

## Appendix: Curriculum for Double Degree Agreement between Wuhan University (WHU) and the Technische Universität München (TUM)

### Wuhan University Master's program:

- Schools of Resources and Environmental Science
- School of Urban Design
- School of Geodesy and Geomatics
- School of Remote Sensing and Information Engineering
- State Key Lab of Information Engineering in Surveying, Mapping and Remote Sensing

### Technische Universität München Master's program

- Earth Oriented Space Science and Technology (ESPACE)

As explained in the Agreement on the Double Master's program between the Technische Universität München and Wuhan University, the double degree Master's program is comprised of six semesters over three years. The students should spend the first year at their home university. At least one year of studies should be spent at the host university.

For the double degree Master's program, three different curricula are scheduled. **Two curricula (Curriculum 1a and Curriculum 1b)** are intended for WHU students going to the TUM. **One curriculum (Curriculum 2)** is intended for TUM students going to WHU.

Curriculum 1a		Curriculum 1b		Curriculum 2	
3rd year	Co-supervised Master's Thesis	3rd year	Co-supervised Master's Thesis	3rd year	Co-supervised Master's Thesis
	TUM		WHU		TUM
2nd year	TUM	2nd year	TUM	2nd year	WHU
1st year	WHU	1st year	WHU	1st year	TUM

Fig. 1) Curricula 1a and 1b: for WHU students going to the TUM  
Curriculum 2: for TUM students going to WHU

## General information regarding both universities

### Study year:

Study year at WHU starts in the summer term:

Summer term: September-January

Winter term: February – July

Vacation between the terms starts in July and lasts two months.

Study year at TUM starts in the winter term:

Winter term (lectures and exams): mid-October – beginning of March

Summer term (lectures and exams): mid-April – mid-August

### Credits:

**WHU:** To obtain a Master's degree, the students are required to earn 34 credits in the Wuhan University Credit System (of which at least 28 are for degree courses and 6 are for elective courses). Further, a written thesis must be submitted and be defended in a colloquium. At WHU, there is no fixed amount of credits that needs to be obtained for each semester. If the students select more courses, they can earn more credits. One credit in the Wuhan University Credits System corresponds to 18 hours of classes.

**TUM:** Full-time study at the TUM is equivalent to 30 credits in the European Credits Transfer System (ECTS) per semester (one year equals 60 credits). To obtain a Master's degree, students are required to earn 120 ECTS credits. Of this, 90 credits have to be obtained from courses. Further, students are awarded 30 credits for submitting a written thesis and defending it in a colloquium. The amount of ECTS credits awarded for a single course corresponds to the workload of the students. Thereby 1 credit means a workload of 15 hours. Workload time consists of the time spent in lectures, self-study time during the term and before the exams, and time spent working on a project or a lab. The total workload of a student is 40 hours per week. One semester is equivalent to 22.5 weeks.

The scaling factor is 0.37 for the conversion of Wuhan University Credits System into the ECTS, that is:

1 WHU credit = 0.37 ECTS credits

1 ECTS credit = 2.7 WHU credits

### Grading scale:

TUM grades are awarded on a scale from 1.0 (best) to 5.0 (worst). Grades for individual exams are given in the increments 1.0, 1.3, 1.7, 2.0... 4.7, 5.0. The grading scale is expressed as follows:

WHU has two grading systems. Most courses are graded A, B,..., F. A few courses are graded P(Pass) or F(Failure).

