VIDYASAGAR UNIVERSITY

Midnapore, West Bengal

PROPOSED CURRICULUM & SYLLABUS (DRAFT) OF

B.Sc. (HONOURS/ HONOURS WITH RESEARCH)
MAJOR IN GEOLOGY

4-YEAR UNDERGRADUATE PROGRAMME

(w.e.f. Academic Year 2023-2024)

Based on

Curriculum & Credit Framework for Undergraduate Programmes

(CCFUP), 2023 & NEP, 2020

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VIDYASAGAR UNIVERSITY
BACHELOR OF SCIENCE (HONOURS/ HONOURS WITH RESEARCH) IN GEOLOGY
(under CCFUP, 2023)

Level	YR.	SEM	Course Type	Course Code	Course Title		Credit	L-T-P	Marks		
									CA	ESE	TOTAL
B.Sc. (Hons./ Hons. with Research) in HM	4th	VII	SEMESTER-VII								
			Major-14	GELHMJ14	T: Engineering Geology; P: Practical		4	3-0-1	15	60	75
			Major-15	GELHMJ15	T: Geophysics; P: Practical		4	3-0-1	15	60	75
			CRM	GELHCRM	T: Research Methodology and Ethics;		4	3-1-0	15	60	75
			Major Elective-03	GELHDSE03	T: Geostatistics; P: Practical OR T: Sequence stratigraphy and Basin Evolution; P: Practical		4	3-0-1	15	60	75
			Minor-07	GELMIN07	T: Structural Geology; P: Practical		4	3-0-1	15	60	75
						Semester-VII Total	20				375
		VIII	SEMESTER-VIII								
			Major-16	GELHMJ16	T: Remote Sensing, GIS and Geomorphology; P: Practical		4	3-0-1	15	60	75
			Major Elective-04	GELHDSE04	T: Environmental Geology; T: Applications of Micropalaeontology, Ichnology P: Practical		4	3-0-1	15	60	75
			Major Elective-05	GELHDSE05	T: Oceanography;	FOR HONOURS STUDENTS	4	3-1-0	15	60	75
			Major Elective-06	GELHDSE06	P: Seminar & Grand viva -voce		4	0-0-4	15	60	75
			Research	GELHRD	DISSERTATION	*FOR HONOURS WITH RESEARCH STUDENTS*	*8*	*0-0-8*	*-*	*150*	*150*
			Minor-8	GELMIN08	T: Hydrogeology;		4	3-1-0	15	60	75
						Semester-VIII Total	20				375
						YEAR-4	40				750
			To be awarded *B.Sc. (Honours / Honours with Research) in Geology*				166	Marks (Year: I+II+III+IV)			3075

MJ = Major, MI = Minor Course, DSE = Discipline Specific Elective Course, CRM= Compulsory Research Methodology, INT= Internship, RD= Research / Dissertation; CA= Continuous Assessment, ESE= End Semester Examination, T = Theory, P= Practical, L-T-P = Lecture-Tutorial-Practical

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SEMESTER-VII

MAJOR (MJ)

Major (MJ)-14:
ENGINEERING GEOLOGY
Credits 04; FM-75

MJ-14T: Engineering Geology **Credits 03 (45Hrs.)**

Course Content:

Unit-1: Role of engineering geologists in planning, design and construction of major man-made structural features.

