

# Curriculum Vitae | Stipo Sentic

## Personal information

Affiliation Department of Civil Engineering and Geological Sciences, College of Engineering, University of Notre Dame du Lac  
Address Department of Civil Engineering and Geological Sciences  
Notre Dame, IN 46556  
Telephone (574) 631-1833  
Cellphone (781) 568-0177  
Fax (574) 631-9236  
Email [ssentic@nd.edu](mailto:ssentic@nd.edu)  
Nationality Croatian  
Date of birth February 18, 1986  
Gender Male

## Research interests

Nonlinear dynamics and turbulence, boundary layer meteorology, numerical weather prediction

## Professional experience

Dates 2010/08 – present  
Position held Research Assistant  
Main activities and responsibilities Chicago heat island analysis and modeling (using GIS and the WRF-ARW model), wind turbine - atmosphere coupling (using the WRF/ARW model)  
Name and address of employer Fernando, J. H. (address same as the applicant)

Dates 2010/08 – present  
Position held Teaching Assistant  
Main activities and responsibilities Grading homework, classroom demonstrations and office hours  
Name and address of employer Kennedy, A., Bolster, D. (address same as the applicant)

## Education and training

Dates 2010/08 – present  
Degree desired Ph.D.  
Principal subject/skills Environmental Fluid Dynamics  
Name and type of organization providing education Department of Civil Engineering and Geological Sciences, College of Engineering, University of Notre Dame du Lac

Dates 2008/09 - 2010/07  
Degree awarded Master of Science in Physics – Geophysics  
Principal subjects/skills Meteorology and Physical Oceanography  
Average grade 4.684 (on 1 to 5 scale)  
Name and type of organization providing education Department of Geophysics, Faculty of Science, University of Zagreb, Croatia

Dates 2005/10 - 2008/09  
Degree awarded Bachelor of Science in Geophysics  
Principal subjects/skills Meteorology and Physical Oceanography  
Average grade 4.556 (on 1 to 5 scale)  
Name and type of organization providing education Department of Geophysics, Faculty of Science, University of Zagreb, Croatia

<b>Awards and achievements</b>	
Awards	
2010	Received the Deans Award for the best student in his generation in the Department of Geophysics for the academic year 2009/2010
Stipends	
2009-2010	Stipend for the top 100 students of the University of Zagreb, Croatia
2005-2009	Stipend of the town Metkovic (applicants home town), Croatia
<b>Professional societies memberships</b>	
2011-present	Croatian Meteorological Society
<b>Personal skills and competencies</b>	
Principal language	Croatian
Other languages understand/speak/write	English (understands excellent, speaks excellent, writes excellent), German (understands good, speaks proficient, writes proficient)
Social skills	Communicative, cordial, works well under pressure both in teams and individually
Organizational skills	
2011	Help in organization: NATO Advanced Research Workshop, Climate Change, Human Health and National Security
2010	Help in organization: 2010 University of Zagreb College fair in Zagreb, Croatia
Technical skills	
2010	Field experiment in geomagnetic measurements
2010	Participation in the College Fair by building a 'Tornado machine'
2009	Participation in the College Fair
Computer skills	Advanced programming in Fortran 90, excellent in Matlab and Mathematica, operational knowledge in MS Windows and Linux operating systems
<b>Papers</b>	
In review	Verbanac, G., Manda, M., Vrsnak, B., Sentic, S.: Evolution of solar and geomagnetic activity indices, and their relationship: 1960-2001, Journal of Atmospheric and Solar-Terrestrial Physics
Master degree thesis	Sentic, S., 2010: A new parameterization of the atmospheric surface layer in the WRF model (in Croatian, abstract in English attached)
<b>Workshops and summer schools</b>	
Workshops	
2008/08	High performance computing on Grid for meteorological applications, Zagreb, Croatia (2 days)
2010/05	Second Split Workshop in Atmospheric Physics and Oceanography, Split, Croatia (1 week), prominent lecturers included: David Raymond, Kerry Emanuel, Roger Smith, Alan Betts, etc. ( <a href="http://fizika.pmfst.hr/SSWAP/">http://fizika.pmfst.hr/SSWAP/</a> )
Summer schools	
2009/08	Physics of the Climate System, Utrecht, Netherlands (2 weeks)

