B.Sc.(Hons.)Geology

COURSE STRUCTURE

SEMESTER I		SEMESTER II	
C1	GEO-C1: Earth System Science	C3	GEO-C3: Elements of Geochemistry
C2	GEO-C2: Mineral Science	C4	GEO-C4: Structural Geology
AECC1	Environmental Science	AECC2	English
C-GE1B*	Essentials of Geology	C-GE2B*	Minerals and Rocks
SEMESTER III		**SEMESTER IV**	
C5	GEO-C5: Igneous Petrology	C8	GEO-C8: Metamorphic Petrology
C6	GEO-C6: Sedimentary Petrology	C9	GEO-C9: Stratigraphic Principles & Indian Stratigraphy
C7	GEO-C7: Palaeontology	C10	GEO-C10: Hydrogeology
SEC1	Field Geology-1	SEC2	Field Geology-2/3/4/5
C-GE3B*	Structural Geology	C-GE4B*	Fossils & their Applications
SEMESTER V		**SEMESTER VI**	
C11	GEO-C11: Economic Geology	C13	GEO-C13: Engineering Geology
C12	GEO-C12: Geomorphology	C14	GEO-C14: Remote Sensing & GIS
DSE1	Geophysics	DSE3	Evolution of Life Through Time
DSE2	Earth's, Climate and Environment	DSE4	Fuel Geology

C: Core Courses; GE: General Elective; AECC: Ability Enhancement Compulsory Courses; SEC: Skill Enhancement Courses; DSE: Discipline Specific Elective

*: GE subjects are to be selected by the students from the pool of GE Subjects offered by various Departments of the University.

***GENERIC ELECTIVE SUBJECTS (Offered by Geology Department) for students of other departments**

1. **GEO-C-GE1B: Essentials of Geology**
2. **GEO-C-GE2B: Minerals and Rocks**

Outlines of Tests, Syllabi and Courses of Reading for B.Sc. (Honours: under the Framework of Honours School System) II Year in Geology (Choice Based Credit System) Examinations 2019-20, 2020-21 and 2021-22

IIISemesterExamination

Paper	Course	Title	Credit	Mid-Semester Test	End-Semester Examination	TotalMarks
Theory:CoreCourse						
I	GEO-C5	Petrology	4	20	80	100
II	GEO-C6	Petrology	4	20	80	100
III	GEO-C7	Palaeontology	4	20	80	100
	Course			Continuous Assessment		
I	GEO-C5P	Petrology	2	10	40	50
II	GEO-C6P					

UNIT2:PhaseDiagrams andMagmaDiversification(15hrs)

Forsterite-Fayalite systems; eutectic: Diopside-Anorthite system;peritectic: Forsterite-Silica system;solid

solidsolutionandeutectic:Diopside-Albite-Anorthitesystem).Magmaticprocessesofmagmadiversification: differentiation, fractional crystallisation, liquid immiscibility, magma mixing and assimilation.

UNIT3:PetrogenesisandTectonicSetting-I(15 hrs)

Classification, petrography, chemistry, tectonic setting and petrogenesis of: Layered mafic intrusions; Komattites; Ophiolites; Mid-ocean ridge basalt (MORB); Ocean island basalt (OIB); Continental flood basalt (CFB).

UNIT4:PetrogenesisandTectonicSetting-II(15hrs)

Classification, petrography, chemistry, tectonic setting and petrogenesis of: Island arc magmatism; Continental arc magmatism; Granitoid rocks; Continental rift magmas: Alkaline magmatism, Carbonatites, Lamprophyres, Kimberlites; Lamproites; Anorthosites.

SUGGESTEDREADING

1. Best,M.G.(2001).IgneousandMetamorphicPetrology,CBS.NewDelhi.
2. Blatt,H.,Tracy,R.J.andOwens,B.E.(2006).Petrology:Igneous,Sedimentaryand Metamorphic,3rd Edn.W.H.FreemanandCompany.
3. Hyndman,D.W.(1985).PetrologyofIgn] h0. us,u0 = dĎ om ẋ reo- S. t0Aý (Á

UNIT3: Vertebrates(15hrs)

Originofvertebratesandmajorstepsinvertebrateevolution.Mesozoicreptiles, dinosaurian evolution and extinction patterns. Evolution of horse and humans.

UNIT4:IntroductiontoPalaeobotany, GondwanaFlora(15 hrs)

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Skill Enhancement Course: Field Geology 1: Basic Field Training-

Total Marks: [50 (Field Work M.M. 25, Field Report M.M. 25)

Credits: 2

UNIT 1: Orientation of Topographic sheet in field; marking location in toposheet; Bearing (Front and back); Concepts of map reading, distance, height and pace approximation.