Unit-2: Site investigation and characterization

Unit-3: Foundation treatment; Grouting, Rock Bolting and other support mechanisms

Unit-4: Rock aggregates; Significance as Construction Material

Unit-5: Concept, Mechanism and Significance of: a) Rock Structure Rating (RSR) b) Rock Mass Rating (RMR) c) Tunneling Quality Index (Q)

Unit-6: Geological, Geotechnical and Environmental considerations for Dams and Reservoirs, Tunnels and Tunneling Methods

Unit-7: Landslides: Causes, Factors and corrective/Preventive measures

Unit-8: Earthquakes: Causes, Factors and corrective/Preventive measures. Mitigating the damage caused by Earthquake

Suggested Readings:

1. Krynin, D.P. and Judd W.R. 1957.Principles of Engineering Geology and Geotechnique, McGraw Hill (CBS Publ).
2. Johnson, R.B. and De Graf, J.V. 1988.Principles of Engineering Geology, John Wiley. Goodman, R.E., 1993.Engineering Geology: Rock in engineering constructions. JohnWiley & Sons, N.Y.
3. Waltham, T., 2009. Foundations of Engineering Geology (3rd Edn.)Taylor & Francis.
4. Bell: F.G-, 2006. Basic Environmental and Engineering Geology Whittles Publishing.
5. Bell, .F.G, 2007. Engineering Geology, Butterworth-Heineman

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MJ-14P: Engineering Geology **Credits 01 (30Hrs.)**

1. Computation of reservoir area, catchment area, reservoir capacity and reservoir life.
2. Computation of Index properties of rocks.
3. Computation of RQD, RSR, RMR and ‘Q

Suggested Readings:

1. Krynin, D.P. and Judd W.R. 1957.Principles of Engineering Geology and Geotechnique, McGraw Hill (CBS Publ).
2. Johnson, R.B. and De Graf, J.V. 1988.Principles of Engineering Geology, John Wiley. Goodman, R.E., 1993.Engineering Geology: Rock in engineering constructions. JohnWiley & Sons, N.Y.
3. Waltham, T., 2009. Foundations of Engineering Geology (3rd Edn.)Taylor & Francis.
4. Bell: F.G-, 2006. Basic Environmental and Engineering Geology Whittles Publishing.
5. Bell, .F.G, 2007. Engineering Geology, Butterworth-Heineman

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Major (MJ)-15:
GEOPHYSICS
Credits 04; FM-75

MJ-15T: Geophysics **Credits 03 (45Hrs.)**

Course Content:

Unit 1: Introduction to geophysics. Interrelationship between geology and geophysics

Unit 2: Different types of geophysical methods - gravity, magnetic, electrical and seismic; Principles of different methods. Applications of different methods. Elements of well logging. Corrections in geophysical data.

Unit 3: Data acquisition and Processing. Data reduction, Signal and noise. Different types of surveys, grid and route surveys, profiling and sounding techniques- a. Scales of survey. b. Presentation of geophysical data

Unit 4: Regional geophysics, oil and gas geophysics, ore geophysics, groundwater geophysics, engineering geophysics. Geological interpretation of geophysical data

Unit 5: Geophysical anomalies- Correction to measured quantities, geophysical, anomaly, regional and residual (local) anomalies, factors controlling anomaly. Depth of exploration.

MJ-15P: Geophysics **Credits 01 (30Hrs.)**

Practical:

1. Anomaly and background- Graphical method.
2. Study and interpretation of seismic reflector geometry.
3. Gravity anomaly: Problems on gravity anomaly.

Suggested Reading:

1. Ramachandra Rao, M.B., Prasaranga, 1975 Outlines of Geophysical Prospecting - A manual for geologists, University of Mysore, Mysore.
2. Bhimasarikaram V.L.S 1990 Exploration Geophysics - An outline, Association of Exploration Geophysicists, Osmania University, Hyderabad.
3. Dobrin, M.B. 1984, An introduction to Geophysical Prospecting. McGraw-Hill, NewDelhi.
4. Telford, W. M., Geldart, L. P., & Sheriff, R. E. 1990 Applied geophysics (Vol. 1). Cambridge University Press.
5. Lowrie, W. (2007). Fundamentals of geophysics. Cambridge University Press.
6. Mussett, A. E. and Khan, M. A. (2000). Looking into the Earth. Cambridge University Press.

