# **30552 Satellite Geodesy – E20 – course plan**

Lecture room: 044 in building 116

Teachers: Anna Jensen (AJ) [aboj@space.dtu.dk](mailto:aboj@space.dtu.dk) and Ole Baltazar Andersen (OA) [oa@space.dtu.dk](mailto:oa@space.dtu.dk)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Date | Lecture | Topic | Reading | Assignments | Report/  presentation due | Teacher |
| 31.08.2020 | 1 | Course introduction, geodetic coordinate and time systems | GS pp. 1-42 | 1. Transformation of positions between geodetic coordinate systems using Matlab | 20.09.2020 | AJ |
| 07.09.2020 | 2 | Satellite orbits and Kepler elements | GS pp. 62-82  + 121-122 + 222-229 | 2. Compute GPS satellite positions from Kepler elements, theoretically and with real data. Use Matlab | 20.09.2020 | AJ |
| 14.09.2020 | 3 | Satellite perturbations and orbit determination | GS pp. 82-134 | 2. Continued | 20.09.2020 | AJ |
| 21.09.2020 | 4 | Observation concepts used in satellite geodesy | GS pp. 135-160  + 161-210 cursory | 3. Characterize and describe a geodetic mission / satellite | 28.09.2020 | AJ |
| 28.09.2020 | 5 | Reference frame realization | GS pp. 485-499  + 506-513 + 527-537 | 3. Present the mission/satellite for the class. Presentation must be 10 minutes | 28.09.2020 | AJ |
| 05.10.2020 | 6 | Global navigation satellite systems (GNSS) | GS pp. 211-222 + 234-243 + 252-276 + 297-324 | 4. Estimate position from GNSS code observations and  apply models for atmospheric effects. Use Matlab | 25.10.2020 | AJ |
| Autumn vacation | | | | | | |
| 19.10.2020 | 7 | Atmospheric effects in satellite geodesy | GS pp. 42-62  + MatCampusnet | 4. Continued | 25.10.2020 | AJ |
| 26.10.2020 | 8 | Satellite radar altimetry – technology and theory | GS pp. 443-459  + MatCampusnet | 5. Part 1: Waveform analysis.  Range precision and accuracy exercises | 15.11.2020 | OA |
| 02.11.2020 | 9 | The Shape of the Earth – Global MSS and gravity field models | GS pp. 460-468,  GS pp. 519-523  + MatCampusnet | 5. Part 2: Mean sea surface, geoid and gravity | 15.11.2020 | OA |
| 09.11.2020 | 10 | The changing shape of the Earth –  Sea level change, Vertical Land Movement and ocean tides | MatCampusnet | 6. Alias periods, relative/absolute sea level, and sea level change | 15.11.2020 | OA |
| 16.11.2020 | 11 | Advanced Satellite altimetry  SAR, SAR-in, FF-SAR IceSat-2 & SWOT) | MatCampusnet: Coastal Altimetry (536-554) | 7. Part 1. Waveform analysis. Bathymetry  Altimetry for hydrology and cryosphere studies. | 06.12.2020 | OA |
| 23.11.2020 | 12 | Satellite gravimetry, principles: High-Low, Low-Low, and gradiometry. Mass changes from GRACE. | GS pp. 469-484  MatCampusnet | 7. Part 2. Analyze mass changes from GRACE | 06.12.2020 | OA |
| 30.11.2020 | 13 | Putting Space Geodesy together -sea level changes explained.  Geodynamic changes with GNSS+(IR) | MatCampusnet | Closing the sea level budget.  Course evaluation. | 06.12.2020 | OA |

**Litterature:**

Course book: Günter Seeber (GS): Satellite Geodesy, 2nd edition, de Gruyter, 2003. It is available both a e-book and paper-book.

MatCampusnet: The course book will be supplemented by other material. This material will be upload to Campusnet one week ahead of the lectures.

This is mainly articles and chapters from other books as technology has Space Geodesy Technology has advances dramatically since 2003 when GS was published.

**Assignments and marks:**

The assignment descriptions become available in CampusNet during the term.

All assignments will be marked and the final mark for the course is the average of the marks for the assignments where the mark for Assignment 3 is weighted double.

Assignments 1, 2, 4, 5, 6, 7 shall result in a lab report to be handed in through CampusNet. We expect the lab reports to be short e.g. five pages. The reports should describe the purpose or the problem to be solved, solutions chosen, results obtained and answers to questions that may be provided in the assignment text. In the reports it is important to document the work you have done e.g. by referring to Matlab scripts which should be submitted separately (so the teacher can run the scripts).

It is allowed to work together with fellow students on the assignments, but the reports must be made individually.

Students who hand in labs by the due dates listed above, will receive brief feedback during the term. If the labs are not handed in by the due date, the final deadline is by the end of the term i.e. by 22.12.2020. Students handing in lab reports by the end of the term will receive a mark for the reports but no further feedback.

Assignment 3 shall result in a 10-minute presentation for the class. The mark is given for the presentation including both the content and the way it is presented. Slides must be handed in through CampusNet.

/ Ole and Anna, August xx 2020