**Additional information** | Spare time activities: hiking, tai chi chuan, fencing, art and design, philosophy, theatre

**Attachments** (in chronological order)  
Current transcript summary  
Master degree thesis abstract in English  
Certificate of graduation (official diploma still not received due to administrative delays)  
Certificate of Second Split Workshop in Atmospheric Physics and Oceanography attendance  
Certificate of Utrecht summer school attendance  
Bachelor degree diploma and supplement

## **Transcript summary**

Course level: Graduate

Program: PhD – Civil Engineering and Geological Sciences

College: College of Engineering

Major: Civil Engineering and Geological Sciences

### **Fall Semester 2010**

Numerical Methods (credits: 3, grade: A)

Advanced Fluid Dynamics (credits: 3, grade: A)

Intro to Coastal Oceanography (credits: 3, grade: A)

Environmental Fluid Dynamics Seminar (credits: 1, grade: S)

Research and Dissertation (credits: 2, grade: S)

Total Credits: 12

GPA credits: 9

GPA: 4.000

### **Spring Semester 2011**

IN PROGRESS WORK

Computational Fluid Mechanics (IN PROGRESS)

Finite Elements in Engineering (IN PROGRESS)

Water waves I (IN PROGRESS, auditing)

Fundamentals of Turbulence (IN PROGRESS)

Environmental Fluid Dynamics Practicum (IN PROGRESS)

Environmental Fluid Dynamics Seminar (IN PROGRESS)

Research and Dissertation (IN PROGRESS)

Total Credits: 15

## Master degree thesis abstract in English

**Title:** A new parameterization of the atmospheric surface layer in the WRF model

**Mentor:** Grisogono, Branko

**Keywords:** katabatic flow, parameterization, Monin-Obukhov length, WRF model

**Abstract:** On mildly sloped stably stratified boundary layers katabatic flow occurs (Parmhed et al.), i.e. the flow of air down a hill. The use of the Monin-Obukhov length,  $L$ , which is used in parameterizing surface turbulent fluxes, is not justified because the assumption of horizontal homogeneity, one of the assumptions the length scale has been derived with, is violated. Grisogono and Zovko Rajak (2009) have pragmatically applied the assumption that the low level jet, which arises in katabatic flows, is more appropriate for scaling surface turbulent fluxes. They proposed a modified form of the Monin-Obukhov length:  $L_{mod} = \max(L, C \cdot z_j)$ , where  $C$  is a constant acquired from measurements from the Pasterze glacier in Austria (Smeets et al.), and  $z_j$  is the height of the low level jet. The modified length  $L_{mod}$  was applied to the mildly sloped stably stratified boundary layer in the atmospheric numerical research model WRF. The acquired numerical solutions were compared with a simple analytical model for katabatic flow. By analyzing and comparing the numerical and analytical model for terrains of different slopes it was concluded that the modified Monin-Obukhov length  $L_{mod}$  more adequately scales surface turbulent fluxes of heat and impulse in the case of a coarse vertical grid resolution. For very fine vertical grid resolutions neither the original nor the modified Monin-Obukhov lengths have considerable impact on the flow: then the model uses the local mixing scale for parameterizing surface turbulent fluxes of heat and impulse.

### Chosen references:

- [1] Grisogono, B., D. Zovko Rajak, 2009, *Assessment of Monin-Obukhov scaling over small slopes*, Geofizika, 26, 101-108.
- [2] Parmhed, O., J. Oerlemans and B. Grisogono, 2004, *Describing the surface fluxes in the katabatic flow on Breidamerkurjokull, Iceland*, Quart. J. Roy. Meteorol. Soc., 130, 1137-1151.
- [3] Smeets, C., J., P., P., P. G. Duynkerke and H. F. Vugts, 1998, *Turbulence characteristics of stable boundary layer over a mid-latitude glacier. Part I: A combination of katabatic and large-scale forcing*, Boundary-Layer Meteorol., 87, 117-145.