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COMPULSORY RESEARCH METHODOLOGY (CRM)

[for both Hons. and Hons. with Research students]

CRM: Research Methodology and Ethics
Credit: 4
Full Marks: 75

GELCRM T: Research Methodology and Ethics **Credits 03**

Unit-1: Foundations of Research: Meaning and definition of research. What is Research Methodology and needs of methodology in research. Concept, Construct, Variable, Research Process

Unit-2: Problem Identification & Formulation

Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance

Unit-3: Type of Research

Qualitative research, Quantitative research, Concept of measurement, causality, generalization, replication. Merging the two approaches

Unit-4: Sampling

Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size. Characteristics of a good sample. Determining size of the sample – Practical considerations in sampling and sample size.

Unit-5: Data Analysis

Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages). Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.

Unit-6: Interpretation of Data & publication

Processes of data interpretation, Layout of a Research Papers, Impact factor of Journals,, Bibliography

Unit-7: Research Ethics

Ethical issues related to publishing, Plagiarism and Self-Plagiarism.

Suggested Reading:

1. C.R. Kothari Research Methodology: Methods and Techniques
2. John W. Creswell and Cheryl N. Poth -Qualitative Inquiry and Research Design

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Major Elective (MJDSE)-03:
GEOSTATISTICS
Credits 04; FM-75

MJDSE-3T: Geostatistics **Credits 03 (45Hrs.)**

Course Content:

Unit 1: Basic Statistics – Classification an.d presentation of statistical data, Characteristics of Normal distribution, measures of central tendency and dispersion, correlation, Least square method and regression analysis, probability and probability distributions, concept of population and sample, Sampling and sample distributions.

Unit 2 : Central limit theorem; Concept and methodology of Hypotheses Testing and its application in geology - student's t test, F test, $\chi 2$ test, ANOVA(one way).

Unit 3 : Concept of regionalized variable- semi variance & semivariogram, kriging

Unit 4 : Analysis of sequences of data: Markov chains, auto correlation and cross correlation.

Unit 5 : Analysis of multivariate data, Map analysis

Unit 6 : Fractals in geology.

MJDSE-3P: Geostatistics **Credits 01 (30Hrs.)**

1. Measurement of central tendency by numerical and graphical methods
2. Graphical analysis of geological data and interpretation of that data
3. Hypothesis testing

Suggested Readings:

1. Schabenberger, O. and Gotway, C. 2005 Statistical Methods for Spatial Data Analysis Chapman & Hall/CRC.
2. Peter J. Diggle, Paulo J. Ribeiro, Jr 2007 Model-based geostatistics, Springer.
3. Cressie, N. 1993. Statistics for Spatial Data (Revised Ed.). John Wiley & Sons, Inc.
4. Chiles, J. P. and Delfiner, P. 1999 Geostatistics: Modeling Spatial Uncertainty. Wiley.
5. Davis, J.C., Statistics and Data Analysis in Geology, 3rd Edition, John Wiley & Sons, Inc.

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Major Elective (MJDSE)-03:
SEQUENCE STRATIGRAPHY AND BASIN EVOLUTION
Credits 04; FM-75

MJDSE-3T: Sequence stratigraphy and Basin Evolution **Credits 03 (45Hrs.)**

Course Content:

Unit 1: Sequence stratigraphy

1. An integrated methodology to understand the predictability in the course of development of sedimentary successions,
2. Historical developments, Definitions and key concepts.
3. Base level (stratigraphic and geomorphic) changes, Eustatic and Relative Sea level, Transgressive-Regressive sequences, Hierarchy of sequences and bounding surfaces, T-R cycles
4. Regional and global controls; Stratigraphic surfaces, Systems Tracts, Predictable differences between their products and Sequence Models;
5. Sequences in carbonate systems
6. Genetic stratigraphic sequences
7. Event stratigraphy
8. Sequence stratigraphic approach in hydrocarbon exploration, coal and mineral resources.

