able to understand different Hydraulic structures and systems of water storage and harvesting for drinking and irrigation purpose.</p>