WHU	TUM	Definition
A (90-100)	1.0, 1.3	Very Good
B (80-89)	1.7, 2.0, 2.3	Good
C (70-79)	2.7, 3.0, 3.3	Satisfactory
D (60-69)	3.7, 4.0	Sufficient
F (0-59)	4.3, 4.7, 5.0	Fail

## Curriculum 1a and Curriculum 1b for WHU students going to the TUM

	Wuhan University Credits System	ECTS Credits (European Credits Transfer System)
<b>1<sup>st</sup> Semester (Wuhan University)</b>		
Scientific Socialism Theory and Practise	2	
Natural Dialectics	2	
Public English	2	
Principle of Photogrammetry	2	
Advanced Remote Sensing	2	
Advanced Cartography	2	
Advanced Geographical Information Technology	2	
<b>Total:</b>	<b>14</b>	
<b>2<sup>nd</sup> Semester (Wuhan University)</b>		
Spoken English and paper writing	3	
Generalized Adjustment	2	
Image Processing and Analysis	3	
Advanced Photogrammetry	2	
Spatial Database Management	3	
Digital Terrain Modeling: Principles and Methodology	2	
<b>Total:</b>	<b>15</b>	
<b>3<sup>rd</sup> Semester (Technische Universität München)</b>		
Introduction to Earth System Science		6
Introduction to Satellite Navigation		4
Spacecraft Technology 1		4
Orbit Mechanics 1		3
Numerical Modeling		6
Signal Processing		4
Information Technology 1		3
<b>Total:</b>		<b>30</b>
<b>4<sup>th</sup> Semester (Technische Universität München)</b>		
Orbit Mechanics 2		3
Spacecraft Technology 2		4
Orbit and Attitude Control		3
Estimation Theory		3
Electrodynamics		3
Information Technology 2		3
Seminar		3
Elective modules from the Master's programs Transportation Systems or Environmental Engineering*		8
<b>Total:</b>		<b>30</b>

**5<sup>th</sup> semester – optionally at TUM (Curriculum 1a) or at WHU (Curriculum 1b)**

<b>Curriculum 1a:</b> <b>WHU students studying 5<sup>th</sup> semester at TUM</b> Students need to do 6 credits of required courses and 24 credits of elective courses.	<b>Wuhan University Credits System</b>	<b>ECTS Credits (European Credits Transfer System)</b>
<b>Required courses</b>		
Ground and User Segment		3
Project		3
<b>Elective courses</b> Students need to do 24 credits of elective courses. Each student has to choose one of the three specializations <i>Earth System Science from Space</i> , <i>Remote Sensing</i> , or <i>Navigation</i> (18 credits) and in addition one single course from the remaining specializations (6 credits).		
<b>Specialization (Earth System Science from Space)</b>		
Atmosphere and Ocean		6
Earth System Dynamics		6
Earth Observation Satellites		6
<b>Specialization (Remote Sensing)</b>		
Photogrammetry		6
Remote Sensing		6
Geo-Information		6
<b>Specialization (Navigation)</b>		
Precise GNSS		6
Advanced Aspects of Navigation Technology		6
Navigation Labs		6
<b>Total:</b>		<b>30</b>

<b>Curriculum 1b:</b> <b>WHU students studying 5<sup>th</sup> semester at WHU</b> Students do need not to do any specific course, but are required to finish thesis proposal, to attend seminars and to do project R&D in one of the three specializations of Remote Sensing, Geospatial Information System and Geodesy	<b>Wuhan University Credits System</b>	<b>ECTS Credits (European Credits Transfer System)</b>
<b>Specialization offered by Wuhan University:</b>		
Thesis proposal (literature review and plan)	-	<b>8</b>
Attending at least 10 academic seminars or workshops	-	<b>5</b>
Project algorithm design and coding , experimental analysis	-	<b>17</b>
<b>Total:</b>		<b>30</b>

<b>6<sup>th</sup> semester:</b> <b>Master's Thesis at one of the Universities according to the student's choice.</b>	<b>Wuhan University Credits System</b>	<b>ECTS Credits (European Credits Transfer System)</b>
Master's Thesis	-	24
Master's Colloquium	-	6
<b>Total</b>	<b>-</b>	<b>30</b>

