

## Second Semester

### MGH 451: STRUCTURAL GEOLOGY AND HYDROGEOLOGY

**Skills, employability and entrepreneurship:** These subjects are good opportunity for students to learn not only to know the large-scale earth's features which favour water and mineral accumulations. Similarly, students who pay attention to this subject can become a hydrogeologist. They will be exposed to start their own entrepreneurship. Students are encouraged to undergo internships after the regular offline classes as well as during the vacation.

#### Structural Geology

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| <b>Unit 1</b> | <b>Introduction:</b> Importance of structural geology and its relationship with other branches of geology. Dip and strike.<br><b>Force, stress and strain:</b> Force and acceleration, composition and resolution of forces. Concept of stress and strain; strain analysis using deformation objects.                                                                                                                                                                                                     | 6 hrs |
| <b>Unit 2</b> | <b>Folds:</b> Parts of a fold. Geometrical classification of folds. Mechanics and causes of folding. Criteria for recognition of folds in the field.                                                                                                                                                                                                                                                                                                                                                      | 6 hrs |
| <b>Unit 3</b> | <b>Faults:</b> General characteristics, nature of movement along faults. Geometric and genetic classification of faults. Mechanics of faulting. Criteria for recognition of faults in the field.                                                                                                                                                                                                                                                                                                          | 6 hrs |
| <b>Unit 4</b> | <b>Joints:</b> Geometry and classification. Field studies, importance of joints in geological, structural/civil engineering studies.<br><b>Unconformities:</b> Different types of unconformities. Recognition of unconformities in the field. Criteria to differentiate between faults and unconformities.<br>Interactive sessions of teaching to enhance students-teacher interactions through hands-on demonstrations and exercises in the recent advancement of the subject related to the curriculum. | 8 hrs |

#### Hydrogeology

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| <b>Unit 5</b> | <b>Introduction:</b> Origin of water, hydrological cycle and its components – precipitation, interception, runoff, evaporation and evapotranspiration. types, importance, occurrence, movement and vertical distribution of ground water; Water bearing geological formations; Springs, classification of aquifers, hydrologic properties of rocks: porosity; permeability; specific yield; specific retention, hydraulic conductivity, transmissivity, storage coefficient. Darcy's law and its applications. |       |
| <b>Unit 6</b> | <b>Groundwater quality:</b> Physical and chemical properties of water, quality criteria for different uses, groundwater quality provinces of India, Groundwater contamination; water table fluctuation, water table contour maps; hydrostratigraphic units.                                                                                                                                                                                                                                                    | 6 hrs |
| <b>Unit 7</b> | <b>Wells:</b> Types, drilling methods, construction, design, development and maintenance. Salt water intrusion in coastal and island aquifers; groundwater legislation in rural and urban areas.                                                                                                                                                                                                                                                                                                               | 4 hrs |

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| <b>Unit 8</b> | <p><b>Groundwater development and management:</b> Methods of artificial groundwater recharge; rainwater harvesting, problems of over-exploitation of groundwater; water management in rural and urban areas, geological and geophysical methods of groundwater exploration.</p> <p>Interactive sessions of teaching to enhance students-teacher interactions through hands-on demonstrations and exercises in the recent advancement of the subject related to the curriculum.</p> | 6 hrs |
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#### References:

1. Field Geology – McGraw Hill Book Co. - Lahee, F. H. (1961)
2. Folding and Fracturing of Rocks - McGraw Hill Book Co. - Ramsay, J.G. (1967)
3. Structural Geology – 3<sup>rd</sup> edition, Prentice Hall - Billings M.P. (1977)
4. Structural Geology of Rocks and Regions - John Wiley and Sons - Davis, G.H. (1984)
5. Structural Geology Principles, Concepts and Problems, 2<sup>nd</sup> Edition, New Jersey Prentice Hall - Hatcher, Robert D. (1995)
6. Structural Geology – W.H. Freeman, New York - Twiss, Robert J. (1992)
7. Structural Geology – McGraw Hill - Timothy Whetten (1975)
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10. Murthy, K.S. 1998. Watershed management in India, 3<sup>rd</sup> edition, Wiley Eastern Ltd. New Age International Ltd, New Delhi, 198 p.
11. Groundwater – C. F. Tolman – McGraw-Hill Book Co. Inc.
12. Groundwater Hydrology (2<sup>nd</sup> Ed.) – D. K. Todd, John Wiley and Sons Inc. New York
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14. Groundwater Resources Evaluation - W.C. Walton - McGraw-Hill Book Co. New York
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16. Handbook of Applied Hydrology - V.T. Chow (Ed) – McGraw-Hill Book Co. New York
17. Hydrogeology – K. R. Karanth – Tata McGraw Hill Publishing Co. Ltd.
18. Ground Water Assessment, Development and Management – K. R. Karanath – Tata McGraw Hill Publishing Co. Ltd.
19. Groundwater – H. M. Raghunath – Wiley Eastern Limited
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21. Elements of Hydrology – V. P. Singh
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23. Introduction to Hydrology – Viessman, W., Lewis, G. L. and Knapp, J. W. (3<sup>rd</sup>ed.) Harper and Row, New York
24. Applied Hydrology – Mutreja, K. N. – Tata McGraw Hill Publishing Co. Ltd.
25. Global Groundwater Resources and Management: Paliwal - Scientific publishers.