



*Joint European Summer School on Fuel Cell,
Electrolyser, and Battery Technologies
JESS 2017*

*Week 1 - Introductory Courses
11 – 15 September 2017*

*Hotel Amarilia,
Vouliagmeni, Athens, Greece*



sponsored by



Imperial College
London

INTRODUCTION

The increase in energy production from renewable sources creates a demand for energy storage technologies. Storage and conversion can be accomplished electrochemically: in batteries or through electrolysis and fuel cells. Therefore, these technologies are poised to play a major role in the energy supply infrastructure of the near future.

The Joint European Summer School JESS 2017 addresses these issues by offering high quality graduate level courses on selected topics of fuel cells, electrolyser, and battery technologies. This series of summer schools has been ongoing since 2004 and targets an audience of **university students** (MSc and PhD levels), and **post-doctoral researchers**. We also welcome more **experienced researchers and engineers** wishing to review these technologies and expand their general knowledge, for instance, to suit a newly acquired position or collect credits for a Continuous Professional Development (CPD) scheme. The topical content is tailored to the needs of a diverse audience: **newcomers to the field, experienced students, and young professionals** working at the forefront of fuel cell, electrolyser, and battery applications.

Week 1 (11 – 15 Sept 2017) offers three introductory courses to

- High temperature fuel cells and electrolyzers (SOFC and SOE),
- Low temperature fuel cells and electrolyzers (PEM and alkaline),
- Battery technology.

During the first week of Summer School, the main focus will be on the scientific and technological aspects. Starting from the fundamental principles of electrochemistry and thermodynamics, the entire spectrum of materials, design and balance of plant will be covered both from a scientific and an engineering point of view. In addition to the lectures, the participants will be asked to join in student projects where the content of the lectures is applied to a case study to be presented at the end of the week.

These courses are accredited at the three universities organising the Summer School and each carry 3 ECTS points (see below).

The following week (Week 2) will offer the Modelling Master Class, and modules on Fuel Cell Vehicles, Business Development and Innovation, and Hydrogen Safety for more advanced students (please refer to the separate programme). The two weeks are conducted independently of each other and students can choose the courses most appropriate to their studies.

NETWORKING WITH EXPERTS IN THE FIELD

The school draws on the knowledge and expertise of a carefully selected group of lecturers currently working at the leading edge of fuel cell, hydrogen, and battery research and development in Europe and associated to universities, national research centres, and industry.

Informal networking is a key element of science and scientific work in general. JESS offers ample opportunity for networking with peers and seasoned scientists. Students will be asked to give a short introduction to themselves and briefly present the research work they are doing (or expect to be doing).

CERTIFICATE OF ATTENDANCE

A Certificate of Attendance will be issued to all students of JESS. This Certificate of Attendance can be used for acquiring CPD points. The courses are accredited at the Technical University of Denmark and the universities of Aachen and Birmingham. On taking the optional final exam of their respective course, students can be attributed 3 ECTS points (10 credits in the UK system) for use in their studies.

ORGANISING COMMITTEE

Prof Rüdiger-A. Eichel (Forschungszentrum Jülich, Germany)

Prof Jens Oluf Jensen (DTU Energy Conversion, Denmark)

Prof Robert Steinberger-Wilckens (U Birmingham, United Kingdom)

LECTURERS

The following distinguished lecturers will be delivering the talks for JESS 2017:

Jens Oluf Jensen	Technical University of Denmark
Rüdiger-A. Eichel	Research Centre Jülich, Germany
Robert Steinberger-Wilckens	University of Birmingham, UK
Ico Vinke	Research Centre Jülich, Germany
Anke Hagen	Technical University of Denmark
Alan Atkinson	Imperial College London, UK
Karin Kleiner	Technical University of Munich, Germany
Sébastien Martinet	CEA, France
Shangfeng Du	University of Birmingham, UK
Juan Maria Garcia Lastra	Technical University of Denmark
Lars N. Cleemann	Technical University of Denmark
Marcelo Carmo	Research Centre Jülich, Germany
Oliver Posdziech	SunFire, Germany

You can find brief CV's of the lecturers, programme updates, and information on past events on the JESS web site: <http://www.jess-summerschool.eu>

The current status of the programme with the general lectures for all participants and the specialised talks has been included in this brochure.