UNIT 2: Identification of rock types in field; Structures and texture of rocks; Use of handlens.

UNIT 3: Basic field measurement techniques: Bedding dip and strike, Litholog measurement.

UNIT 4: Reading contours and topography; Traverse mapping.

Note: The duration of field work would be of eight days (two credits). It is mandatory for the students to maintain a systematic field diary and also to submit a well illustrated field report based on the field work. A candidate who does not attend the field work or fails to get pass marks in it will have to do the Field Work by joining the field tour of the same class in a subsequent year as per University rules.

IV Semester Examination

Paper	Course	Title	Credit	Mid-Semester Test	Examination	Total Marks
Theory: Core Course						
I	GEO-C8	Petrology	4	20	80	100
II	GEO-C9					

FieldtransectinSiwalik. or
IdentificationoftheHimalayanandthepre-Himalayanelements.

Note: The duration of field work would be of eight days (two credits). It is mandatory for the students to maintain asystematicfielddiaryand also to submit awellillustratedfield reportbased onthefield work. A candidate who does not attend the field work or fails to get pass marks in it will have to do the Field Work by joining the field tour of the same class in a subsequent year as per University rules.

OR

SkillEnhancementCourse:FieldGeology4:Stratigraphy&Palaeontology-relatedField

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TotalMarks:[50(FieldWorkM.M.25,FieldReportM.M.25)

Credits:2

UNIT 1: Field training along Phanerozoic basin of India.

UNIT2:Documentationofstratigraphicdetailsinthefield.

UNIT3:Collectionofsedimentological,stratigraphicandpaleontologicaldetailsandtheirrepresentation.

UNIT4: JointsandFaults(15hrs)

Joints:generalcharacteristics,jointsets,jointsystem,majorjointsandtheirrelationwith other structure; use of Rose diagram and stereographic projection; joint intensity.

Fault: parts; geometric and genetic classification; geologic/geomorphic criteria for recognition of fault and fault plane solution. Difference between fault and unconformity. Effects of faulting on outcrop pattern. Throw of the fault, horst and graben. Mechanics of faulting; Introduction to Thrust, Nappe, Klippe and window.

SUGGESTEDREADING

Outlines of Tests, Syllabi and Courses of Reading for B.Sc. (Honours: under the Framework of Honours School System) III Year in Geology (Choice Based Credit System) Examinations 2019-20, 2020-21 and 2021-22

VSemester Examination

Paper	Course	Title	Credit	Mid-Semester Test	End-Semester Examination	TotalMarks
Theory:CoreCourse						
I	GEO-C11	Geology	4	20	80	100
II	GEO-C12	Geomorphology	4	20	80	100
Theory:DisciplineSpecificElective						
III	GEO-DSE1	Geophysics	4	20	80	100
IV	GEO-DSE2	Environment	4	20	80	100
	Course			Continuous Assessment		
I	GEO-C11P	Geology	2	10	40	50
II	GEO-C12P	Geomorphology	2	10	40	50
Practical:DisciplineSpecificElective						
III	GEO-DSE1P	Geophysics	2	10	40	50
IV	GEO-DSE2P	Environment	2	10	40	50
TotalCredits&Marks			24			600

PaperI:ECONOMICGEOLOGY-

TotalMarks:[100(Mid-SemesterTestM.M.20,End-SemesterExam.M.M.80)]

TotalLectures:60 f 3Ɣe · ʃ î f Credits:4

Objectives: This course aims to provide a detailed study of formation of various mineral deposits along with an overview of basics of ore minerals. It also focuses on Indian disM "

UNIT3: LandformEvolution(15hrs)

Weatheringandassociatedlandforms;Geomorphicprocessesandlandformsassociated with fluvial, glacial, eolian, coastal and karst topography.

UNIT4:ExhumationandAppliedGeomorphology(15hrs)

Processesofexhumation:upliftmentanddenudation;Sealevelandclimatechanges in relation to geomorphology; Applied geomorphology; Palaeogeomorphology

