| Course Type | Course Code | Name of Course | L | T | P | Credit |
|---|---|---|---|---|---|---|
| DC | NGPC531 | **Magnetic Method** | 3 | 1 | 0 | 4 |

| **Course Objective** |
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| Students are exposed to potential field theory, basic survey practices of data acquisition, advanced processing and interpretation methods of magnetic data used in today's oil and mineral exploration |
| **Learning Outcomes** |
| To emphasize the importance of the magnetic method in geophysical exploration. |

| Unit No. | Details of Lectures | Lecture Hrs. (L+T | Outcome |
|---|---|---|---|
| **1.** | Earth's main magnetic field: Origin and its variation in time and space; Magnetic Elements; Magnetic Vector and Scalar Potential; Poisson's Relation; Basics of Spherical Harmonics; Application of Spherical Harmonics to the Earth's Magnetic Field, Determination of the Gauss Coefficients, Interpretation of Spherical Harmonic terms. | 9L + 3T | This unit introduces the concept of potential and the consequences of Laplace's equation. Also provides a brief discussion about the earth's magnetic field and theory of spherical harmonics to understand the global geomagnetic fields. |
| **2.** | Magnetic petrophysics and magnetic petrology: Induced and Remanent Magnetization; types of remanent magnetization; Mineral Magnetism; Magnetization of rocks and soils; Magnetic susceptibility, factors controlling susceptibility, Laboratory and in-situ methods of determining susceptibility. | 6L +2T | It helps to understand the magnetization of different earth materials, and the physical and geological controlling factors and its importance in the planning surveys and interpreting the magnetic anomalies. |
| **3.** | Principle of magnetic prospecting, Instruments: Nuclear, fluxgate, and optical pumping magnetometers, gradient measurements; Plan of magnetic surveys in regional geological mapping and different exploration programs, Magnetic data reduction: diurnal and IGRF corrections; Airborne magnetometry: orientation mechanisms, survey techniques, data acquisition and reduction, Advantages and disadvantages; Brief principles of ship-borne and satellite magnetometry. | 9L + 3T | Helps to understand the basic instruments, survey practices, and data processing techniques used in magnetic exploration. |

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| **4.** | Qualitative interpretation of magnetic data: nature of anomalies, identification of different structural features; Dependence of magnetic anomalies on latitude and orientation; Isolation and enhancement of anomalies using graphical, trend surface analysis, digital filtering, first and second vertical derivatives, upward and downward continuation filters, reduction to Pole filter; Ambiguity in magnetic interpretation, generalized approach of interpretation. | 9L + 3T | This unit emphasizes the several image enhancement techniques used in the Qualitative interpretation of magnetic data. |
| **5.** | Magnetic anomalies expressions over singlepole, dipole, line pole, sphere, cylinder, faults and dike, graticules and anomalies of irregular bodies; the relation between gravity and magnetic potentials; Depth determination methods: Peter's half slope, Werner and Euler deconvolution, and statistical spectral techniques; Application of the magnetic method in (i) Regional Geological and Structural problems (ii) Mineral and Hydrocarbon Exploration (iii) Groundwater and geotechnical problems, (iv) locating Coal fire zones, case histories. | 9L + 3T | It provides the theoretical formulation of magnetic response due to simple geometrical bodies and source-depth determination techniques. It also provides extensive discussion of field examples related to resource exploration and crustal dynamics. |
| | **Total Classes** | **42L+14T** | |

**Text Books:**


- Rao, B. S. R and Murthy, I. V.R., Gravity and Magnetic Methods of Prospecting, 1978.
- Hinze, W. J., Ralph, R. B. V and Saad, A.H. Gravity and Magnetic Exploration: Principles, Practices, and Applications, 2013.
- Blakely, R., Potential theory in gravity and magnetic applications, 1996.


**Reference Books:**


- Campbell, W.H., Introduction to Geomagnetic Fields. Cambridge University Press, 1997.
- Telford, W. M., Geldart, L. P and Sheriff, R.E., Applied Geophysics, 1990.
- Nettleton, L. L., Gravity and Magnetics in Oil prospecting, 1976.