Republic of Croatia  
University of Zagreb  
Faculty of Science

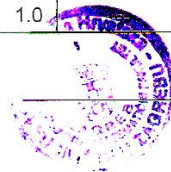
Zagreb, January 28<sup>th</sup>, 2011  
Number: 0128042412-64

Upon the paragraph 159 of the General procedure act this Faculty issues the following

## CERTIFICATE

Mr. **Stipo Sentić**, born on February 18<sup>th</sup>, 1986 in Zenica, Bosnia and Herzegovina, graduate of the Faculty of Science, study of **Physics - Geophysics** in duration of 4 semesters, in the module: **Meteorology and physical oceanography**, passed examinations and completed exercises in the following subjects:

	Subject	Total hours		ECTS credits	Date of examination	Grade	Remark
		Lectures	Exercises				
1.	Seismology III	30	15	5.0	06/29/2009	5 (excellent)	--
2.	Climatology I	30	15	5.0	02/13/2009	5 (excellent)	--
3.	Dynamic Meteorology II	30	30	6.0	02/23/2009	4 (very good)	--
4.	Numerical Methods in Physics	30	30	6.0	---	---	**
5.	Selected Chapters of Seismology	30	15	4.0	02/26/2009	5 (excellent)	--
6.	Planetology	30	15	4.0	06/30/2009	5 (excellent)	--
7.	Numerical Methods in Physics	30	30	6.0	09/29/2009	4 (very good)	--
8.	Dynamic Meteorology III	45	30	6.0	07/03/2009	5 (excellent)	--
9.	Climatology II	30	15	5.0	07/03/2009	5 (excellent)	--
10.	Meteorological Practicum	15	30	4.0	07/06/2009	5 (excellent)	--
11.	Dynamics of Coastal Sea	30	15	5.0	09/09/2009	4 (very good)	--
12.	Statistical Physics	30	15	4.0	06/24/2009	5 (excellent)	--
13.	Geomagnetism and Aeronomy I	45	15	4.0	05/04/2010	4 (very good)	--
14.	Geophysical Seminar	0	15	2.0	---	---	**
15.	Climatology III	30	30	4.0	04/29/2010	5 (excellent)	--
16.	Weather Analysis and Forecasting I	30	15	3.0	07/01/2010	4 (very good)	--
17.	Diploma Thesis	0	120	0.0	---	---	**
18.	Seminar in Dynamic Meteorology	0	15	3.0	---	---	**
19.	Physical Meteorology I	30	15	4.0	02/23/2010	5 (excellent)	--
20.	Geomagnetism and Aeronomy II	30	15	4.0	07/01/2010	5 (excellent)	--
21.	Geophysical Seminar	0	15	1.0	---	---	**



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Republic of Croatia  
University of Zagreb  
Faculty of Science

Zagreb, January 28<sup>th</sup>, 2011  
Number: **0128042412-64**

	Subject	Total hours		ECTS credits	Date of examination	Grade	Remark
		Lectures	Exercises				
22.	Weather Analysis and Forecasting II	30	15	4.0	07/02/2010	4 (very good)	--
23.	Diploma Thesis	0	180	25.0	07/15/2010	5 (excellent)	--
24.	Seminar in Physical Oceanography	0	15	2.0	---	---	**
25.	Physical Meteorology II	30	15	4.0	07/01/2010	5 (excellent)	--

Total ECTS credits: 120.0

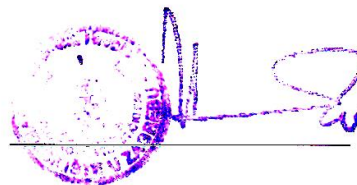
Remarks: \* Grade not counted towards GA

GA: 4.684 at 5.00 scale

\*\* Not graded

According to success shown in written graduate thesis work (excellent (5)), verbal graduate exam (excellent (5)) and according to general success during the whole period of studies, Stipo Sentić passed his GRADUATE EXAMINATION with 4.736 grade on July 15, 2010. On the basis of these facts, the Faculty of Science, Zagreb, confirms that, Stipo Sentić passed all prescribed exams and met all other formal requirements from the study of **Physics - Geophysics** in duration of 4 semesters, in the module: **Meteorology and physical oceanography**, and obtained the degree **Master of Science in Physics - Geophysics**, together with all other rights he is entitled pursuant to law.

This certificate is issued upon the personal request of the party as a **Enrollment regulations for the International Summer School** and it cannot be used for any other purpose.