SUGGESTEDREADING

1. Anderson, R.S. and Anderson, S.P. (2010). The Mechanics and Chemistry of Landscapes. Cambridge University Press.
2. Bloom,A.L.(2003).Geomorphology-ASystematicAnalysisofLateCenozoicLandforms.Pearson.
3. Butzer,K.W.(1976).GeomorphologyfromtheEarth.HarperandRowPublishers.
4. Dink,P.(1976).MapWork.AtmaRam Pub.
5. Kale,V.S.(2014).LandscapesandLandformsofIndia(WorldGeomorphologicalLandscapes).Springer.
6. King,L.C.(1962).TheMorphologyofEarth.Hafner,NewYork.
7. Leopold,L.B.,Wolman,M.G.andMiller,J.P.(1970). FluvialProcessesinGeomorphology. S.ChandCo.Ltd.,NewDelhi.
8. PavlopoulosK.,Evelpidou,N.,Vassilopoulos,A.(2009).MappingGeomorphological Environments. Springer.
9. Penck,W.(1953).MorphologicAnalysisofLandforms.St.MarsipPress,London.
10. Singh,R.L.andSingh,R.P.B.(2014).ElementsofPracticalGeography.KalyaniPublishers,Hyderabad.
11. Singh,S.(2006).Geomorphology.PrayagPustakBhavan, Allahabad.
12. Smith,M.,Paron,P.andGriffiths,J.(2011).GeomorphologicalMapping:Methodsand Applications.Elsevier.
13. Thornbury,W.D.(2004).PrinciplesofGeomorphology,2nd Edn. CBS.
14. Twidale,C.R.(1971).StructuralLandforms.A.W.UPress,Canberra.

PaperIII:GEOPHYSICS-

TotalMarks:[100(Mid-SemesterTestM.M.20,End-SemesterExam.M.M.80)]

TotalLectures:60 **Credits:4**

Objectives: The major objective of this course is to provide fundamentals of geophysics and also to comprehend geophysical exploration methods used for mineral, subsurface fault determination, water, oil and geothermal exploration.

UNIT1:GeologyandGeophysics(15hrs)

Interrelationship between geology and geophysics; role of geological and geophysical data in explaining geodynamical features of the earth.

UNIT2:GeneralandExplorationGeophysics(15hrs)

UNIT3:GeophysicalFieldOperations(15 hrs)

SUGGESTEDREADING

1. Aguado,E.andBurt,J.(2009).UnderstandingWeather.
2. Berner,E.K. andBerner, R.A.(2012).GlobalEnvironment-Water,Air,andGeochemical Cycles.2nd Edn,PrincitonUniversityPress.
3. Eby,N.(2003).PrinciplesofEnvironmentalGeochemistry.BrooksCole.
4. Lutgens,F.,Tarbuck,E.andTasa,D.(2009).The Atmosphere:AnIntroductionto Meteorology. Pearson Publisher.
5. Rohli, R.V. and Vega, A.J. (2007). Climatology. AJonesand Barlatt.
6. Rudiman, W.F. (2001). Earth's Climate: Past and Future. 2nd Edn,FreemanPublisher.

Practical I: ECONOMIC GEOLOGY -

TotalMarks:[50(ContinuousAssessmentM.M.10,End-SemesterExam.M.M.40)]

TotalLectures:60 ESrIBI]H]OiESM course O. GO-C1V Credits:2 3 /

Practical IV: EARTH'S CLIMATE AND ENVIRONMENT-

Total Marks: [50 (Continuous Assessment M.M. 10, End-Semester Exam. M.M. 40)]

Total Lectures: 60 **Credits: 2**

1. Study of distribution of major climatic regimes of India on map.
2. Distribution of major wind patterns on world map.
3. Preparation of paleogeographic maps (distribution of land and sea) of India during specific geological time intervals.
4. Numerical exercises on interpretation of proxy records for paleoclimate.
5. Exercises on data interpretation about earth's environment-numerical and map based.

VI Semester Examination

Paper	Course	Title	Credit	Mid-Semester Test	End-Semester Examination	Total Marks
Theory: Core Course						
I	GEO-C13		4	20	80	100
II	GEO-C14		4	20	80	100
Theory: Discipline Specific Elective						
III	GEO-DSE3	Evolution of Life Through Time	4	20	80	100
IV	GEO-DSE4	Fuel Geology	4	20	80	100
	Course			Continuous Assessment		
I	GEO-C13P		2	10	40	50
II	GEO-C14P		2	10	40	50
Practical: Discipline Specific Elective						
III	GEO-DSE3P	Evolution of Life Through Time	2	10	40	50
IV	GEO-DSE4P	Fuel Geology	2	10	40	50
Total Credits & Marks			24			600

PaperI:ENGINEERINGGEOLOGY-

TotalMarks:[100(Mid-SemesterTestM.M.20,End-SemesterExam.M.M.80)]

TotalLectures:60 Credits:4

Objectives:Themainaimofthiscourseistounderstandthebasicsofgeotechnicalandengineering properties of rocks, rating of rock mass and application of geologyto various engineering projects.