LOCATION & VENUE

Athens is the capital and largest city of Greece. Athens dominates the Attica region and is one of the world's oldest cities, with its recorded history spanning around 3,400 years. Classical Athens was a powerful city-state. A centre for the arts, learning and philosophy, home of Plato's Academy and Aristotle's Lyceum, it is widely referred to as the cradle of Western civilisation and the birthplace of democracy, largely due to the impact of its cultural and political achievements during the 5th and 4th centuries BC on the rest of the European continent. The heritage of the classical era is still evident in the city, represented by ancient monuments and works of art, the most famous of all being the Parthenon, considered a key landmark of early Western civilisation. The city also retains Roman and Byzantine monuments, as well as a smaller number of Ottoman monuments. It is home to two UNESCO World Heritage Sites, the Acropolis of Athens and the medieval Daphni Monastery. Landmarks of the modern era, dating back to the establishment of Athens as the capital of the independent Greek state in 1834, include the Hellenic Parliament (19th century) and the Athens Trilogy, consisting of the National Library of Greece, the Athens University and the Academy of Athens.

The hotel hosting the school is located only steps away from a sandy beach in the Vouliagmeni area, 17 km from Athens city centre and 19 km from Athens international airport. All rooms have individual controlled A/C, free WiFi internet access, hairdryer, mini fridge, LCD TV and DVD player. More details can be found at <http://www.amarilia.gr/>.

HOW TO REGISTER

To register, fill in one of the forms attached at the end of this document, scan, and send to the e-mail addresses on the form. Or follow the registration links on the web site

<http://www.jess-summerschool.eu/JESS-2017>

The final deadline for registration is **31 August 2017**.

PARTICIPATION FEE

The registration fee is 1.340,- €/course and covers tuition fees, and accommodation in single room from Sunday 10 to Saturday 16 Sept. 2017. This includes full board (all meals and coffee breaks), the drinks reception, end-of-week banquet, and excursion.

Double room occupancy is charged at 1.150,- €/course and person. Accompanying persons sharing a double room with a participant and not taking part in the lectures are charged at 550 € for the 6-day stay (including all meals and events).

All prices include Greek V.A.T.

An **Early Bird Discount of 150 €** is offered on registrations up until **31 May 2017**.

Participants wishing to arrive early or stay longer should make their [own arrangements](#) with our booking partner, Panhellas Tourism & Congress (see below). They can offer special rates for additional nights.

CORRESPONDENCE

For issues concerning registration and payment please contact Ms Manuela Drape-Stathoglou at Panhellas Tourism & Congress:

Mail to: manuela@panhellas.gr, Tel: +30 2810 300847.

She is also the contact person for any issues relating to the hotel, booking additional nights, and for questions about meals and the excursion.

If you have any [dietary requirements](#) with respect to food choice or food allergies, please contact Mrs. Drape in due time before the Summer School.

Lecturer information and arrangements - r.steinbergerwilckens@bham.ac.uk

Student and general information - J.C.Hooper@bham.ac.uk, Phone +44 121 414 5275.

CANCELLATION POLICY

To cancel your registration with JESS, send an email stating your intent to: manuela@panhellas.gr

Refunds will be subject to a cancellation fee. If your request arrives by 01 September 2017, the registration fee will be refunded after the school applying a cancellation fee of 350,00 € off the processed registration fee.

No reimbursement will be made for cancellations received after 01 September 2017.

LIABILITY

The school secretariat and organisers cannot accept liability for personal accidents, loss of or damage to private property of participants and/or accompanying persons, either during, or directly arising from the JESS 2017. Participants should make their own arrangements with respect to health and travel insurance.

Reaching Amarilia Hotel from Athens international airport 'Eleftherios Venizelos'

By bus and/or/ metro

There is a bus service X96 from the arrivals terminal in Athens International Airport (Eleftherios Venizelos). The trip to the closest bus station to Amarilia Hotel (named 'Pegadakia') takes approx. 35-40 minutes and the cost is ~ € 5,00. From the bus station 'Pegadakia' you turn left onto the main avenue and walk 10 minutes before you turn right off the avenue into street Ag. Nikolaou and arrive at Amarilia Hotel, on the left side after 100 m.

You can also take the metro from the airport (blue line), change at 'Syntagma' to the red line to terminus 'Helleniko'. From there you can take a bus no. 122 to the stop 'Ag. Nikolaos' on the avenue close to the hotel. Walk back from the bus stop for about 20 m and turn left into Ag. Nikolaou. Or take a taxi from 'Helleniko' – about 5 to 10 minutes ride.

