



**INSTITUT TEKNOLOGI SEPULUH NOPEMBER  
FACULTY OF CIVIL, PLANNING AND GEO ENGINEERING  
DEPARTMENT OF GEOMATICS ENGINEERING  
UNDERGRADUATE PROGRAM**

Document Code

## SEMESTER LEARNING PLAN (SLP)

| COURSE NAME            |                                                             | CODE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | COURSE GROUP            | CREDITS (SKS)                      |     | SEMESTER                    | Date of Preparation |
|------------------------|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|------------------------------------|-----|-----------------------------|---------------------|
| Geoid Modelling        |                                                             | CM234962                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Geodesy and Geodinamics | T=2                                | P=0 | Elective Course             | -                   |
| AUTHORIZATION          |                                                             | SLP Developer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         | Course Group Coordinator           |     | Head of Study Program       |                     |
|                        |                                                             | Ira Mutiara Anjasmara, S.T., M.Phil., Ph.D.                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                         | Prof. Dr. Eko Yuli Handoko, ST, MT |     | Putra Maulida, ST, MT, Ph.D |                     |
| Learning Outcomes (LO) | Expected Learning Outcomes (ELO) that Imposed in the Course |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                         |                                    |     |                             |                     |
|                        | ELO-2                                                       | Able to study and utilize science and technology in order to apply it to the areas of expertise in Geodesy and Surveying, Hydrography, Photogrammetry, and Remote Sensing, as well as Geospatial and Land Information, and able to make appropriate decisions from the results of their own work or group work in the form of a final project report or other forms of learning activities whose outcomes are equivalent to the final project through logical, critical, systematic and innovative thinking. |                         |                                    |     |                             |                     |
|                        | ELO-6                                                       | Able to identify, formulate, analyze and solve problems in the fields of geodesy, surveying, hydrographic, remote sensing, photogrammetry, and cadastral.                                                                                                                                                                                                                                                                                                                                                    |                         |                                    |     |                             |                     |
|                        |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                         |                                    |     |                             |                     |
|                        | Course Learning Outcomes (CLO)                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                         |                                    |     |                             |                     |
|                        | CLO-1                                                       | Able to explain the basic concepts of various geoid modeling methods                                                                                                                                                                                                                                                                                                                                                                                                                                         |                         |                                    |     |                             |                     |
|                        | CLO-2                                                       | Able to create gravimetric geoid models using various methods from gravity data obtained from measurements                                                                                                                                                                                                                                                                                                                                                                                                   |                         |                                    |     |                             |                     |
|                        | CLO-3                                                       | Able to perform analysis and validation of the resulting geoid model                                                                                                                                                                                                                                                                                                                                                                                                                                         |                         |                                    |     |                             |                     |
|                        | CLO-4                                                       | Able to make decisions and make reports based on the resulting geoid model.                                                                                                                                                                                                                                                                                                                                                                                                                                  |                         |                                    |     |                             |                     |
|                        |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                         |                                    |     |                             |                     |

|                           |                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                        |      |       |       |       |  |   |       |  |   |       |  |   |       |   |  |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|-------|-------|--|---|-------|--|---|-------|--|---|-------|---|--|
|                           |                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                        |      |       |       |       |  |   |       |  |   |       |  |   |       |   |  |
|                           |                                                                                                                                                                                                                                                                                                         | <b>Matrix ELO – CLO</b> <table> <tr> <td>CPMK</td><td>ELO-2</td><td>ELO-6</td></tr> <tr> <td>CLO-1</td><td></td><td>V</td></tr> <tr> <td>CLO-2</td><td></td><td>V</td></tr> <tr> <td>CLO-3</td><td></td><td>V</td></tr> <tr> <td>CLO-4</td><td>V</td><td></td></tr> </table>                                                                                           | CPMK | ELO-2 | ELO-6 | CLO-1 |  | V | CLO-2 |  | V | CLO-3 |  | V | CLO-4 | V |  |
| CPMK                      | ELO-2                                                                                                                                                                                                                                                                                                   | ELO-6                                                                                                                                                                                                                                                                                                                                                                  |      |       |       |       |  |   |       |  |   |       |  |   |       |   |  |
| CLO-1                     |                                                                                                                                                                                                                                                                                                         | V                                                                                                                                                                                                                                                                                                                                                                      |      |       |       |       |  |   |       |  |   |       |  |   |       |   |  |
| CLO-2                     |                                                                                                                                                                                                                                                                                                         | V                                                                                                                                                                                                                                                                                                                                                                      |      |       |       |       |  |   |       |  |   |       |  |   |       |   |  |
| CLO-3                     |                                                                                                                                                                                                                                                                                                         | V                                                                                                                                                                                                                                                                                                                                                                      |      |       |       |       |  |   |       |  |   |       |  |   |       |   |  |
| CLO-4                     | V                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                        |      |       |       |       |  |   |       |  |   |       |  |   |       |   |  |
| <b>Course Description</b> | This course studies the modeling of the shape and size of the Earth (Geoid) using gravity data with various methods                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                        |      |       |       |       |  |   |       |  |   |       |  |   |       |   |  |
| <b>Course Materials</b>   | <ol style="list-style-type: none"> <li>1. The concept of gravity</li> <li>2. Source of gravity data</li> <li>3. Dedicated gravity satellite mission</li> <li>4. Global Geoid Model</li> <li>5. Gravimetric geoid</li> <li>6. Methods of geoid modeling</li> <li>7. Validation of geoid model</li> </ol> |                                                                                                                                                                                                                                                                                                                                                                        |      |       |       |       |  |   |       |  |   |       |  |   |       |   |  |
| <b>References</b>         | <b>Main:</b>                                                                                                                                                                                                                                                                                            | <ol style="list-style-type: none"> <li>1. Heiskanen, W.A. and H. Moritz. 1967. Physical Geodesy. Freeman, San Fransisco.</li> <li>2. Vanicek, P. and E.J. Krakiwsky.1986. Geodesy: the Concepts. 2nd ed. Amsterdam: Elsevier</li> <li>3. Torge, W. 1989. Gravimetry. de Gruyter, Berlin.</li> <li>4. Chuji Tsuboi. 1979. Gravity, Allen &amp; Unwin, London</li> </ol> |      |       |       |       |  |   |       |  |   |       |  |   |       |   |  |
|                           | <b>Additional :</b>                                                                                                                                                                                                                                                                                     | <ol style="list-style-type: none"> <li>1. E-learning Geoid Modelling (share.its.ac.id)</li> <li>2. Related journals, such as: <ul style="list-style-type: none"> <li>- Journal of Geodesy</li> <li>- Geophysical Journal International</li> <li>- Geophysical Reseach Letters</li> <li>- Journal of Geodynamics</li> <li>- Dll.</li> </ul> </li> </ol>                 |      |       |       |       |  |   |       |  |   |       |  |   |       |   |  |
| <b>Lecturer</b>           | 1. Ira Mutiara Anjasmara, S.T., M.Phil., Ph.D.                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                        |      |       |       |       |  |   |       |  |   |       |  |   |       |   |  |
| <b>Prerequisite</b>       | Physical Geodesy                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                        |      |       |       |       |  |   |       |  |   |       |  |   |       |   |  |