# University of Split Faculty of Science



*Second Split Workshop in Atmospheric Physics and Oceanography*

## CERTIFICATE

*Name: Stipo Sentić*

### **Courses:**

*Alan K. Bett: Land-surface-atmosphere coupling*

*Kerry Emanuel: Hurricanes and Climate*

*Nicholas Hall: Modelling techniques for diagnosing large scale dynamical responses in the atmosphere*

*George Kiladis: The Madden-Julian oscillation and oceanic Kelvin waves*

*Darko Koraćin: Application of a Lagrangian stochastic dispersion model to forward and inverse air quality modeling*

*Zhiming Kuang: Large scale convectively coupled tropical transients*

*Stjepan Marčelja: Ocean heat content*

*Antonio Parodi: Spatial and temporal evolution of deep moist convective processes: the role of microphysics*

*David J. Raymond: Tropical cyclogenesis and gross moist stability*

*Roger Smith: Dynamics of heat lows*

*Adam Sobel: Highly idealized semiempirical MJO model*

*The student gave an independent presentation: Thermodynamic control of tropical rainfall*

*The student actively participated in the Split Workshop in Atmospheric Physics and Oceanography, and earned 5 ECTS.*

*Brač, May 2010*

*Workshop manager:*



**Dr. Željka Fuchs**





# Certificate

Name : S. Sentic  
Date of birth : 18-02-1986  
Country : Croatia

Courses	Credits
Core lectures on Physics of the Climate System	1,5
Research talks: - IPCC and climate change - Reactive organic compounds in the atmosphere - Nearshore sandbars - Simple models of the large-scale ocean circulation - Glaciers and climate change - Weather systems: characteristics and forecasting	0,5
Research project: - Dynamics of El Niño	1,0
Total	3,0

The student has actively participated in the USPC 2009.

Utrecht, August 2009

Course leader,

Prof.dr. W.P.M. de Ruijter







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OF CROATIA

REPUBLIC OF CROATIA  
UNIVERSITY OF ZAGREB  
FACULTY OF SCIENCE



UNIVERSITY  
OF ZAGREB



FACULTY  
OF SCIENCE

# DIPLOMA

STIPO SENTIĆ

Born on 18 February 1986, in Zenica, Bosnia And Herzegovina, having passed all of his exams and fulfilled all other academic requirements, has completed on 2 September 2008 the undergraduate course of study in GEOPHYSICS and earned the academic title of

BACHELOR OF SCIENCE

IN

GEOPHYSICS

as well as all the related rights to  
which he is entitled by law.

No. 2-08  
in Zagreb, 21 December 2009

DEAN

  
MLADEN JURAČIĆ, PH.D. PROF.







REPUBLIC  
OF CROATIA

REPUBLIC OF CROATIA  
UNIVERSITY OF ZAGREB  
FACULTY OF SCIENCE



UNIVERSITY  
OF ZAGREB

DIPLOMA SUPPLEMENT



FACULTY  
OF SCIENCE

This Diploma Supplement model was developed by the European Commission, Council of Europe and UNESCO/CEPES. The purpose of the supplement is to provide sufficient independent data to improve the international 'transparency' and fair academic and professional recognition of qualifications (diplomas, degrees, certificates etc.). It is designed to provide a description of the nature, level, context, content and status of the studies that were pursued and successfully completed by the individual named on the original qualification to which this supplement is appended. It should be free from any value judgements, equivalence statements or suggestions about recognition. Information in all eight sections should be provided. Where information is not provided, an explanation should give the reason why.