Unit 2: Basin evolution

1. Formation of sedimentary basins in different tectonic environments
2. Mechanisms for basin formation and parameters that control subsidence, sedimentary architecture and thermal history, Burial history reconstruction and Geohistory analysis
3. Fundamentals and key concepts of basin mapping methods: structure and isopach contouring, lithofacies maps
4. Palaeocurrent analysis
5. Provenance analysis;
6. Tectonic classification of sedimentary basins
7. Sedimentary basins of India.

MJDSE-3P: Sequence stratigraphy and Basin Evolution **Credits 01 (30Hrs.)**

1. Identifying sequence stratigraphic units and boundaries in seismic maps and well log data.
2. Preparation of lithofacies map.
3. Provenance Analysis

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Suggested Readings:

1. Allen P.A., Allen,J.R. (1990) Basin Analysis: Principles and Applications. Blackwell Publishing
2. Buby, C., Azor, A. (2012) Tectonics of Sedimentary basins. Wiley Blackwell
3. Catuneanu, O. (2006) Principles of Sequence Stratigraphy. Elsevier
4. Emery, D., Mayers, K. (1996) Sequence Stratigraphy. Blackwell Publishers
5. Miall, A.D. (1997) The geology of stratigraphic sequences. Springer
6. Miall, A.D. (2000) Principles of Sedimentary Basin Analysis. Springer Verlag, New York

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MINOR (MI)

Minor (MI)-7: Structural Geology **Credits 04; FM-75**

Minor (MI)-7T: Structural Geology **Credits 03 (45Hrs.)**

Course Content:

Unit 1: Introduction to Structural Geology; contours, topographic and geological maps; Elementary idea of bed, dip and strike; Outcrop, effects of various structures on outcrop. Clinometer/Brunton compass and its use.

Unit-2: Elementary idea of types of deformation, Concept of stress strain, Foliations and lineations; Folds: nomenclature and types of folds;

Unit-3: Faults: nomenclature, geometrical and genetic classifications, normal, thrust and slip faults;

Unit-4: definition, kinds and significance of joints and unconformity.

Minor (MI)-7P: Structural Geology **Credits 01 (30Hrs.)**

Practical

Study of clinometers/Brunton compass; Identification of different types of folds/faults from block models; Exercises on structural problems: preparation of cross section profile from a geological map.

Suggested readings

1. Ghosh, S.K. 1993 Structural Geology: Fundamentals and Modern Developments. Pergamon Press
2. Park, R. G. 2005 Foundations of Structural Geology. Routledge

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SEMESTER-VIII

MAJOR (MJ)

Major (MJ)-16:
GEOMORPHOLOGY, REMOTE SENSING AND GIS
Credits 04; FM-75

MJ-16T: Geomorphology, Remote Sensing and GIS **Credits 03 (45Hrs.)**

Course Content:

Unit-1: Introduction to Geomorphology. Relationship between the landforms and the properties of earth material and different kind of processes. Endogenic and Exogenic processes

Unit-2: Surficial Processes and geomorphology, Weathering and associated landforms, Hill slopes Glacial, Periglacial processes and landforms, Fluvial processes and landforms, Aeolian Processes and landforms, Coastal Processes and landforms, Landforms associated with igneous activities

Unit-3: Concepts in Remote Sensing. Sensors and scanners. Satellites and their characteristics. Data formats- Raster and Vector.

Unit-4: Photogeology: 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

Unit-5: Digital Image Processing: Image Errors, Rectification and Restoration, FCC, Image Enhancement, Filtering, Image Rationing. Image classification and accuracy assessment. GIS integration and Case studies-Indian Examples.

Unit-6: Datum, Coordinate systems and Projection systems.Spatial data models and data editing. Introduction to DEM analysis. Concepts of GPS. Integrating GPS data with GIS. Applications in earth system sciences.

