



Scheme and Syllabus

of

M.Sc. (Geology)

Program Code: MSCGEOLR109

**Semester system for affiliated college
(As per LOCF and credit system)**

w.e.f. 2023-2024



Scheme of M.Sc. Geology under Semester System

Program Code:

Semester	N.	Course Code	Subject Name	Credit			Total Credit	Marks			
				L	P	T		ESE	IA	Total	
										Max	Min
First	1	GLT101	Structural Geology	3	0	1	4	80	20	100	36
	2	GLT102	Mineralogy	3	0	1	4	80	20	100	36
	3	GLT103	Geochemistry	3	0	1	4	80	20	100	36
	4	GLT104	Crystallography & Crystal Optics	3	0	1	4	80	20	100	36
	5	GLL101	Structural Geology & Survey	3	0	1	4	80	20	100	36
	6	GLL102	Crystallography, Crystal Optics, Mineralogy & Geochemistry	3	0	1	4	80	20	100	36
			Subtotal								
Second	1	GLT201	Igneous Petrology	3	0	1	4	80	20	100	36
	2	GLT202	Metamorphic Petrology	3	0	1	4	80	20	100	36
	3	GLT203	Sedimentology and Crustal Evolution	3	0	1	4	80	20	100	36
	4	GLT204	Stratigraphic principles and Indian geology	3	0	1	4	80	20	100	36
	5	GLL201	Petrology and Stratigraphy	3	0	1	4	80	20	100	36
	6	GLL202	Fieldwork	3	0	1	4	80	20	100	36
			Subtotal								

Abbreviations used:

ESE: End Semester Exam

IA: Internal Assessment



Semester Syllabus M.Sc. Geology

SCHEME OF EXAMINATION & DISTRIBUTION OF MARKS

Program Specific Outcomes of M.Sc. Geology

The student graduating with the M.Sc. Geology will be able to

1. Acquire fundamental/systematic or coherent understanding of the academic field of Geology, its different learning areas
2. Demonstrate the ability to use skills in Geology and its related areas of technology for formulating and tackling geosciences-related problems and identifying and applying appropriate geological principles and methodologies to solve a wide range of problems associated with geosciences.
3. Demonstrate competencies related to problem-solving skills that are required to solve different types of geosciences-related problems and investigative skills, including skills of independent investigation of geosciences-related issues and problems;
4. Develop Communication skills and analytical skills ability to work both independently and in Teams.
5. Attain the ability to read texts and research papers analytically and to present information in a concise manner.

SEMESTER I

Paper No.	Title	Internal Assessment	Term end Exam	Total Marks
I	Structural Geology	20	80	100
II	Mineralogy	20	80	100
III	Geochemistry	20	80	100
IV	Crystallography & Crystal Optics	20	80	100
Lab-I	Structural Geology & Survey	-	-	100
Lab-II	Crystallography, Crystal Optics, Mineralogy & Geochemistry	-	-	100
Total				600



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SEMESTER II

Paper No.	Title	Internal Assessment	Term end Exam	Total Marks
I	Igneous Petrology	20	80	100
II	Metamorphic Petrology	20	80	100
III	Sedimentology & Crustal Evolution	20	80	100
IV	Stratigraphic principles and Indian Geology	20	80	100
Lab-I	Petrology and Stratigraphy	-	-	100
Lab-II	Fieldwork	-	-	100
Total				600

Semester Syllabus M.Sc. Geology

SEMESTER III

Paper No.	Title	Internal Assessment	Term end Exam	Total Marks
I	Paleontology	20	80	100
II	Ore & Fuel Geology	20	80	100
III	Geomorphology and Remote Sensing	20	80	100
IV	Mineral Exploration	20	80	100
Lab-I	Ore Geology and Mineral Exploration	-	-	100
Lab-II	Paleontology, Geomorphology and Remote sensing	-	-	100
Total				600



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SEMESTER IV

Paper No.	Title	Internal Assessment	Term end Exam	Total Marks
I	Mining and Engineering Geology	20	80	100
II	Environmental Geology	20	80	100
III	Hydrogeology	20	80	100
IV	Disaster Management	20	80	100
Lab-I	Hydrogeology	-	-	100
Lab-II	Engineering Geology and Mining Geology			100
Total				600
Grand Total				2400

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Part A: Introduction			
Program: M.Sc. Geology	Semester: I	Year: First	w.e.f. : 2023-2024
1.	Course Code	GLT -101	
2.	Course Title	STRUCTURAL GEOLOGY	
3.	Course Type	Compulsory	
4.	Pre-requisite	Geology subject in B.Sc. Level.	
5.	Course Learning Outcomes (CLO)	<ol style="list-style-type: none">1. Understand and assess stress acting on a rock during deformation. Identify, classify and compare various types of folds2. Classify and describe faults, joints and unconformities and conclude about the mechanics of their formation.3. Demonstrate the ability to judge the order of superposition of rock beds. Identify, classify, interpret and compare planer and linear fabric in rocks. Construct and interpret geological maps and π and β diagrams4. Summarize the theory of plate tectonics and explain the evolution of continental and oceanic crust and anatomy of Precambrian orogenic belts of India.	
6.	Credit Value	4	
7.	Total Marks	100	