1	<b>INFORMATION IDENTIFYING THE HOLDER OF THE QUALIFICATION</b>	
1.1	<b>family name(s)</b>	Sentić
1.2	<b>given name(s)</b>	Stipo
1.3	<b>date, place and country of birth</b>	18 February 1986, Zenica, Bosnia And Herzegovina
1.4	<b>student identification number or code</b>	01280.42412
2	<b>INFORMATION IDENTIFYING THE QUALIFICATION</b>	
2.1	<b>name of qualification and (if applicable) title conferred (in original language)</b>	sveučilišni prvostupnik (baccalaureus) geofizike
2.2	<b>main field(s) of study for the qualification</b>	Bachelor of Geophysics
2.3	<b>name and status of awarding institution</b>	University of Zagreb, Faculty of Science Public higher education institution. Accreditation issued by the Ministry of Science, Education and Sports on October 7, 2004. Accreditation for the university undergraduate study programme in geophysics issued by the Ministry on June 21, 2005.
2.4	<b>name and status of institution (if different from above)</b>	University of Zagreb, Faculty of Science Public higher education institution. Accreditation issued by the Ministry of Science, Education and Sports on October 7, 2004. Accreditation for the university undergraduate study programme in geophysics issued by the Ministry on June 21, 2005.
2.5	<b>language(s) of instruction/examination</b>	Croatian
3	<b>INFORMATION ON THE LEVEL OF THE QUALIFICATION</b>	
3.1	<b>level of qualification</b>	Undergraduate university study programme (first cycle degree)
3.2	<b>official length of programme</b>	Three-years study programme, 180 ECTS credits
3.3	<b>access requirements(s)</b>	Four-year secondary school
4	<b>INFORMATION ON THE CONTENTS AND RESULTS GAINED</b>	
4.1	<b>mode of study</b>	Full-time study
4.2	<b>programme requirements</b>	The holders of the bachelor's degree in Geophysics achieve fundamental knowledge of the physical basis of geophysical disciplines, as well as skills needed for professional and technical tasks: performing measurements, maintenance and calibration of instruments, data acquisition and basic interpretation, routine analyses of geophysical data, data archiving and field work (e.g. macroseismic field work). Therefore they are qualified for praxis of fundamental professional and technical work in professional service providers (Croatian Meteorological and Hydrological Service, Croatian Seismological Survey, ...).
		The third year of the undergraduate study follows up the first two years of the study of physics, therefore the curriculum is built on the fundamental physical and mathematical education that students acquire during their first two years of study at the Department of Physics of the Faculty of Science. The study of geophysics at the Faculty of Science is unique due to a rather broad geophysical education it offers before any specialization - future seismologists thus attend compulsory courses of dynamical meteorology and fluid dynamics, and meteorologist and physical oceanographers learn basics of the theory of elasticity, seismology and seismometry.



The first-cycle graduates have:

**A) KNOWLEDGE AND UNDERSTANDING OF**

Appropriate mathematical principles of importance for physics and geophysics underlying linear algebra, calculus, vector calculus and integral transforms; The scientific principles important for study of geophysics; The key aspects and concepts of computer engineering underlying numerical methods of programming.

**B) INVESTIGATIONS ABILITIES**

The ability to conduct searches of literature, and to use databases and other sources of information; The ability of interpretation of physical solutions and specific numerical methods, as well as their critical analysis.

**C) TRANSFERABLE SKILLS**

The ability to function as an individual or as a member of a team, and to present the work both in written and oral form; The ability to use diverse methods to communicate; The ability to recognize the need for further learning, and the ability to engage in independent, life-long learning.