Suggested Readings:

1. Robert S. Anderson and Suzzane P. Anderson (2010): Geomorphology - The Mechanicsand Chemistry of Landscapes. Cambridge University Press.
2. M.A. Summerfield (1991) Global Geomorphology.Wiley & Sons.
3. Demers, M.N., 1997.Fundamentals of Geographic Information System, John Wiley &sons. Inc.
4. Hoffmann-Wellenhof, B., Lichtenegger, H. and Collins, J., 2001. GPS: Theory & Practice,Springer Wien New York.

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5. Jensen, J.R., 1996. Introductory Digital Image Processing: A Remote SensingPerspective, SpringerVerlag.
6. Lillesand, T. M. & Kiefer, R.W., 2007.Remote Sensing and Image Interpretation, Wiley.
7. Richards, J.A. and Jia, X., 1999.Remote Sensing Digital Image Analysis, SpringerVerlag.

MJ-16P: Geomorphology, Remote Sensing and GIS (Practical) Credits 01 (30Hrs.)

1. Reading topographic maps. Preparation of a topographic profile.

2. Preparation of longitudinal profile of a river.

3. Calculating Stream length gradient index

4. Morphometry of a drainage basin.

5. Aerial Photo interpretation: Identification of sedimentary, igneous and metamorphic rocks and various aeolian, glacial, fluvial and marine landforms.

6. Introduction to DIP and GIS softwares.

7. Digital Image Processing exercises including analysis of satellite data in different bands and interpretation of various objects on the basis of their spectral signatures.

8. Use of stereoscope. Flight line determination using aerial photograph.

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MAJOR ELECTIVE (DSE)

Major Elective (MJDSE)-04:
ENVIRONMENTAL GEOLOGY
Credits 04; FM-75

MJDSE-4T: Environmental Geology **Credits 04 (60Hrs.)**

Course Content:

Unit 1: Introduction to Environmental Geology:

Definition of Environment; Earth as a System; Earth and Human Population – Population growth rate and Consequences; The Human Response to Hazards; Population Increase, Land Use Change and Natural Hazards.

Unit 2: Natural Resources and Pollution:

Water Resources : A Brief Global Perspective, Water and Ecosystems, Surface Water, Groundwater, Interactions Between Surface Water and Groundwater; Consumption of Water and Emerging Global Water Shortages; Water Pollution : An Overview, Surface and Groundwater Pollution and Treatment, Water-Quality Standards, Wastewater Treatment; Mineral Resources : Geology of Mineral Resources, Environmental Impact of Mineral Development, Mining and Toxicity, Recycling Mineral Resources, Minerals and Sustainability; Energy Resources : Fossil and Nuclear Fuels, The Environmental Impact, Renewable Energy Sources, Conservation, Efficiency and Cogeneration.

Unit 3: Natural Hazards:

Hazard and Disaster : Natural Causes - Earthquakes, Tsunami, Volcanism, Flood, Landslides and Subsidence, Coastal Hazards; Prediction, Preventive Measures and Anthropogenic Contributions

Unit 4: Global Climate

Earth's Climate System : Major Controls on Global Climate; The Greenhouse Effect; Coupling of Global Change Processes : Ozone Depletion and Global Warming; Consequences of Global Warming, Mitigation.

Suggested Readings

1. Montgomery, C. W., 2011. Environmental Geology, Ninth Edition, McGraw-Hill.
2. Keller, E. A., 2012. Introduction to Environmental Geology, Fifth Edition, Prentice Hall.
3. Reichard, J. S., 2011. Environmental Geology, McGraw-Hill.

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Major Elective (MJDSE)-04:
APPLICATIONS OF MICROPALAEONTOLOGY, ICHNOLOGY
Credits 04; FM-75

MJDSE-4T: Applications of Micropalaeontology, Ichnology **Credits 03 (45Hrs.)**

Course Content:

Unit 1: Sample collection and processing

1. Surface and sub-surface sampling methods, sample processing techniques
2. Morphology, classification, and evolution of foraminifera.
3. Study of selected benthic and planktonic foraminifera.
4. Morphology and geological distribution of ostracoda, calcareous nannofossils, radiolaria, conodonts and diatoms.