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Part B: Contents of the Course		
Total No. of the Lecture		60
Unit	Topic	No. of Lecture
I.	Rock deformation; Theory of stress & strain, their relationship. Properties of elastic, plastic and brittle materials. Strain analysis: types of strain; strain ellipse; strain ellipsoid; geological application of strain theory, Stress analysis: compressive and shear stress; biaxial and triaxial stress. Mohr's Circle and envelope.	12
II.	Fold: Definition; Classifications- Geometrical and Genetic, Mechanism of Fold formation and types of fold, Fractures; their nomenclature, and relationship. Origin and significance, Joints its types their analysis and relation with major structures.	12
III.	Fault: Types and mechanism of faulting, Principal stress orientation for the main fault types. Analyses of brittle-ductile and ductile shear zones, Petrofabric Analysis; Field and laboratory techniques; preparation of petrofabric diagrams and their interpretation.	12
IV.	Cleavage & Schistosity: definition and types, Mechanism of formation of cleavage & schistosity ; its relationship with major deformation structures, Lamination; definition and its types; their mode of development and relation to major structures, Plutons: Definition & description; its role in progressive deformation.	12
V.	Tectonites: definition and its types. Stereographic Projection: Principles and application Tectonics and structural characteristics of Plate Boundaries, Geodynamic evolution of the Himalayas.	12

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Part C - Learning Resources

Text Books , Reference Books, E -Resources

Books Recommended

Ramsay, J.G., 1967: Folding and Fracturing of Rocks. McGraw Hill.

Hobbs, B.E., Means, W.D. and Williams, P.F., 1976: An Outline of Structural Geology, John Wiley.

Davis, G.R., 1984: Structural Geology of Rocks and Region. John Wiley.

Ramsay, J.G. and Huber, M.I., 1987: Modern Structural Geology, Vol. I and II Academic Press.

Ghosh , S.K.,1995: Structural Geology Fundamentals of Modern Developments. Pergamon Press.

Billings, M.P., Structural Geology

Moores, E. and Twiss, R.J., 1995: Tectonics. Freeman.

Valdiya, K.S.,1998: Dynamic Himalaya. Universities Press, Hyderabad.

Summerfield, M.A., 2000: Geomorphology and Global Tectonics. Springer Verlag.

E -Resources:

1. <https://www.mindat.org>

2. <https://www.mooc-list.com/tags/minerals>

3. <https://epgp.inflibnet.ac.in/Home>

4. <https://archive.org/details/in.ernet.dli.2015.233340/page/n15/mode/2up>

5. <https://egyankosh.ac.in/>

6. <https://sites.google.com/ignou.ac.in/bscgeology>

7. SWAYAM – <https://swayam.gov.in/explorcr?searchtext>

8. National digital library – <https://ndl.iitkgp.ac.in>

9. e-PG pathshala (MHRD) portal, <https://epgp.inflibnet .ac.in>



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Part A: Introduction				
Program: M.Sc. Geology		Semester -I	Year: First	w.e.f. : 2023-2024
1.	Course Code	GLT-102		
2.	Course Title	MINERALOGY		
3.	Course Type	Compulsory		
4.	Pre- requisite	Geology subject in B.Sc. Level.		
5.	Course Learning Outcomes (CLO)	At the end of the course, the students will be able to 1. Identify and classify the rock-forming minerals on the basis of their physical and optical properties and discuss the construction and working of Quartz wedge, Gypsum plate and Mica plate. 2. Determine the optical characters, order of interference color and pleochroic scheme of minerals. 3. Discuss the symmetry characteristics and forms of various crystal systems. 4. Categorize and describe the properties of rock forming silicates and gemstones.		
6.	Credit Value	4		
7.	Total Marks	100		



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Part B: Contents of the Course		
Total No. of the Lecture 60		
Unit	Topic	No. of Lecture
I.	Minerals and Mineraloids; definition composition, Physical Properties of Minerals depending on Crystal Structure. Electrical, Magnetic, Luminescence, Thermal and Radioactive Properties of Minerals, Structure of Silicates.	12
II.	Ionic Radius, Coordination Principles, Close Packing, Pauling's Rules, Unit Cell, Bonding Forces in crystals; Ionic Bond, Covalent Bond, Vander Waal's Bond, Metallic Bond. Solid solution; Substitution, Interstitial and Omission. Ex- solution, Polymorphism, polytypism, pseudomorphism.	12
III.	Classification of Minerals. Systematic Mineralogy of common rock forming, silicate groups. Classification of Minerals. Systematic Mineralogy of common rock forming, silicate groups. Nesosilicates - (a) Olivine Group (b) Garnet Group (c) allsilicate Group. a) Topaz ,(b) Staurolite, (c) Sphene , Sorosilicates- Epidote.	12
IV.	Systematic Mineralogy of common rock forming silicate groups Cyclosilicates - (a) Cordierite (b) Tourmaline (c) Beryl Inosilicates- (a) Pyroxene Group Inosilicates - (a)Amphibole Group Phyllosilicates - (a) Mica Group (b) Chlorite Group (c) Clay Mineral Group	12
V.	Tectosilicates - (a) SiO ₂ Group (b) Zeolite Group, Tectosilicates - (a) Feldspar Group (b) Feldspathoid Group, Carbonates and Phosphates, Gem and Semi precious minerals.	12