4.3

**programme details**

	hours	ECTS credits	date of		subject	hours	ECTS credits	date of		subject	
			examination	grade				examination	grade		
1	105	11.0	29/06/06	5	General Physics 1	26	6.0	5.0	20/12/07	5	Seismology I
2	90	8.0	01/03/06	5	Mathematical Analysis 1	27	4.5	4.0	30/01/08	5	Introduction to Spectral Analysis
3	105	8.0	07/02/06	5	Linear Algebra	28	4.5	3.0	06/02/08	5	Statistical Methods in Geophysics
4	60	3.0	23/02/06	5	Computing Laboratory	29	4.5	0.0		+	Theory of Elasticity with Application in Geophysics
5	30	0.0			+ Physical Education and Health Culture 1						
6	105	11.0	27/09/06	3	General Physics 2	30	6.0	3.0	28/01/08	5	Advanced Physics Lab 1
7	90	8.0	20/09/06	4	Mathematical Analysis 2	31	9.0	8.0	02/09/08	4	Dynamic Meteorology I
8	75	6.0	06/09/06	5	Statistics and Basic Measurements	32	4.5	5.0	10/07/08	5	Physical Oceanography I
9	60	5.0	04/09/06	5	Numerical Methods	33	6.0	5.0	17/06/08	5	Seismology II
10	30	0.0		+	Physical Education and Health Culture 2	34	4.5	2.0	01/07/08	5	Seismometry
11	105	8.0	05/07/07	5	General Physics 3	35	4.5	2.0	20/06/08	5	Meteorological Measurements
12	60	3.0	01/02/07	5	Introductory Physics Lab 1	36	4.5	10.0	06/06/08	5	Theory of Elasticity with Application in Geophysics
13	75	9.0	06/07/07	3	Mathematical Methods in Physics 1	37	6.0	3.0	01/07/08	5	Advanced Physics Lab II
14	75	8.0	16/05/07	4	Classical Mechanics 1						
15	30	1.0	15/03/07	5	Elective Seminar 1						
16	30	1.0	05/02/07	4	Elective Seminar 2						
17	30	0.0		+	Physical Education and Health Culture 3						
18	105	7.0	27/09/07	5	General Physics 4						
19	60	5.0	26/09/07	5	Introduction to Quantum Physics						
20	90	8.0	24/09/07	4	Mathematical Methods in Physics 2						
21	75	7.0	14/09/07	4	Classical Mechanics 2						
22	60	3.0	21/06/07	5	Introductory Physics Lab 2						
23	30	0.0		+	Physical Education and Health Culture 4						
24	45	5.0	12/02/08	5	Introduction to Geophysics I Fluid Dynamics					additional ECTS credits	—
25	45	5.0	06/02/08	5	Physical Oceanography I						

total ECTS credits 180

beginning of the study – end of the study 1 October 2005– 2 September 2008

diploma number 2-08

graduation thesis; mentor; defended on —



4.4 **grading scheme and, if available, grade distribution guidance** All courses are graded through continuous assessment of student activity (preliminary exams, homeworks, regular class attendance, final exam). Mode of evaluation i.e. contribution of particular activity on final grade depends on the specific structure of each individual course. After the final exam student are able to achieve one of the following grades: izvrsan - 5 (excellent); vrlo dobar - 4 (very good); dobar - 3 (good); dovoljan - 2 (sufficient); nedovoljan - 1 (insufficient - fail). The minimum passing grade is dovoljan - 2. Some courses are not graded, but all course requirements must be fulfilled. Such courses are marked with "+" in the transcript.

4.5 **overall classification of the qualification** Cumulative grade point average: 4.556

**INFORMATION ON THE FUNCTION OF THE QUALIFICATION**

5  
5.1 **access to further study** After completing this undergraduate university study programme, a student gains access to one of two offered graduate university programmes at the Department of Geophysics, Faculty of Science, University of Zagreb. The conditions of application to university or vocational graduate programmes in other areas of natural sciences or at other higher education institutes are determined by the higher education institution delivering programme.

5.2 **professional status** The bachelor's degree in Geophysics entitles its holder to bear the legally protected professional title Bachelor of Science (univ. bacc. geophys.) and to exercise professional and technical work in the field for which the degree was awarded. The study programme rests on a strong fundamental knowledge of physics and mathematics. Because of that, the students generally easily find employment in professional organizations (Croatian Meteorological and Hydrological Service or the Croatian Seismological Survey), scientific institutes, academic institutions, companies dealing with exploration geophysics, banks, etc.

**ADDITIONAL INFORMATION**

6  
6.1 **additional information** —

6.2 **further information sources** Republic of Croatia, Ministry of Science, Education and Sports, <http://www.mzos.hr>; University of Zagreb, <http://www.unizg.hr>; Faculty of Science, <http://www.pmf.hr>; Department of Geophysics, <http://www.gfz.hr>

**CERTIFICATION OF THE SUPPLEMENT**

7.1 **place and date**  
Zagreb, 21 December 2009

7.2 **name and signature**  
Mladen Juračić, PhD Prof.

7.3 **capacity**  
Dean





### 8.1 Types of institutions

UNIVERSITIES (*sveučilišta*) are institutions of higher education which offer university study programmes in at least two research areas and/or art areas covering a number of disciplines. Exceptionally, universities may also offer vocational study programmes. Universities may be comprised of constituent units which are legal entities and which are called FACULTIES (*fakulteti*) or ART ACADEMIES (*umjetničke akademije*). Universities and their constituent units offer study programmes, and engage in research and other professional and art-related work.