By car

You drive on the highway until the KOROPi - MARKOPOULO sign and you exit to the left. Then you follow the signs to GLYFADA and drive along the Vari - Koropi Avenue at the end of which there is a sign VOULIAGMENI where you turn left. After 300m, you reach a traffic light; you turn right in the small street 15m after the traffic lights, then right in the first street and then right to Agiou Nikolaou street. This is VOULIAGMENI area and it is where our hotel is located. The distance from the Airport is 19km (20 minutes driving distance).

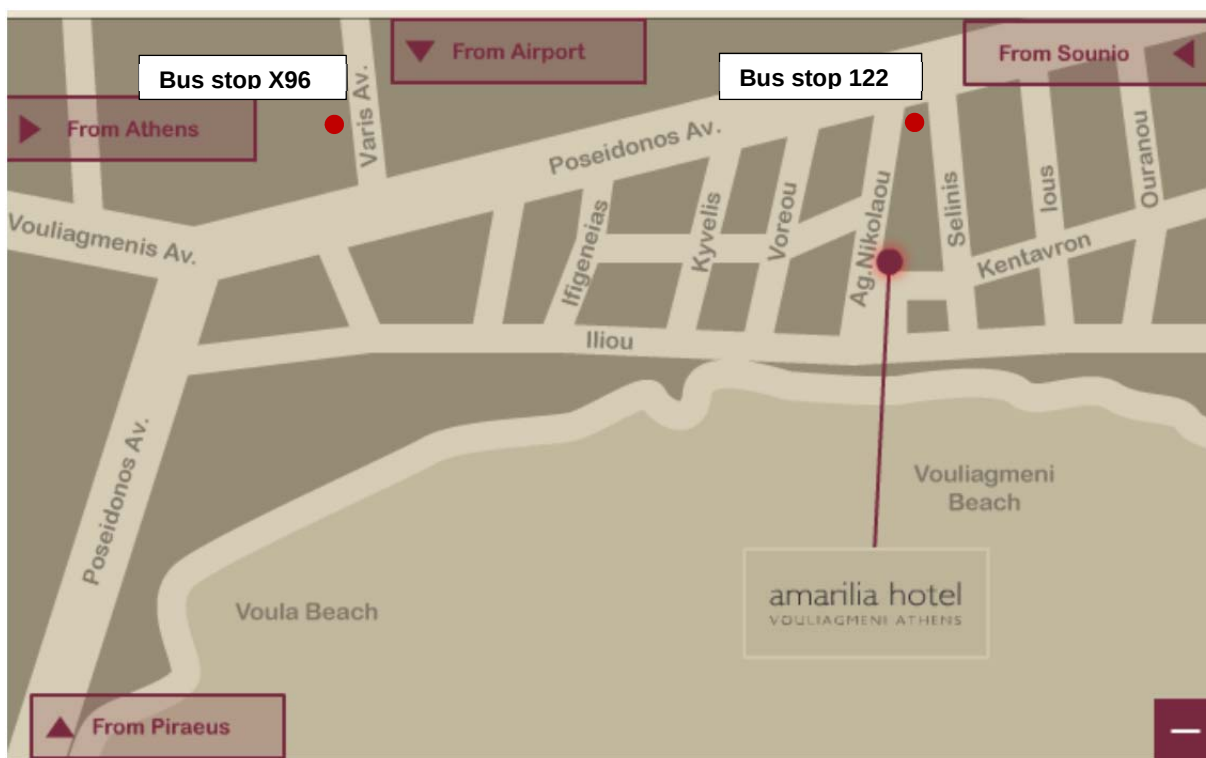
By taxi

Either take one of the taxis from the airport or pre-book a taxi from Panhellas mail: manuela@panhellas.gr, Tel: +30 2810 300847.

Both will cost around € 50,00 (one way). This fee is not included in the registration fee and has to be paid separately.

Manuela Drape-Stathoglou can arrange for shared taxis, depending on when participants arrive. Please contact her in case you want to use this option.

The full address of the hotel is: Hotel Amarilia, 13 Agiou Nikolaou, 16671 Vouliagmeni.