UNIT1:GeologicalParameters(15hrs)

Geology and its relationships to engineering; Role of engineering geologists in planning, design and construction of major man-made structural features; Site investigation and characterisation; Earthquakes: causes, factors and corrective/preventive measures.

UNIT2:GeotechnicalProperties(15 hrs)

Intact rock and rock mass properties; Rock aggregates; Rock as a construction material; Concept, mechanism and significance of Rock Quality Designation (RQD); Concept, mechanism and significance of Rock Structure Rating (RSR), Rock Mass Rating (RMR) and Tunneling Quality Index (Q).

UNIT3:EngineeringGeologicalInvestigations(15hrs)

Foundation treatment; Grouting, rock bolting and other support mechanisms; Geological investigations for river valley projects; Geological and geotechnical studies for dams and reservoirs.

UNIT4:EngineeringProjects(15 hrs)

Tunnels and tunneling methods and problems; Landslides: causes, factors and corrective/preventive and rehabilitation measures; Case histories related to Indian Civil Engineering Projects, such as Bhakra Nangal project and Nagarjunsagar project.

SUGGESTEDREADING

1. Bell:F.G.(2006).BasicEnvironmentalandEngineeringGeology.WhittlesPublishing.
2. Bell,F.G.(2007).EngineeringGeology,Butterworth-Heineman.
3. Goodman,R.E.(1993).EngineeringGeology:RockinEngineeringConstructions.JohnWiley.
4. Johnson,R.B.andDeGraf,J.V.(1988).PrinciplesofEngineeringGeology,John Wiley.
5. Krynine,D.P.andJuddW.R.(1957).PrinciplesofEngineeringGeologyandGeotechnique.McGraw Hill.
6. Waltham,T.(2009).FoundationsofEngineeringGeology,3rdEdn,Taylor&Francis.
7. Wyllie,D.C.andMah,C.W.(2005).RockSlopeEngineering,Butterworth-Heineman.

PaperII:REMOTESENSING&GIS-

TotalMarks:[100(Mid-SemesterTestM.M.20,End-SemesterExam.M.M.80)]

TotalLectures:60 Credits:4

Objectives: This course aims to understand the basic principles and applications of remotesensingandgeographicinformationsysteminvariousbranchesofgeosciences.

UNIT1:Photogeology(15 hrs)

Types and acquisition of aerial photographs; Scale and resolution; Principles of stereoscopy, relief displacement, vertical exaggeration and distortion; Elements of air photo interpretation; Identification of sedimentary, igneous and metamorphic rocks and various aeolian, glacial, fluvial and marine landforms.

UNIT2: RemoteSensing(15hrs)

Concepts in Remote Sensing; Sensors and scanners; Satellites and their characteristics; Data formats- Raster and Vector.

UNIT3: DigitalImageProcessing(15hrs)

Image Errors; Rectification and Restoration; FCC; Image Enhancement; Filtering; Image Rationing; Image classification and accuracy assessment; GIS integration and Case studies-Indian Examples.

UNIT4:GeographicInformationSystem(15 hrs)

PracticalI:ENGINEERINGGEOLOGY-

TotalMarks:[50(ContinuousAssessmentM.M.10,End-SemesterExam.M.M.40)]

TotalLectures:60 **Credits:2**

1. Computationofreservoirarea,catchmentarea,reservoircapacityandreservoirlife.
2. Studyofmapsandmodelsofimportantengineeringstructures,suchasdamsitesandtunnels.
3. Merits,demerits&remedialmeasuresbasedupongeologicalcrosssectionsofprojectsites.
4. ComputationofIndexpropertiesofrocks;
5. ComputationofRQD,RSR,RMRand‘Q’

PracticalII:REMOTESENSING&GIS- ϖiedieI % î ᵀ 0i)

TotalMarks:[50(ContinuousAssessmentM.M.10,End-SemesterExam.M.M.40)]

TotalLectures:60 **Credits:2**

1. Aerial Photo interpretation, identification of sedimentary, igneous and metamorphic rocks and various aeolian, glacial, fluvial and marine landforms.
2. IntroductiontoDIPandGISsoftware.Digitalimageprocessingexercisesincludinganalysis of satellite data in different bands and interpretation of various objects on the basis of their spectral signatures; Creating a FCC from raw data.
3. Registration of satellite data with a toposheet of the area, Enhancing the satellite images; GeneratingNDVI ! eaÁ]DVra ® ! aVra is ! ntattrpo aterp ! ct%Mf hede th ! codelt