| Class/<br>Week | Lesson Learning Outcome<br>(Sub-CLO)                                                                                                    | Evaluation |                                                                                               | Forms of Learning, Learning methods, Student<br>Assignments/Task,<br>[ Estimated Time ] |        | Learning Materials<br>[ References ] | Weight<br>(%) |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------|------------|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|--------|--------------------------------------|---------------|
|                |                                                                                                                                         | Indicators | Criteria and Form                                                                             | Offline                                                                                 | Online |                                      |               |
| (1)            | (2)                                                                                                                                     | (3)        | (4)                                                                                           | (5)                                                                                     | (6)    | (7)                                  | (8)           |
| 1              | Review of Geodesy science Earth's gravity concept in the geoid modeling                                                                 |            | 1. Completeness of the material<br>2. Depth of explanation and effectiveness of communication | 1. Lecture [1 x 50']<br>2. Discussion [1 x 50']                                         |        | •                                    | 10            |
| 2 – 3          | Terrestrial gravity Marine gravity Airborne gravity Altimetry satellite system Gravity dedicated satellite mission (CHAMP, GRACE, GOCE) | 1.         | 1. Completeness of the material<br>2. Depth of explanation and effectiveness of communication | 1. Lecture [2 x 50']<br>2. Discussion [1 x 50']<br>3. Task [1 x 50']                    |        |                                      | 20            |
| 4 – 5          | Geoid determination from gravity data Global geoid models - Static Model - Temporal Model - Topographic Gravity Field Model             | 1.         | 1. Completeness of the material<br>2. Depth of explanation and effectiveness of communication | 1. Lecture [2 x 50']<br>2. Discussion [2 x 50']                                         |        |                                      | 10            |
| 6 – 7          | Methods of geoid determination - Gravimetric geoid - Geometric geoid - Hybrid geoid                                                     | 1.         | 1. Completeness of the material<br>2. Depth of explanation and effectiveness of communication | 1. Lecture [2 x 50']<br>2. Discussion, Task [1 x 50']<br>3. Response/Exercise [1 x 50'] |        |                                      | 10            |
| 8              | Midterm Evaluation / Midterm Exam                                                                                                       |            |                                                                                               |                                                                                         |        |                                      | 50            |
| 9 – 10         | Stokes Integral Solution of Stokes Integral                                                                                             | 1.         | 1. Completeness of the material                                                               | 1. Lecture [2 x 50']<br>2. Discussion, Task [1 x 50']<br>3. Response [1 x 50']          |        |                                      | 20            |

|                |                                                                               |    |                                                                                               |                                                                                         |  |  |            |
|----------------|-------------------------------------------------------------------------------|----|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|--|--|------------|
|                |                                                                               |    | 2. Depth of explanation and effectiveness of communication                                    |                                                                                         |  |  |            |
| <b>11 – 13</b> | Direct numerical integration Fast Fourier Transform Least-squares Collocation | 1. | 1. Completeness of the material<br>2. Depth of explanation and effectiveness of communication | 1. Lecture [2 x 50']<br>2. Discussion, Task [1 x 50']<br>3. Response/exercise [1 x 50'] |  |  | 20         |
| <b>14 – 15</b> | Geoid model validation                                                        | 1. | 1. Completeness of the material<br>2. Depth of explanation and effectiveness of communication | 1. Lecture [2 x 50']<br>2. Discussion, Task [1 x 50']<br>3. Response/exercise [1 x 50'] |  |  | 10         |
| <b>16</b>      | <b>Final Semester Evaluation / Final Semester Examination</b>                 |    |                                                                                               |                                                                                         |  |  | <b>100</b> |