Part C - Learning Resources

Text Books , Reference Books, E –Resources

Books Recommended

Deer, W.A., Howie, R.A., and Zussman, J., 1996: The Rock Forming Minerals. Longman.

Klein and Hurlbut, Jr., C.S., 1993: Manual of Mineralogy. John Wiley.

Phillips, W.R. and Griffen, D.T., 1986: Optical Mineralogy. CBS Edition.

Perkins, D. 2002: Mineralogy. Prentice Hall.

Nesse, W.D., 2000: Introduction to Mineralogy. Oxford University Press.

E -Resources:

1. <https://www.mindat.org>
2. <https://www.mooc-list.com/tags/minerals>
3. <https://epgp.inflibnet.ac.in/Home>
4. <https://archive.org/details/in.ernet.dli.2015.233340/page/n15/mode/2up>
5. <https://egyankosh.ac.in/>
6. <https://sites.google.com/ignou.ac.in/bscgeology>
7. SWAYAM – <https://swayam.gov.in/explorer?searchtext>
8. National digital library – <https://ndl.iitkgp.ac.in>
9. e-PG pathshala (MIIRD) portal, <https://epgp.inflibnet.ac.in>



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Part A: Introduction				
Program: M.Sc. Geology		Semester: I	Year: First	w.e.f. : 2023-2024
1.	Course Code	GLT--103		
2.	Course Title	Geochemistry		
3.	Course Type	Compulsory		
4.	Pre- requisite	Geology subject in B.Sc. Level.		
5.	Course Learning Outcomes (CLO)	At the end of the course, the students will be able to 1. Understand about the chemical differentiation of solar system and the earth, 2. Formulate the radioactive decay schemes and their application in radiometric dating, recall laws of Thermodynamics and geochemistry of oceanic crust, continental crust and island arcs. 3. Explain element partitioning in minerals and rocks and its use in P-T Estimation; Understand elemental mobility in Geochemical cycle and Bio geochemical cycle. 4. Describe instrumentation and analytical techniques used in geochemical analysis.		
6.	Credit Value	4		
7.	Total Marks	100		

Part B: Contents of the Course		
Total No. of the Lecture		60
Unit	Topic	No. of Lecture
I.	Cosmic Abundance of the Element: Formation of Solar System and planets. Composition and Classification of Meteorites, Geochemical classification of elements. Trace, Volatile, Semi volatile, Alkali and Alkaline earth elements, its behaviour in magmatic processes. REE and Y, HF. SE elements, Transition & Noble elements -its importance and concentrations in various igneous rocks and its behaviour in various magmatic process.	12



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II.	Partition coefficient, Factors governing partition co- efficient. Fundamental Laws of Thermodynamics-. free energy. Phase equilibrium and Gibb's Phase Rule. Thermodyanamics of magmatic Crystallization, Geochemistry of Crust.	12
III.	Geochemistry of island arcs. Composition of Mantle; Mineralogy of lower mantle, Phase transition in the Mantle. Formation of Core.	12
IV.	Aquatic Chemistry-Acid Base reaction, dissolution and Precipitation of CaCO ₃ Solubility of Mg, SiO ₂ and Al ₂ (OH) ₃ . Geochemical properties of clays- Kaolinite. Ion exchange_of clays. Redox in Natural Waters. Eutrophication. Factors controlling Weathering. Soil profile. Chemical and biogeochemical cycling in the soil.	12
V.	Basics of radiogenic isotope geochemistry, scope of stable geochemistry. Composition of Rivers water. Composition of Seawater. Distribution of CO ₂ in Ocean. Carbonate dissolution and precipitation Sources and sinks of Dissolved matter in seawater.	12

Part C - Learning Resources

Text Books , Reference Books, E –Resources

Books Recommended

Mason B. and Moore, C.B., 1991: Introduction to Geochemistry. Wiley Eastern.

Krauskopf, K.B., 1967: Introduction to Geochemistry. McGraw Hill.

Henderson, P. 1987: Inorganic Geochemistry. Pergamon Press.

Faure, G.,:1986: Principles of Isotope Geology. John Wiley.

