

## Course plan

### AH2923 - Global Navigation Satellite Systems - VT 2020

	Date	Start time	End time	Room	Topic	Reading
F1	16.03	10	12	Hjärne	Course introduction, introduction to GPS, basic principle for positioning, selected applications	GNSS: p. 1-12 + 309-340
F2	19.03	10	12	Hjärne	Reference systems, reference ellipsoid, N,E,U, azimuth and elevation angle, time systems	GNSS: p. 13-25 + 277-302
L1	19.03	13	16	M102	Implement geodetic tools: (lat, lon, height) <-> (X, Y, Z), (X,Y,Z) <-> (N,E,U), azimuth, elevation angle and distance	Combined report from L1 and L2 due: 30.03.2020
F3	23.03	10	12	Hjärne	Satellite orbits, Kepler elements, perturbations, broadcast ephemeris, precise orbits	GNSS: 27-53
L2	23.03	13	16	M102	Compute satellite position from broadcast ephemerids	Combined report from L1 and L2 due: 30.03.2020
F4	26.03	10	12	Hjärne	Absolute positioning, least squares adjustment, DOP	GNSS: p. 161-165 + 238-241 + 250-257 + 262-276
F5	06.04	10	12	Hjärne	GNSS signals, code and carrier phase, signal propagation, ionosphere, troposphere	GNSS: p.55-68 + 105-140
L3	06.04	13	16	M102	Implement atmospheric models	Combined report from L3 and L4 due: 20.04.2020
F6	09.04	10	12	M35	Multipath, other error sources, error budget and mitigations, observation equations	GNSS: p.141-160 M&E: p. 174-188
L4	09.04	13	16	M102	Compute receiver position from pseudorange	Combined report from L3 and L4 due: 20.04.2020
F7	20.04	10	12	Hjärne	Relative positioning, carrier phase based positioning, ambiguity resolution, cycle slip detection and correction	GNSS: p. 173-183 + 193-237
F8	23.04	10	12	Hjärne	Static and kinematic positioning, RTK, planning Applications	GNSS: p. 183-191 + 460-466
L5	23.04	13	16		Compute receiver position from code and phase data	Combined report from L5 and L6 due: 07.05.2020

F9	27.04	10	12	Hjärne	DGPS, WADGPS, Kalman filtering and smoothing	GNSS: p. 169-173 + 241-250
L6	27.04	13	16		Compute ambiguity resolution	Combined report from L5 and L6 due: 07.05.2020
F10	07.05	10	12	Hjärne	GLONASS, Galileo, Beidou, regional systems GNSS future development	GNSS: p. 341-430
L7	07.05	13	16	M102	Kalman filter	Combined report from L7 and L8 due: 18.05.2020
	11.05	13	16		No teaching	
F11	14.05	10	12	Hjärne	GNSS data processing. Discussion of journal papers, sustainability and ethical aspects of GNSS. M.Sc. project ideas, discussion before exam	Journal papers
L8	14.05	13	16	M102	Compute GNSS positions with data from an outside lab from a previous year	Report from L7 and L8 due: 18.05.2020
F12	18.05	10	12	Hjärne	Reserved time	-

#### Teachers:

Amin Alizadeh-Khameneh will teach the first two weeks, Anna B. O. Jensen will teach the remaining part of the course. Change of teacher is marked by the bold line in course plan above.

#### Reading references:

GNSS – Global Navigation Satellite Systems by Hofmann-Wellenhof, Lichtenegger, and Wasle. Springer Verlag 2008.

M&E - Global Positioning System, Signals, Measurements and Performance by Misra and Enge. Ganga-Jamuna Press 2006 (14 pages provided by teacher)

#### Passing the course:

- To pass the course the student must pass the written examination (TEN1; 4.5c) and be approved on all labs (LAB1;3c)

#### Grades:

Students who have completed all lab reports in due time (ref. to the due dates in the table above) achieve a bonus of 10% of points at the examination. The bonus will not apply in a re-examination.

Written exam: Monday, May 28<sup>th</sup> 2020 @ 14:00 – 18:00 in room E51