Paper: GELH 601(THEORY): Remote Sensing and Hydrogeology *(Contact hours: 72)*

Max. Marks: 75 *Time: 3 hours*

Group A: (Remote Sensing)

Unit I: Physical basis of Remote Sensing and Photogeology
Introduction to remote sensing: Indian efforts, elements and processes of remote sensing.
Electro Magnetic Spectrum; Sensors and its types, Platform and its types.
Elements of aerial photo and satellite imageries: interpretation for geologic purposes: Photo elements and geotechnical elements.
Application of remote sensing in geological sciences.

Unit II*: *Basic Photogrammetry
Flight lines and geometry of vertical aerial photography; fiducial marks, principal point and conjugate principal point; scale and height measurement on single vertical aerial photographs. Vertical exaggregation. Stereovision and stereoscopes. Mosaics-controlled, semi-controlled and uncontrolled. Annotations.
Aerial photographs and maps; types of aerial photographs; advantages and limitations of aerial photographs,

Geographical Information System (GIS) and Global Positioning System (GPS): Definition, component and uses.

Group B: Hydrogeology

Unit III: Hydrogeology:
Concept of hydrologic cycle.
Definition and origin of ground water, its occurrence and distribution. Water table and piezometric surface. Ground water movement-Darcy's law.Hydrologic properties of rocks - porosity, permeability, specific yield, specific retention, transmissivity and storativity. Aquifers- confined and unconfined aquifers. Springs.

Unit IV: Groundwater exploration and Management:
Basic concepts of ground water survey. Selection of sites for dug and bore wells. Artificial recharge methods of ground water. Groundwater quality and its pollution. Ground water provinces of India.

Reading List:

1. Miller, V.C.(1981) *Photogeology*, McGraw Hill
2. Pandey, S.N (1987) *Principles and Applications of Photo Geology*, New Age, Delhi
3. Price, M. (1985)*Introducing Ground water*, George Allen and Unwin
4. Raghunath, H.M.(1996) *Ground Water*, New Age
5. Ramasamy, S.M (2003)*Remote Sensing in Geology*, Rawat, Jaipur
6. Singh, P.(1999) *Engineering and General Geology*, Kataria and Sons, Delhi
7. Todd, D.K(1986) *Groundwater hydrology*, John Wiley
8. Keller, E.A.(2008)*Environmental Geology*, Oxford
9. Ravi P. Gupta (2002) *Remote Sensing Geology*, Springer
10. Thomas M. Lillesand Ralph W. Kiefer , *Remote Sensing and Image Interpretation*
11. George B. Korte, P.E. *The GIS Book- How to Implement, Manage and Assess the Value of Geographic Information System*
12. M.A. Siddiqui (2005) *Introduction to Geographical Information Systems*
13. Aroygaswamy, R.N.P.(1980) *Mining Geology*, Oxford

Paper: GELH 602(PRACTICAL): Remote Sensing and Hydrogeology *(Contact hours: 48)*

Max. Marks: 25 *Time: 4 hours*

1. Remote Sensing *Marks: 5 + 5 + 2=12*

Study of the aerial photographs with the help of tone, texture, shape & size. Drainage pattern and their interpretation. GPS handling.

2. Hydrogeology *Marks: 4 + 4 = 8*

Drawing of ground water contours and determination of flow direction

Interpretation of groundwater quality maps

3. Laboratory note book and viva-voce *Marks: 2+3=5*

Reading List:

1. Pandey, S.N(1987) *Principles and Applications of Photo Geology*, New Age, Delhi
2. Sen, A.K.(1987)*Laboratory Manual of Geology*, Modern Book agency, Calcutta
3. Todd, D.K.(1986) *Groundwater hydrology*, John Wiley

Paper: GELH 603 (THEORY): Applied Geology (Exploration, Mining and Engineering Geology) *(Contact hours: 72)*

Max. Marks: 75 *Time: 3 hours*

Unit I: Exploration techniques:
Principles of geological exploration. Sampling and its types. Drilling and its types.

Unit II: Geochemical exploration and geophysical methods:
Geochemical exploration and geophysical exploration (gravity, magnetic, electrical, seismic and radiometric methods).

Unit III: *Mining geology*:
Common mining terms: Exploitation, Development, Shaft and its types, Hanging and foot walls, Adit, Drive and level, Cross cut, Tunnel, Raise and winze, Ore bin, Chute, Stope and its types .
Elementary idea about open cast and underground mining along with advantages and disadvantages. Types of mining methods (glory hole and hydraulic mining for open cast mining and room & pillar and long wall for underground mining)

Unit IV: Engineering geology
Engineering geological properties of rocks and soils. Geological and geotechnical investigation for dams, tunnels and highways.
Landslides: causes and mitigation.

Reading list:

1. Beavis, F.C.(1985) *Engineering Geology*, Blackwell
2. Bhimasankaram, V.L.S(1990) *Exploration Geophysics*, Association of Exploration Geophysicists, Hyderabad
3. Evans, A.M.(1987) *An Introduction to Ore Geology*, ELBS
4. GSI Misc. Publication no.30, *Geology and Mineral Resources of North-Eastern States*
5. Kaul, I; Bhattacharya, A.K. and Sengupta, S.(1990) *General and Applied Geophysics*, Association of Exploration Geophysicists, Hyderabad
6. Keary, P. and Brooks, M. (1988) *An Introduction to Geophysical Exploration*, ELBS
7. Kesavelu, N.C.(1993) *Engineering Geology*, Momilam India
8. Krishnasamy and Sinha(1988) *Indian Mineral Resources* Oxford and IBH, New Delhi
9. Arogyaswamy R.N.P.(1997) Courses in Mining Geology, Oxford & IBH Publishing Co. New Delhi

Paper: GELH 604 Geological Field work and Field report

Max. Marks: 25

Two field works and field reports are required with reference to petrology, palaeontology, stratigraphy, economic geology and applied geology

1. *Field work and field report with reference to petrology and stratigraphy* *(Marks: Field work 6+ Field report 4=10)*
2. *Field work and field report with reference to economic geology and applied geology* *(Marks: Field work 6+ field report 4 = 10)*
3. *Viva-voce:* *(Marks: 5)*