E -Resources:

1. <https://www.mindat.org>
2. <https://www.mooc-list.com/tags/minerals>
3. <https://epgp.inflibnet.ac.in/Home>
4. <https://archive.org/details/in.ernet.dli.2015.233340/page/n15/mode/2up>
5. <https://egyankosh.ac.in/>
6. <https://sites.google.com/ignou.ac.in/bscgeology>
7. SWAYAM – <https://swayam.gov.in/explorer?searchtext>
8. National digital library – <https://ndl.iitkgp.ac.in>
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Part A: Introduction				
Program: M.Sc. Geology		Semester: I	Year: First	w.e.f. : 2023-2024
1.	Course Code	GLT--104		
2.	Course Title	CRYSTALLOGRAPHY & CRYSTAL OPTICS		
3.	Course Type	Compulsory		
4.	Pre- requisite	Geology subject in B.Sc. Level.		
5.	Course Learning Outcomes (CLO)	At the end of the course, the students will be able to 1. Identify and classify the rock-forming minerals on the basis of their physical and optical properties and discuss the construction and working of Quartz wedge, Gypsum plate and Mica plate. 2. Determine the optical characters, order of interference color and pleochroic scheme of mineral 3. Discuss the symmetry characteristics and forms of various crystal systems 4. Categorize and describe the properties of rock forming silicates and gemstones.		
6.	Credit Value	4		
7.	Total Marks	100		



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Part B: Contents of the Course		
Total No. of the Lecture		60
Unit	Topic	No. of Lecture
I.	Crystal growth. Development of ideas about internal structure of crystals Space , lattices , and point systems. X-ray .analysis of crystal structure. Morphology of crystals. Fundamental Laws of Crystal, Zones. Symmetry elements. Classification of Crystals in 32 Classes:	12
II.	Symmetry and forms of crystals of holohedral class of isometric, tetragonal and hexagonal systems. Symmetry and forms of crystals of holohedral class of orthorhombic , monoclinic and triclinic systems . Goniometry of crystals. Crystal Projection - Stereographic, Crystal Aggregates, Twinning. Irregularities&Imperfection in crystal.	12
III.	Principles of transmission/reflection of light from crystal. Interference colour. Refraction and Refractometry . Method of determination of R1. Birefringence in crystal. Significance and use of plates, wedge and Berek Compensator. Pleochroism in Crystals.	12
IV.	Classification of Crystals into isotropic, Uniaxial and biaxial minerals .isotropic uniaxial and biaxial indicatrix. Optical characters of Isotropic and uniaxial minerals. Optical characters of biaxial minerals.	12
V.	Optical Orientation -Extinction angle. Dispersion in mineral , optic axial angle Optical anomalies. Systematic determination of optical , properties of minerals.	12

Part C - Learning Resources	
Text Books , Reference Books, E –Resources	
Books Recommended Deer, W.A., Howie, R.A., and Zussman, J., 1996: The Rock Forming Minerals. Longman. Klein and Hurlbut, Jr., C.S., 1993: Manual of Mineralogy. John Wiley. Phillips, W.R. and Griffen, D.T., 1986: Optical Mineralogy. CBS Edition. Perkins, D. 2002: Mineralogy. Prentice Hall. Nesse, W.D., 2000: Introduction to Mineralogy. Oxford University Press.	



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1. <https://www.mindat.org>
2. <https://www.mooc-list.com/tags/minerals>
3. <https://eggp.inflibnet.ac.in/Home>
4. <https://archive.org/details/in.ernet.dli.2015.233340/page/n15/mode/2up>
5. <https://egyankosh.ac.in/>
6. <https://sites.google.com/ignou.ac.in/bscgeology>
7. SWAYAM – <https://swayam.gov.in/explorer?searchtext>
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Part A: Introduction				
Program: M.Sc. Geology		Semester: I	Year: First	w.e.f. : 2023-2024
1.	Course Code	GLL -101		
2.	Course Title	Structural Geology & Survey		
3.	Course Type	Laboratory Course		
4.	Pre- requisite	Geology subject in B.Sc. Level.		
5.	Course Learning Outcomes (CLO)	1.Demonstrate the skill of preparation of geological cross sections 2. Interpretations of geological maps, Completion of outcrops. 3. Solve structural problems with the help of stereographic projections. 4. Identify structures present in natural rock specimens and models.		
6.	Credit Value	4		
7.	Total Marks	100		

Total Number of Teaching Hours = 60		
	Lab Work	No.of Hours.
	1. Concept of line and plane, attitude of plane and line. Bedding plane, dip and strike, and their measurement 2. Criteria for determination of top and bottom of strata in structurally deformed terrain and its study in hand specimen. 3. Preparation and interpretation of geological maps for simple structure contour maps, as well as, for fold, fault and unconformity 4. Stereographic projection – problems in angular relationship true dip, apparent dip plunge and rake of the intersection of planes. 5. Survey; Field techniques of geological mapping using: . Chain tape; Plane table and Prismatic compass & Global Positioning System.	60