Unit 2: Applications of microfossils

1. Application in biostratigraphy, palaeoenvironmental interpretation and sequence stratigraphy
2. Deep sea record and stable isotopes studies of calcareous microfossils
3. Role of micropalaeontology in hydrocarbon exploration.

Unit 3: Palynology

1. Overview, spore and pollen morphology, sporoderm stratifications
2. Geological distribution
3. Application in paleobotany, paleoclimatic study, biostratigraphy and geochronology

Unit 4: Ichnology

1. Introduction Ichnology.
2. Ichnotaxonomy and classification
3. Palaeoecology and trace fossils

GELHDSE-04P: Applications of Micro and trace fossils **Credits 01 (30Hrs.)**

1. Sampling, extraction and analytical procedure
2. Laboratory visit for understanding of sample preparation methods
3. Identification of various types fossils (Micro fossils, trace fossil etc.)

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Suggested Readings:

1. Haynes, J.R. (1981) Foraminifera. John Wiley and Sons.
2. Armstrong, H.A. and Brasier, M.D. (2005) Microfossils, II Edition, Blackwell Publishing,
3. Haq, B.U. and Boersma, A. (1978) Introduction to Marine Micropaleontology. Elsevier,
4. Murray, J.W. (1991) Ecology and Palaeoecology of Benthic Foraminifera. Longman,
5. Tissot, B.P., Welte, D.H., (1984) Petroleum Formation and Occurrence. Springer.
6. Frey, R.B. (1975) The Study of Trace Fossils, Springer-Verlag.
7. Mángano, M.G and Buatois, L.A. (2016) The Trace-Fossil Record of Major Evolutionary Events, Volume-I & II, Springer.

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MAJOR ELECTIVE- 05

[to be studied by Honours students only]

Major Elective (MJDSE)-05:
OCEANOGRAPHY
Credits 04; FM-75

MJDSE-5T: Oceanography **Credits 03 (45Hrs.)**

Course Content:

Unit 1: Introduction to the Oceans

Oceanography – the concept, brief historical review; Origin of Ocean Basins; Physiography of the Ocean Floor

Unit 2: Wind and Ocean Circulation

Atmospheric Processes - Air Pressure, Coriolis Deflection, General Wind Circulation; Surface Ocean Currents; Deep-Ocean Circulation; Thermohaline Conveyer Belt - impact on Global Climate

Unit 3: Waves in the Ocean

Properties of Ocean Waves; Wave Motions; Standing Waves, Internal Waves, Tsunamis

Unit 4: Tides

Origin of the Tides, Equilibrium Model of Tides, Dynamic Model of the Tides; Tidal Currents

Unit 5: The Dynamic Shoreline

Coastal Water Movement, Shoaling Waves and Refraction, Circulation in the Surf Zone; Beaches; Coastal Dunes; Barrier Islands; Deltas; Estuaries; Lagoons; Mangrove swamps; Anthropogenic impact on the Coastline

Unit 6: Marine Resources

Types of marine resources; Physical, energy, biological and non-extractive resources; Mineral resources; Laws of the sea

Suggested Readings

1. Gross, M. G., 1977. Oceanography: A view of the earth.
2. Pinet, Paul R., 2016. Invitation to Oceanography, Seventh edition. Jones & Bartlett Learning.
3. Webb, P., Introduction to Oceanography.