JESS 2017**High Temperature Fuel Cells and Electrolysers (SOFC and SOE)**tentative programme
last changed 26/03/17P ... plenary lectures (all students), St ... student presentations,
HT ... specialised lectures, HL ... high & low temperature courses**Monday 11/09/2017**

P.01	08:30	Welcome and General Introduction	Jens Oluf Jensen (DTU)
	09:00	Sustainable and Renewable Energy Future	Rüdiger-A. Eichel (FZJ)
	09:45	coffee break	
P.02	10:00	Introduction to Fuel Cells and Electrolysis	Shangfeng Du (U Bham)
	11:15	break	
P.03	11:30	Introduction to Batteries	Rüdiger-A. Eichel (FZJ)
	13:00	lunch	
P.04	16:00	Thermodynamics and Efficiency of Electrochemical Cells	Jens Oluf Jensen (DTU)
	17:30	coffee break	
P.05	18:00	Introduction to Solid State Chemistry & Ionics	Rüdiger-A. Eichel (FZJ)
P.06	19:30	Introduction to the Students' Project	Robert Steinberger-Wilckens (U Bham)
	19:45	welcome reception (bar)	
	20:15	dinner	
St.01	21:15	Students' Introductions I	Jens Oluf Jensen (DTU)

Tuesday 12/09/2017

HT.01	08:30	Electrolyte Materials for SOFC / SOEC	Alan Atkinson (ICL)
	09:45	coffee break	
HT.02	10:00	Anode Materials for SOFC / SOEC	Alan Atkinson (ICL)
	11:15	break	
HT.03	11:30	Cathode Materials for SOFC / SOEC	Alan Atkinson (ICL)
	13:00	lunch	
P.07	16:00	Characterisation Methods for Fuel Cell, Electrolyser and Battery Materials	Shangfeng Du (U Bham)
	17:15	coffee break	
P.08	17:30	Exercise on Characterisation, Electrochemistry and Thermodynamics	Shangfeng Du (U Bham)
	18:45	break	
St.02	19:00	Students' Introductions II	Jens Oluf Jensen (DTU)
	20:30	dinner	

Wednesday 13/09/2017

HT.04	08:30	Cell and Stack Designs for SOFC / SOEC	Ico Vinke (FZJ)
	09:45	coffee break	
HT.05	10:00	Manufacturing of SOFC / SOEC	Ico Vinke (FZJ)
	11:15	break	
HT.06	11:30	Exercise on Materials / Design	Ico Vinke (FZJ)
	13:00	lunch	
	15:00	excursion	
	21:00	dinner	

Thursday 14/09/2017

P.09	08:30	Atomistic Modelling in fuel cell, electrolyser and battery research	Juan Maria Garcia Lastra (DTU)
	09:45	coffee break	
HT.07	10:00	System Technology for SOFC	Ico Vinke (FZJ)
	11:15	break	
HT.08	11:30	System Technology for SOEC	Oliver Posdziech (SunFire)
	13:00	lunch	
HT.09	16:00	Exercise on System Technology	Robert Steinberger-Wilckens (U Bham)
	17:00	coffee break	
HT.10	17:15	Degradation in SOFC / SOEC	Anke Hagen (DTU)
	18:30	break	
St.03	18:45	Student project time	n/a
	20:00	dinner	

Friday 15/09/2017

HT.11	08:30	Exercise on Degradation	Anke Hagen (DTU)
	09:45	coffee break	
HT.12	10:00	New Trends in SOFC / SOEC	Anke Hagen (DTU)
	11:15	break	
HL.01	11:30	Power to Gas, Fuels and Chemicals	Oliver Posdziech (SunFire)
	13:00	lunch	
St.04	16:00	Optional ECTS exams	
	17:00	coffee break	
St.05	17:15	Students' Project Presentations	Robert Steinberger-Wilckens (U Bham)
	18:45	break	
P.10	19:00	Farewell	Robert Steinberger-Wilckens (U Bham)
	20:30	gala dinner	

JESS 2017**Low Temperature Fuel Cells and Electrolysers (PEFC, alkaline & PEM)**

P ... plenary lectures (all students), St ... student presentations,
 LT ... specialised lectures, HL ... high & low temperature courses

tentative programme
 last changed 26/03/17

Monday 11/09/2017

P.01	08:30	Welcome and General Introduction	Jens Oluf Jensen (DTU)
	09:00	Sustainable and Renewable Energy Future	Rüdiger-A. Eichel (FZJ)
P.02	09:45	coffee break	
	10:00	Introduction to Fuel Cells and Electrolysis	Shangfeng Du (U Bham)
P.03	11:15	break	
	11:30	Introduction to Batteries	Rüdiger-A. Eichel (FZJ)
P.04	13:00	lunch	
	16:00	Thermodynamics and Efficiency of Electrochemical Cells	Jens Oluf Jensen (DTU)
P.05	17:30	coffee break	
	18:00	Introduction to Solid State Chemistry & Ionics	Rüdiger-A. Eichel (FZJ)
P.06	19:30	Introduction to the Students' Project	Robert Steinberger-Wilckens (U Bham)
	19:45	welcome reception (bar)	
St.01	20:15	dinner	
	21:15	Students' Introductions I	Jens Oluf Jensen (DTU)