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Part A: Introduction			
Program: M.Sc. Geology	Semester: I	Year: First	w.e.f. : 2023-2024
1.	Course Code	GLL -102	
2.	Course Title	Crystallography, Crystal Optics, Mineralogy & Geochemistry	
3.	Course Type	Laboratory Course	
4.	Pre- requisite	Geology subject in B.Sc. Level.	
5.	Course Learning Outcomes (CLO)	1 At the end of the course, the students will be able to 1. Identify rock forming minerals in hand specimen and thin section 2. Determine pleochroic scheme in minerals, 3. Estimate Anorthite content in plagioclase, 4. Determine order of interference colour in common minerals. 5. Interpret of results of water analysis with the help of various diagrams.	
6.	Credit Value	4	
7.	Total Marks	100	

Total Number of Teaching Hours = 60		
	Lab Work	No.of Hours.
	A] Mineralogy and Geochemistry 1. Megascopic study of common rock forming minerals. 2. Microscopic study of common rock forming minerals. 3. Principles and methods of geochemical analysis. Calculation of mineral formulae. 4. Determination of total hardness in water. 5. Spot test for qualitative analysis. B] Crystallography and Crystal Optics 1. Morphological study of crystal models and twins. 2. Stereographic projection of crystals. 3. Optical determination of	60



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	a) Refractive Index. b) Order of Interference colour and birefringence. c) Interference figure and optic sign. d) Scheme of pleochroism. e) An content (Michel Levy's method) f) 2V.	
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Part A: Introduction				
Program: M.Sc. Geology		Semester: II	Year: First	w.e.f. : 2023-2024
1.	Course Code	GLT-201		
2.	Course Title	IGNEOUS PETROLOGY		
3.	Course Type	Compulsory		
4.	Pre- requisite	Geology subject in B.Sc. Level.		
5.	Course Learning Outcomes (CLO)	At the end of the course, the students will be able to 1. Explain about the concepts of phase equilibria, Bowen's Reaction Series and petrographic province and describe various forms, structures and textures of igneous rocks. 2. Relate behavior of major and trace elements to the evolution of magma 3. Classify the igneous rocks and describe their megascopic and microscopic characters and discuss their petrogenesis. 4. Summarize the generation of magma with reference to plate tectonics and explain petrogenesis of various igneous rocks.		
6.	Credit Value	4		
7.	Total Marks	100		



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Part B: Contents of the Course		
Total No. of the Lecture		60
Unit	Topic	No. of Lecture
I.	Magma and its evolution. . Composition of primary magma.partial melting of mantle- different models, Trace element behaviour during partial melting. Magmatic differentiation processes. Behaviour of major and trace elements during fractional crystallization.	12
II.	Concurrent assimilation and fractional Crystallization. Magma mixing various oriterion for classification of igneous rock .Petrographic Province. Different variation diagrams and their application. Crystallization of basaltic magmas.	12
III.	Study of the petro genetic significance of following silicate systems: Albite-Anorthite and Forsterite –silica. Diopside-Albite-anorthite. Diopside – Forsterite –Nephelline –silica. Nepheline –kalsite-silica.	12
IV.	Petrogenetic study of the following rock type ad their distribution in india: Basalt and ophiolite ,Peridotite ultramafite. Granite ,Anorthosite.Komatite , Kimberlite.	12
V.	Petrogenetic study of the carbonatite , Lamprophyre , and Their Distribution in India. Mid-ocean ridge, volcanism. Magmatism associated with subduction related igneous activity; continental and island arcs. Magmatism in Large igneous Plutons.	12



Part C - Learning Resources

Text Books, Reference Books, E –Resources

Books Recommended

Turner, F.J., 1980: Metamorphic Petrology. McGraw Hill, New York.

Yardley, B.W. 1989: An Introduction to Metamorphic Petrology. Longman. New York.

Philpotts, A., 1992: Igneous and Metamorphic Petrology. Prentice Hall.

Best, M.G., 1986: Igneous and Metamorphic Petrology, CBS Publishers.

Bose, M.K., 1997: Igneous Petrology. World Press.

Winter, J.D., 2001: Igneous and Metamorphic Petrology. Prentice Hall India Ltd.

