# Metadata template for Learning Resources (V1.0)

|  |
| --- |
| Collector: Angela Aragon-Angel  Revision Date: 17/12/2024  Version: v1.0 |
| Title  GNSS Data Processing: Theory & Practical Exercises |
| Author/s  Research group of Astronomy and Geomatics (gAGE) from UPC. |
| Subject  Global Navigation Satellite Systems (GNSS), Positioning, Navigation and Timing (PNT) |
| Description  A 3-day in-person professional training for upskilling and reskilling in GNSS Training includes lectures followed by practical sessions and workshops focusing on:   * The concepts and techniques used in the positioning by means of the GNSS. * Standard and Precise Point Positioning (SPP, PPP) with the focus on the instrumental use of the concepts and techniques of GNSS navigation, intended to include all the elements need to understand how the system works and how to work with it. * The processing algorithms implemented through guided exercises in laboratory sessions. * The different terms involved in modelling the pseudoranges (relativistic effects, atmospheric troposphere/ ionosphere and instrumental delays, clock synchronism, etc.), arise and navigation equations are solved by Least Squares estimation and by Kalman filtering.   The practical sessions are made with different programs designed specifically for the course to implement different processing modules.  Theoretical topics:  ➢ Fundamentals of GNSS Positioning  GNSS Architecture: segments  GNSS Positioning Concept  GNSS Signals and Applications  ➢ Overview of GNSS Positioning techniques  GNSS Standalone positioning  Code based differential positioning (DGNSS)  Carrier based differential positioning (RTK, PPP)  ➢ Code Pseudorange Modelling  Linear model and prefit-residuals  Example of computation of modelled pseudorange.  ➢ Solving Navigation Equations  Navigation equations system  Predicted accuracy (DOP)  Parameter estimation: Least Squares and Kalman Filter  ➢ Precise Point Positioning (PPP)  Precise Satellite Orbits and Clocks  Precise modelling for PPP  Carrier phase ambiguities: Floating vs Fixing  GNSS Data Processing: Theory & Practical Exercises  Practical lectures:  GNSS Data Processing Laboratory Exercises: the gLAB tool suite |
| Abstract  In this trainins action, the participant will be able to grasp the concepts and techniques used in the positioning by means of the GNSS. Specific emphasis will be made to Standard and Precise Point Positioning (SPP, PPP) techniques with the focus on the instrumental use of the, including all the elements needed to understand how the system works and how to work with it. The different terms involved in modelling the pseudoranges (relativistic effects, atmospheric troposphere/ ionosphere and instrumental delays, clock synchronism, etc.) will be individually analysed, deriving the navigation equations and solving them by means of the Least Squares estimation and by using Kalman filtering. |
| Learning Outcomes  After the training, the participant should be able to understands basic principles of GNSS (knowledge of terminology), to execute commands using the gLAB software tool to infer characteristics of the GNSS signal being analysed, to differentiate between different error contributions to the received GNSS signal (knowledge of specific details and elements), to be able to position using several techniques (knowledge of subject-specific skills and algorithms). |
| Target audience  Professionals working in GNSS and related fields of science and engineering. |
| Date created  Fine tuning of the shared material May and June/2024 to specifically address SpaceSUITE needs. But the big bulk of this material has been created during the past decade, fruit of several training actions by gAGE. |
| Type  Live presentations with audience and real-time solving of exercises. |
| Format  Master classes using Microsoft PPT presentation and the gLAB tool. |
| Publisher  UPC |
| Contributor/s  Research group of Astronomy and GEomatics (gAGE) of UPC. |
| Location (URL)  https://github.com/SpaceSUITE-ReactiveResponseCourses/GNSS-Data-Processing-Theory-And-Practical-Exercises |
| Language  English. |
| Source/s  https://gssc.esa.int/navipedia/index.php?title=GNSS:Tools |
| License  UPC. |
| Duration  20 hours. |
| EQF level  EQF 7 & 8. |
| Table Of Contents   * The concepts and techniques used in the positioning by means of the GNSS. * Standard and Precise Point Positioning (SPP, PPP). * The processing algorithms implemented through guided exercises in laboratory sessions. * The different terms involved in modelling the pseudoranges (relativistic effects, atmospheric troposphere/ ionosphere and instrumental delays, clock synchronism, etc.) |
| Workload  1 ECTS. |
| Training Program  GNSS Training Program. |
| Prerequisites  Some mathematics background is required (Linear Algebra). |
| Type of assessment  Exercises were posed during the training action. It was required to be able to do them to continue with the GNSS data analysis. Students not able to follow such instructions, could always follow instructor’s computer screen displayed on the white board. |
| Certification  At present the participants have only received a certification of attendance to the training. UPC is currently pursuing with the Government of Catalonia the potential assignment of microcrodentials to this training action to those participants over 25 years old (this is a specific requirement from the call by the Catalan government). |
| Title of the micro-credential  Pending (please check previous item). |
| Microcredential awarding body  Pending (please check two previous items). |
| Relation/s (BoK)  NA. |
| BoK Links  NA. |