## Curriculum 2 for TUM students going to WHU

	Wuhan University Credits System	ECTS Credits (European Credits Transfer System)
<b>1<sup>st</sup> Semester (TUM)</b>		
Introduction to Earth System Science		6
Introduction to Satellite Navigation		4
Spacecraft Technology 1		4
Orbit Mechanics 1		3
Numerical Modeling		6
Signal Processing		4
Information Technology 1		3
<b>Total:</b>		<b>30</b>
<b>2<sup>nd</sup> Semester (TUM)</b>		
Introduction to Photogrammetry, Remote Sensing and GIS		6
Image Processing		2
Orbit Mechanics 2		3
Spacecraft Technology 2		4
Orbit and Attitude Control		3
Estimation Theory		3
Electrodynamics		3
Information Technology 2		3
Seminar		3
<b>Total:</b>		<b>30</b>
<b>3<sup>rd</sup> Semester (WHU)</b>		
Geodynamics	2	
Integrated navigation	2	
GIS design and applications	2	
Principle of Photogrammetry	2	
Advanced Remote Sensing	2	
Advanced Cartography	2	
Advanced Geographical Information Technology	2	
<b>Total:</b>	14	
<b>4<sup>th</sup> Semester (WHU)</b>		
Students need to do 10 credits of elective courses according to specializations, as well as to join related projects as seminar.		
<b>Seminar</b>	<b>3</b>	
<b>Specialization (Navigation)</b>		
Spatial geodesy	2	
Generalized Adjustment	2	
Advanced physical geodesy	2	
Satellite navigation and positioning technology	2	
Error processing and reliability theory	2	
<b>Total:</b>	13	
<b>Specialization (Remote Sensing)</b>		
Advanced Digital Photogrammetric Technology	2	
Digital Terrain Modeling: Principles and Methodology	2	
Remote Sensing Image Analysis and Applications	2	
Microwave Remote Sensing	2	
	2	
<b>Total:</b>	13	
<b>Specialization (GIS)</b>		
Map Generalization and Applications	2	

Spatial Database Management	2	
Geospatial Information Service Technology	2	
GIS for Transportation	2	
Planning Support System	2	
<b>Total:</b>	13	

<b>5<sup>th</sup> semester (TUM)</b> Students need to do 6 credits of required courses and 24 credits of elective courses.	<b>Wuhan University Credits System</b>	<b>ECTS Credits (European Credits Transfer System)</b>
<b>Required courses</b>		
Ground and User Segment		3
Project		3
<b>Elective courses</b> Students need to do 24 credits of elective courses. Each student has to choose one of the three specializations <i>Earth System Science from Space</i> , or <i>Navigation</i> , or <i>Remote Sensing</i> (18 credits) and in addition one single course from the remaining specializations (6 credits).		
<b>Specialization (Earth System Science from Space)</b>		
Atmosphere and Ocean		6
Earth System Dynamics		6
Earth Observation Satellites		6
<b>Specialization (Navigation)</b>		
Precise GNSS		6
Advanced Aspects of Navigation Technology		6
Navigation Labs		6
<b>Specialization (Remote Sensing)</b>		
Photogrammetry		6
Remote Sensing		6
Geo-Information		6
<b>Total:</b>		<b>30</b>

<b>6<sup>th</sup> semester:</b> <b>Master's Thesis at one of the Universities according to the student's choice.</b>	<b>Wuhan University Credits System</b>	<b>ECTS Credits (European Credits Transfer System)</b>
Master's Thesis	-	24
Master's Colloquium	-	6
<b>Total</b>	-	<b>30</b>

### Master's Thesis

(1) The Master's Thesis is co-supervised by one teacher from WHU and one teacher from the TUM.

(2) A status report written in English must be submitted to both co-supervisors after three months. The status report must provide a summary of the work that has already been done and give an outlook on the anticipated outcome together with a schedule for the time until submission.

- (3) The Master's Thesis must be written in English.
- (4) The final grade is averaged from the individual grades of both supervisors.
- (5) The Master's Thesis must be defended in a Master's Colloquium at one of the universities.