E -Resources:

1. <https://www.mindat.org>

2. <https://www.mooc-list.com/tags/minerals>

3. <https://eggp.inflibnet.ac.in/Home>

4. <https://archive.org/details/in.ernet.dli.2015.233340/page/n15/mode/2up>

5. <https://egyankosh.ac.in/>

6. <https://sites.google.com/ignou.ac.in/bscgeology>

7. SWAYAM – <https://swayam.gov.in/explorer?searchtext>

8. National digital library – <https://ndl.iitkgp.ac.in>

9. e-PG pathshala (MHRD) portal, <https://eggp.inflibnet.ac.in>



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Part A: Introduction		
Program: M.Sc. Geology		Semester: II
Year: First		w.e.f. : 2023-2024
1.	Course Code	GLT—202
2.	Course Title	METAMORPHIC PETROLOGY
3.	Course Type	Compulsory
4.	Pre- requisite	Geology subject in B.Sc. Level.
5.	Course Learning Outcomes (CLO)	At the end of the course, the students will be able to 1. Describe agents and types of metamorphism, various types, forms, structures and textures of metamorphic rocks and describe their megascopic and microscopic characters. 2. Explain mineralogical phase rule, ACF, AKF, and AFM, diagrams and various facies 3. Discuss regional and thermal metamorphism of various groups of rocks and elaborate metamorphic reactions and special types of metamorphism 4. Explain paired metamorphic belts with reference to Plate Tectonics and influence of P-T conditions on metamorphism.
6.	Credit Value	4
7.	Total Marks	100

Part B: Contents of the Course		
Total No. of the Lecture		60
Unit	Topic	No. of Lecture
I.	Definition of metamorphism, Agents and kinds of metamorphism. Classification of metamorphic rocks. Phase rule and its application in metamorphism. Structure and texture of metamorphic rocks and their significance.	12



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II.	Fabric of metamorphic rocks. Depth zones. Systematic study of Barrovian and Abukuma zones of metamorphism. Grade of metamorphism, Isograd&lsoreactiongrade and construction of petrogenetic grids. Concept of facies and facies series.	12
III.	Study of ACF, AKF and AFM diagrams. Polymetamorphism and paired metamorphic belts. Metamorphic differentiation. Retrograde Metamorphism Crystalloblastic series.	12
IV.	General Characters of thermal and regional metamorphism of limestone, shale and basic igneous rocks. Metamorphism in relation to magma, and orogeny. Metasomatism; Principles and types of metasomatism. Granitization. Anataxis, Palingenesis. Origin of Migmatites in the light 'of .experimental studies.	12
V.	Kinetics of metamorphic mineral reaction. Pressure- temperature- time paths. Ultra-high temperature and ultra-high pressure and ocean floor metamorphism. Layering in metamorphic rocks. Petrogenetic significance of following rocks with special to Indian occurrences: charnockite, amphibolites, khondalite, Gondite, Eclogite.	12

Part C - Learning Resources

Text Books , Reference Books, E –Resources

Books Recommended

Turner, F.J., 1980: Metamorphic Petrology. McGraw Hill, New York.

Yardley, B.W. 1989: An Introduction to Metamorphic Petrology. Longman. New York.

Philpotts, A., 1992: Igneous and Metamorphic Petrology. Prentice Hall.

Best, M.G., 1986: Igneous and Metamorphic Petrology, CBS Publishers.

Winter, J.D., 2001: Igneous and Metamorphic Petrology. Prentice Hall India Ltd.

E -Resources:

1. <https://www.mindat.org>

2. <https://www.mooc-list.com/tags/minerals>



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3. <https://epgp.inflibnet.ac.in/Home>
4. <https://archive.org/details/in.ernet.dli.2015.233340/page/n15/mode/2up>
5. <https://egyankosh.ac.in/>
6. <https://sites.google.com/ignou.ac.in/bscgeology>
7. SWAYAM – <https://swayam.gov.in/explorer?searchtext>
8. National digital library – <https://ndl.iitkgp.ac.in>
9. e-PG pathshala (MHRD) portal, <https://epgp.inflibnet.ac.in>

Part A: Introduction			
Program: M.Sc. Geology		Semester: II	Year: First
		w.e.f. : 2023-2024	
1.	Course Code	GLT--203	
2.	Course Title	SEDIMENTOLOGY AND CRUSTAL EVOLUTION	
3.	Course Type	Compulsory	
4.	Pre- requisite	Geology subject in B.Sc. Level.	
5.	Course Learning Outcomes (CLO)	At the end of the course, the students will be able to 1. Evaluate the role of various sedimentary environments in the formation of sedimentary rocks and evolution of sedimentary basins 2. Identify various structures and textures of sedimentary rocks and classify the sedimentary rocks on the basis of their megascopic and microscopic characters. 3. Explain various aspects of analysis of sedimentary rocks 4. Summarize Field and Laboratory techniques in Sedimentology.	
6.	Credit Value	4	
7.	Total Marks	100	