POLYTECHNICS (*veleučilišta*) and SCHOOLS OF VOCATIONAL HIGHER EDUCATION (*visoke škole*) are higher education institutions which offer vocational study programmes. The two types of institution differ in the range of programmes they offer: polytechnics are institutions of vocational higher education which offer vocational study programmes in three or more disciplines. Their mission is to offer career-oriented programmes, which often include practical work experience.

Public universities are established by law; public polytechnics and schools of vocational higher education are established by a decree of the Croatian Government; private higher education institutions are established by the founder.

### 8.2 Types of programmes

UNIVERSITY STUDY PROGRAMMES prepare students for work in research and higher education institutions, as well as in private and public sectors. Students in these programmes receive an education that enables them to develop and use scholarly and professional knowledge at the appropriate level.

VOCATIONAL STUDY PROGRAMMES provide students with a career-ready level of knowledge, skills and competences required for work in specific vocations.

### 8.3 Accreditation of higher education institutions and study programmes

Higher education institutions (HEIs) and their study programmes are subject to an evaluation process in order to get accreditation. The request for accreditation is submitted to the Ministry in charge of higher education, which then requests an evaluation from the National Council for Higher Education (NCHE). The NCHE appoints an expert committee which, in cooperation with the Agency for Science and Higher Education, performs the evaluation and submits a report. A draft report is then sent to the HEI for feedback and clarifications. The National Council makes a final evaluation of the proposed study programme or of the higher education institution and recommends to the minister issuance or denial of accreditation.

### 8.4 Organisation of university study programmes

Since 2005, all study programmes in Croatia measure student work load in ECTS credits. A student is typically required to earn 60 ECTS credits in one academic year.

UNIVERSITY UNDERGRADUATE PROGRAMMES – FIRST CYCLE (*prediplomski sveučilišni studij*) normally take three years in which students are required to earn 180 ECTS credits. A minority of undergraduate university programmes in Croatia are offered as four-year programmes in which students are required to earn 240 ECTS credits. Upon completion students are awarded a diploma (*svjedodžba*) and the academic degree of University Bachelor (*sveučilišni prvostupnik*) with an indication of the field of study. Students graduating in technical sciences receive the academic degree of University Bachelor in Engineering (*sveučilišni prvostupnik inženjer*) with an indication of the field of study.

Students holding a first cycle university degree can apply for admission to university graduate programmes or vocational specialist graduate programmes, or enter the workforce.

UNIVERSITY GRADUATE PROGRAMMES – SECOND CYCLE (*diplomski sveučilišni studij*) normally take two years in which students are required to earn 120 ECTS credits. A minority of graduate programmes in Croatia are offered as one-year programmes in which students are required to earn 60 ECTS credits. The total number of credits earned in the first and second cycle programmes must be at least 300. Upon completion students are awarded a diploma and the academic degree of Master of (*magistar struke*) with an indication of the field of study. Students graduating in technical sciences receive the academic degree of Master in Engineering (*magistar inženjer*) with an indication of the field of study.

Students holding a second cycle university degree can continue their studies in university postgraduate programmes or enter the workforce.

INTEGRATED UNDERGRADUATE AND GRADUATE UNIVERSITY PROGRAMMES – FIRST AND SECOND CYCLES (*integrirani prediplomski i diplomski sveučilišni studij*) normally take five or six years in which students are required to earn 300 or 360 ECTS credits respectively. Upon completion students are awarded a diploma and the academic degree of Master of (*magistar struke*) with an indication of the field of study. Upon completion of integrated first and second cycle programmes in medicine, dentistry and veterinary medicine students receive the academic degree of Doctor (*doktor struke*) with an indication of the field of study (e.g. Doctor of Medicine, etc.)

Students with this degree can continue their studies in university postgraduate programmes or enter the workforce.

UNIVERSITY POSTGRADUATE PROGRAMMES – THIRD CYCLE (*poslijediplomski sveučilišni studij*) normally take three years. Upon completion students are awarded a diploma and the academic degree of Doctor of Philosophy (or Doctor scientiarum), or Doctor of Fine Art (*doktor znanosti* or *doktor umjetnosti*), with an indication of the academic field or art form.