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MAJOR ELECTIVE- 06

[to be studied by Honours students only]

Major Elective (MJDSE)-06:
SEMINAR & VIVA-VOCE
Credits 04; FM-75

All students undergoing Geology (Hons.) programme will have to appear and qualify in the **Grand Viva** based on the entire course of studies of Major discipline conducted at the end of the 8th Semester

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PROJECT / DISSERTATION (RD)

[to be undertaken by students opting for and eligible for Hons. with Research]

DISSERTATION:
Credit: 8;
Full Marks: 150

Structure of the dissertation

Preliminary Pages

- Title Page: Includes name of the student, university, degree, and submission date.
- Certificate/Declaration: Signed statement of originality and supervisor's approval
- Abstract: A 250-350 word summary covering research problem, methodology, and core findings.
- Acknowledgements: To supervisors and others, if any.
- Table of Contents: Clear hierarchical mapping of chapters with page number
- List of Abbreviations: Specialized terms, if any

Introduction

- Background & Context: Situates the topic in historical or theoretical context.
- Research Problem & Objectives: The specific question or gap the research is addressing.
- Thesis Statement/Hypothesis: The core argument the dissertation intends to prove.
- Scope and Significance: Why the study matters.
- Literature Review & Theoretical Framework

Literature Review: Analyzes existing scholarly works to show the gap the study fills.

- Theoretical Framework: Identifies the philosophers, critics, or schools of thought shaping the analysis in the dissertation.

Methodology

- Describes *how* the research was conducted - Anyone or a combination of textual analysis/ archival research/ conducting interviews/ ethnographic/semi-ethno-graphic research involving both textual analysis and field visit etc.
- Thematic or Analytical Chapters

The Core Body: Usually 3 to 4 chapters focusing on the core concerns of the study.

- Structure: Each chapter introduces its specific theme, analyzes primary and secondary sources, and contributes to the overarching thesis.

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Conclusion

- Summary & Synthesis: Recaps your main points without simply repeating them.

Final Verdict: Answers the research questions posed in the introduction.

Future Scope: Suggests how future scholars can build upon your work.

- Works Cited/ Reference, and/or Bibliography: A comprehensive list of all primary and secondary sources cited as per the latest MLA style.

Appendices: Transcripts, interview logs, or raw archival data, if any.

Marks distribution-

Sl. No	Particulars	Marks
1	Research Project / Dissertation Report	70
	▪ Proposal and Abstract (along with some keywords)	10
	▪ Literature Review &Theoretical Framework	10
	▪ Methodology and Research design	10
	▪ Thematic Analysis (Chapter-wise)	20
	▪ Report Quality	20
2	Seminar Presentation	30
3	Viva-Voce	50
Total		**150**

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MINOR (MI)

Minor (MI)-8: Hydrogeology **Credits 04; FM-75**

Minor (MI)-8T: Hydrogeology (Theory) **Credits 04 (60Hrs.)**

Course Content:

Unit 1: Introduction and Basic Concepts :

Scope of hydrogeology and its societal relevance; Hydrologic cycle; precipitation, evapo-transpiration, run-off, infiltration and subsurface movement of water; Rock properties affecting groundwater; Vertical distribution of subsurface water; Types of aquifer, aquifer parameters.

Unit 2: Groundwater flow:

Darcy's law and its validity, Intrinsic permeability and hydraulic conductivity; Groundwater flow rates and flow direction; Laminar and turbulent groundwater flow.

Unit 3: Well hydraulics and Groundwater Exploration:

Basic Concepts (drawdown; specific capacity etc.); Elementary concepts related to equilibrium and non-equilibrium conditions for water flow to a well in confined and unconfined aquifers; Surface-based groundwater exploration methods; Introduction to subsurface borehole logging methods

Unit 4: Groundwater chemistry:

Physical and chemical properties of water and water quality; Genetic classification of groundwater; Sea water intrusion in coastal aquifers

Suggested Readings

1. Chahar, Bhagu R., 2015. Groundwater Hydrology. McGraw Hill Education (India)
2. Todd, D.K., 2006. Groundwater Hydrology. 3rd Edition. John Wiley & Sons, N.Y.
3. Karanth K.R., 1987. Groundwater: Assessment, Development and management, Tata McGraw-Hill, New Delhi

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