Part B: Contents of the Course



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Total No. of the Lecture		60
Unit	Topic	No. of Lecture
I.	Earth surface system-liberation and flux of sediments. Processes of transport and generation of sedimentary structures. Stromatolites and their significance. Textural analysis of sediments, Graphical representation, statistical treatment and geological significance.	12
II.	Classification of sandstone and carbonate rocks. Dolomite-and dolomitization Volcanoclastics. Sedimentary environments and facies. Continental, alluvial-fluvial facies, lacustrine, Desert- Aeolian and glacial sedimentary environments. Shallow costal clastics and shallow water carbonates.	12
III.	Evaporites. Deep-sea basins. Paleocurrents.and basin analysis. Plaeoclimates and paleoenvironment analysis. Diagenesis of sandstone and carbonate rocks.	12
IV.	Petrogenesis of arkoses and greywacke. Evolution of lithosphere, hydrosphere.atmosphere and,biosphere. Application. of Trace, REE and stable isotopes geochemistry to. sedimentological problems. Evolution of continental and oceanic crust	12
V.	lithological, geochemical, stratigraphic characteristics of granite-greenstone belts. Evolution of Proterozoic sedimentary basins of India. Anatomy of Orogenic belts. Precambrian-Cambrian boundary with special reference to India.	12

Part C - Learning Resources

Text Books , Reference Books, E –Resources

Books Recommended

Alen, J.R.L., 1985: Principles of Physical Sedimentation. George Allen and Unwin.

Allen, P., :1997: Erath Surface Processes. Blackwell.

Nichols, G.,1999: Sedimentology and Stratigraphy. Blackwell.

Pettijohn, F.J., Potter, P.E. and Siever, R., 1990: Sand and Sandstone. Springer Verlag.



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Website : www.bilaspuruniversity.ac.in

Boggs Sam Jr., 1995: Principles of Sedimentology and Stratigraphy. Prentice Hall.

Sengupta, S., 1997: Introduction to Sedimentology. Oxford –IBH.

E -Resources:

1. <https://www.mindat.org>
2. <https://www.mooc-list.com/tags/minerals>
3. <https://epgp.inflibnet.ac.in/Home>
4. <https://archive.org/details/in.ernet.dli.2015.233340/page/n15/mode/2up>
5. <https://egyankosh.ac.in/>
6. <https://sites.google.com/ignou.ac.in/bscgeology>
7. SWAYAM – <https://swayam.gov.in/explorer?searchtext>
8. National digital library – <https://ndl.iitkgp.ac.in>
9. e-PG pathshala (MHRD) portal, <https://epgp.inflibnet.ac.in> E-pathshala geology

Part A: Introduction

Program: M.Sc. Geology		Semester:II	Year: 1st	w.e.f. : 2023-2024
1.	Course Code	GLT- -204		
2.	Course Title	STRATIGRAPHIC PRINCIPLES AND INDIAN GEOLOGY		
3.	Course Type	Compulsory		
4.	Pre- requisite	Geology subject in B.Sc. Level.		
5.	Course Learning Outcomes (CLO)	At the end of the course, the students will be able to 1. Explain fundamental concepts about origin and history of evolution of life and morphology and evolution of Brachiopoda, Echinodermata and Mollusca. Evaluate the principles of Stratigraphy and details of Geological Time scale 2. Describe morphology and evolution of plant fossils, Trilobites,		



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		Graptolites, man and horse 3. Explain various kinds of stratigraphy and stratigraphic correlation. Describe Indian stratigraphic systems of Archean, Dharwar, Cuddapah, Kurnool, Vindhyan and Aravalli Supergroups 4. Assess the significance of the Geological Time events of The Paleozoic, Gondwana, Triassic, Jurassic and Cretaceous and the Tertiary Group, Siwaliks, Deccan Trap and boundary problems of various ages ..
6.	Credit Value	4
7.	Total Marks	100

Part B: Contents of the Course		
Total No. of the Lecture		60
Unit	Topic	No. of Lecture
I.	Principles of stratigraphic scales and its divisions. Stratigraphic units- lithostratigraphic, biostratigraphic and chronostratigraphic. Rules of stratigraphic nomenclature. Stratigraphic correlation.	12
II.	Concept of sequence stratigraphy. Chief divisions of Indian sub-continent and their physiographic characters. Archean Era. Distribution and classification in Peninsula and extrapeninsular regions, their correlation and economic importance. Dharwar Supergroup; (Classification, Distribution, Economic importance)	12



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III.	Cuddaph Supergroup; its distribution, classification & equivalent in extra peninsula. Vindhyan Supergroup; its distribution, classification, age, economic importance and correlation. Chhattisgarh Group. Indravati Group and Khairagarh Group, their classification, age correlations and economic importance. Paleozoic formation of extra peninsular region with special reference to their classification, distribution and correlation.	12
IV.	Distribution, geological succession, classification and climate of Gondwana supergroup. Age and correlation of Gondwana formations. Jurassic system of rocks. Distribution, Classification of cretaceous formation of Peninsular India. Distribution, structural features and age of the Deccan Traps, Intertrappeans and infra trappeans of India.	12
V	Problems of Permo-triassic and Cretaceous- Palaeocene boundaries. Distribution, succession, correlation and life of siwalik formations. Distribution, lithology, correlation & life of the Cenozoics of Assam and Pleistocene (Quaternary) deposits, Karewa Beds, Indogangetic Alluvium. Quaternary climate, glacial and interglacial cycle, Eustatic change.	12



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Part C - Learning Resources

Text Books , Reference Books, E –Resources

Books Recommended

Clarkson, E.N.K., 1998: Invertebrate Palaeontology and Evolution. IV Ed. Blackwell.