UNIVERSITY SPECIALIST POSTGRADUATE PROGRAMMES (*poslijediplomski sveučilišni specijalistički studij*) normally take one to two years. Upon completion students receive a diploma and the academic degree of University Specialist (*sveučilišni specijalist*) with an indication of the field of study.

### Organisation of vocational study programmes

SHORT CYCLE VOCATIONAL STUDY PROGRAMMES (*stručni studij*) normally take two or two-and-a-half years, in which students are required to earn between 120 and 150 ECTS credits respectively. Upon completion students receive a diploma (*svjedodžba*) and a Short-Cycle Vocational Degree (*stručni pristupnik*) with an indication of the field of study.

Students holding a short-cycle vocational degree can apply for admission to higher levels of vocational study programmes, or enter the workforce.

VOCATIONAL UNDERGRADUATE PROGRAMMES – FIRST CYCLE (*stručni prediplomski studij*) normally take three years in which students are required to earn 180 ECTS credits. A minority of vocational programmes in Croatia are offered as four-year programmes in which students are required to earn 240 ECTS credits. Upon completion students are awarded a diploma (*svjedodžba*) and the vocational degree of Vocational Bachelor (*stručni prvostupnik*) with an indication of the field of study. Students graduating in technical sciences receive the vocational degree of Vocational Bachelor in Engineering (*stručni prvostupnik inženjer*) with an indication of the field of study.

Students holding a first cycle vocational degree can apply for admission to vocational specialist graduate programmes, or to second cycle university graduate programmes under conditions determined by the university, or to enter the workforce.

VOCATIONAL SPECIALIST GRADUATE PROGRAMMES – SECOND CYCLE (*stručni diplomski specijalistički studij*) normally take two years in which students are required to earn 120 ECTS credits. A minority of vocational specialist graduate programmes in Croatia are offered as one-year programmes in which students are required to earn 60 ECTS credits. The total number of credits earned in first and second cycle programmes must be at least 300. Upon completion of vocational specialist graduate programmes students are awarded a diploma and the vocational degree of Vocational Specialist (*stručni specijalist*) with an indication of the field of study. Students graduating in technical sciences receive the vocational degree of Vocational Specialist in Engineering (*stručni specijalist inženjer*) with an indication of the field of study, and students graduating in the fields of medicine, dentistry or veterinary medicine receive a diploma vocational degree (*diplomirani*) with an indication of the field of study.

Students holding a second cycle vocational degree can enter the workforce, or they can also apply, under conditions determined by universities, for transfer to a university diploma study programme (with the proviso of taking differential exams) and admission to a university postgraduate programme.

### Educational requirements for admission into study programmes

Higher education institutions independently set the minimum educational requirements for admission to university undergraduate programmes and first cycle vocational programmes. Normally, the minimum requirement for admission to university undergraduate programmes is completion of a four-year secondary school; the minimum requirement for enrolment into first cycle vocational programmes is completion of a three- or four-year secondary school. The admissions process to first cycle study programmes at Croatian universities is normally based on secondary school grades and an entrance examination. Each constituent unit of a university usually carries out its own entrance examination. The admissions process to first cycle programmes at polytechnics and schools of vocational higher education is also based on secondary school grades and sometimes an entrance examination, but the use of the latter is less common than in the case of universities.

The minimum educational requirement for enrolment in university graduate programmes is completion of a university undergraduate programme. Universities can allow students with a higher education vocational degree to enrol in university graduate programmes under specially defined requirements.

The minimum educational requirement for enrolment in vocational specialist graduate programmes is completion of a university undergraduate programme or a vocational programme (first cycle).

The minimum educational requirement for enrolment in university postgraduate programmes is completion of a specific graduate programme. Normally, the requirement for enrolment in a university postgraduate programme is completion of a university graduate programme. Students who have completed pre-Bologna undergraduate programmes lasting at least four academic years (*sveučilišni dodiplomski studij*) can apply for admission to Bologna postgraduate programmes as well.

### 8.7. Grading scale

The Croatian national grading scale consists of five grades with numerical equivalents: *izvrstan* – 5 (excellent); *vrlo dobar* – 4 (very good); *dobar* – 3 (good); *dovoljan* – 2 (sufficient); *nedovoljan* – 1 (fail). The minimum passing grade is 2 (sufficient).

