

ICTP DIPLOMA PROGRAMME IN EARTH SYSTEM PHYSICS 2015-16

SYLLABUS

Physics of the Solid Earth - {12 Lectures = 18 hours} C. Breitenberg, A. Aoudia

- 1- Goals of the course. Importance of Physics of the Earth. Relevance of determining Earth Physical Parameters. Physical parameters and the method to determine them. Units for all fields and physical parameters relevant for earth investigation. Age of Earth. Definition cratons. Define mid-ocean spreading center. Mid-Atlantic ridge. Magnetic anomalies parallel to mid-Atlantic ridge: explanation. Reconstruction of plate movement through magnetic anomalies. Plate movement at Caribbean plate. Haiti Earthquake.
- 2- Global Lithosphere Structure. Quantitative knowledge of range of physical parameters V_p , V_s , density. Main discontinuities inside earth. Principal geophysical techniques of investigation (gravity, magnetic, seismics, magnetotellurics, electric, heat flow), physical parameters used to describe lithosphere, average structure of continental and oceanic crust. CRUST 1.0 model. Number of layers describing model, range of variation for V_p , V_s and density.
- 3- Magnetic field basics, Main, crustal and disturbance field, Total field, magnetic field vector, declination, inclination.
- 4- Spherical harmonic expansion: main properties. Degree and order of expansion. Nodal lines for different degree and order. Tesseral, zonal and sectorial harmonics. Expansion of magnetic potential field., Gauss coefficients, IGRF, Total field anomaly.
- 5- Crustal magnetic sources, magnetization, magnetic potential of dipole, potential of extended magnetized source, total field anomaly of magnetized sphere, remanent magnetization, Königsberger ratio.
- 6- Measurement of the Earth gravity field. Gravimeter; principle of measurement for absolute and relative measurements. Case history Grotta Gigante: size of signal. Model of signal through Laser scan acquisition.
- 7- Local isostatic compensation model (Airy). Quantitative analysis of: vertical movement due to erosion. Uplift response to melting. Compressive topography building. Definition shortening. Lithospheric flexure model.

Textbooks of reference:

Watts A.B. – Isostasy and Flexure of the Lithosphere, Cambridge University Press, 2001.

Blakely R.J. – Potential theory in Gravity and Magnetic Applications, Cambridge University Press, 1996.

Textbooks contained in the ICTP library that are useful:

1-Earth Science (Foster) (for geology definition, geology part)

2-The Earth System (Lee R. Kump, etc)(chapter7)

3- Applied Geophysics (W.M. Telford, etc) (for gravity concepts and equations, chapters 1,2,3)

4- An introduction to Geophysical Exploration (Philip Kearey, etc)

Online courses:

Robert Van Der Hilst. *12.201 Essentials of Geophysics, Fall 2004*. (Massachusetts Institute of Technology: MIT OpenCourseWare), <http://ocw.mit.edu> (Accessed 2 Dec, 2015). License: [Creative Commons BY-NC-SA](#)