Jain, P.C., and Anantharaman, M.S., 1996: Palaeontology – Evolution and animal distribution. Vishal Publications.

Prothero, D.R., 1998: Bringing fossils to life- An Introduction to Palaeobiology. McGrawHill.

Stearn, C.W. and Carrol, R.L., 1989: Palaeontology- the record of life. John Wiley.

Boggs Sam Jr., 1995: Principles of Sedimentology and Stratigraphy. Prentice Hall.

Kumar, Ravindra, 1985 : Fundamentals of Historical Geology and Stratigraphy of India. Wiley Eastern Ltd.

Naqvi, S.M. and Rogers, J.J.W, 1987: Precambrian Geology of India. Oxford University Press.

E -Resources:

1. <https://www.mindat.org>
2. <https://www.mooc-list.com/tags/minerals>
3. <https://eggp.inflibnet.ac.in/Home>
4. <https://archive.org/details/in.ernet.dli.2015.233340/page/n15/mode/2up>
5. <https://egyankosh.ac.in/>
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7. SWAYAM – <https://swayam.gov.in/explorer?searchtext>
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Part A: Introduction				
Program: M.Sc. Geology		Semester: II	Year: First	w.e.f. : 2023-2024
1.	Course Code	GLL -201		
2.	Course Title	PETROLOGY AND STRAITIGRAPHY		
3.	Course Type	Laboratory Course		
4.	Pre- requisite	Geology subject in B.Sc. Level.		
5.	Course Learning Outcomes (CLO)	At the end of the course, the students will be able to 1. Identify various forms, structures and textures of igneous and metamorphic rocks. 2. Draw variation diagrams. 3. Construct ACF, AKF and AFM diagrams.. 4. Prepare rose diagram from palaeocurrentdata . 5. Calculate statistical parameters related to Grain size analysis		
6.	Credit Value	4		
7.	Total Marks	100		



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Total Number of Teaching Hours = 60		
	Lab Work	No.of Hours.
	<p>IA: IGNEOUS AND METAMORPHIC PETROLOGY.</p> <ol style="list-style-type: none">1. Megascopic description and identification of igneous and metamorphic rocks.2. Study of textures and structures of Igneous and metamorphic rocks.3. Microscopic identification of Igneous and metamorphic rocks.4. C.I.P.W. Norm calculations and classification of igneous rocks.5. Constructions of variation diagrams of igneous suits of rocks.6. Construction of A.C.F., A.K.F. and A.F.M. diagrams.7. Plotting the Geographical distribution of Igneous and Metamorphic rocks types in and outline map of India. <p>IB: SEDIMENTARY PETROLOGY AND STRATIGRAPHY</p> <ol style="list-style-type: none">1. Megascopic description and identification of sedimentary rocks.2. Study of sedimentary structures in hand specimen.3. Microscopic study of sedimentary rocks.4. Graphic representation of sedimentary data and interpretation.5. Heavy mineral studies of sediments.6. Distribution of Important geological formations on outline map of India.7. Construction of fence diagrams8. Use of software for norm calculation and geochemical modeling9. Correlation diagrams. Recognition of transgressive-regressive cycles based on vertical columns.	60



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Part A: Introduction			
Program: M.Sc. Geology	Semester: II	Year: First	w.e.f. : 2023-2024
1. Course Code	GLL -202		
2. Course Title	FIELD WORK		
3. Course Type	Laboratory Course		
4. Pre- requisite	Geology subject in B.Sc. Level.		
5. Course Learning Outcomes (CLO)	<ol style="list-style-type: none">1. Understand and assess stress acting on a rock during deformation. Identify, classify and compare various types of folds2. Classify and describe faults, joints and unconformities and conclude about the mechanics of their formation.3. Demonstrate the ability to judge the order of superposition of rock beds. Identify, classify, interpret and compare planer and linear fabric in rocks. Construct and interpret geological maps and π and β diagrams4. Summarize the theory of plate tectonics and explain the evolution of continental and oceanic crust and anatomy of Precambrian orogenic belts of India.		
6. Credit Value	4		
7. Total Marks	100		

Total Number of Teaching Hours = 60		
	Lab Work	No.of Hours.
	<ol style="list-style-type: none">1. Geological mapping in type areas of India to study structural relations and stratigraphic formations in sedimentary, igneous and metamorphic terrains.2. Collection and study of primary and secondary structures of rock bodies and their interpretation.	60



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	<ol style="list-style-type: none">3. Sampling of rocks, minerals and fossils in the field from study areas.4. Preparation of geological maps and sections from the geological data obtained in the field.5. Preparation of geological report based on field studies.6. Viva-Voce on fieldwork and geological report.	
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