Tuesday 12/09/2017

LT.01	08:30	Electrolyte Materials for LT Fuel Cells and Electrolysers	Marcelo Carmo (FZJ)
	09:45	coffee break	
LT.02	10:00	Catalyst and Kinetics for LT Fuel Cells and Electrolysers I.	Lars Cleemann (DTU)
	11:15	break	
LT.03	11:30	Catalyst and Kinetics for LT Fuel Cells and Electrolysers II.	Lars Cleemann (DTU)
	13:00	lunch	
P.07	16:00	Characterisation Methods for Fuel Cell, Electrolyser and Battery Materials	Shangfeng Du (U Bham)
	17:15	coffee break	
P.08	17:30	Exercise on Characterisation, Electrochemistry and Thermodynamics	Shangfeng Du (U Bham)
	18:45	break	
St.02	19:00	Students' Introductions II	Jens Oluf Jensen (DTU)
	20:30	dinner	

Wednesday 13/09/2017

LT.04	08:30	Cells, Bipolar Plates, and Stacks for LT Fuel Cells	Lars Cleemann (DTU)
	09:45	coffee break	
LT.05	10:00	Cells, Bipolar Plates, and Stacks for LT Electrolysers	Marcelo Carmo (FZJ)
	11:15	break	
LT.06	11:30	Hydrogen Compression and Storage	Jens Oluf Jensen (DTU)
	13:00	lunch	
	15:00	excursion	
	21:00	dinner	

Thursday 14/09/2017

P.09	08:30	Atomistic Modelling in fuel cell, electrolyser and battery research	Juan Maria Garcia Lastra (DTU)
	09:45	coffee break	
LT.07	10:00	System Design and Operation for LT Electrolysers	Marcelo Carmo (FZJ)
	11:15	break	
LT.08	11:30	System Design and Operation for LT Fuel Cells	Jens Oluf Jensen (DTU)
	13:00	lunch	
LT.09	16:00	Challenges for LT Electrolysers	Marcelo Carmo (FZJ)
	17:00	coffee break	
LT.10	17:15	Challenges for LT Fuel Cells	Lars Cleemann (DTU)
	18:30	break	
St.03	18:45	Student project time	n/a
	20:00	dinner	

Friday 15/09/2017

LT.11	08:30	Application of LT Fuel Cells and Electrolysers	Lars Cleemann (DTU)
	09:45	coffee break	
LT.12	10:00	New Trends in LT Fuel Cells and Electrolysers	Jens Oluf Jensen (DTU)
	11:15	break	
HL.01	11:30	Power to Gas, Fuels and Chemicals	Oliver Posdziech (SunFire)
	13:00	lunch	
St.04	16:00	Optional ECTS exams	
	17:00	coffee break	
St.05	17:15	Students' Project Presentations	Robert Steinberger-Wilckens (U Bham)
	18:45	break	
P.10	19:00	Farewell	Robert Steinberger-Wilckens (U Bham)
	20:30	gala dinner	

JESS 2017**Introduction to Battery Technology**tentative programme
last changed 26/03/17P ... plenary lectures (all students), St ... student presentations,
B ... specialised lectures**Monday 11/09/2017**

P.01	08:30	Welcome and General Introduction	Jens Oluf Jensen (DTU)
	09:00	Sustainable and Renewable Energy Future	Rüdiger-A. Eichel (FZJ)
	09:45	coffee break	
P.02	10:00	Introduction to Fuel Cells and Electrolysis	Shangfeng Du (U Bham)
	11:15	break	
P.03	11:30	Introduction to Batteries	Rüdiger-A. Eichel (FZJ)
	13:00	lunch	
P.04	16:00	Thermodynamics and Efficiency of Electrochemical Cells	Jens Oluf Jensen (DTU)
	17:30	coffee break	
P.05	18:00	Introduction to Solid State Chemistry & Ionics	Rüdiger-A. Eichel (FZJ)
P.06	19:30	Introduction to the Students' Project	Robert Steinberger-Wilckens (U Bham)
	19:45	welcome reception (bar)	
	20:15	dinner	
St.01	21:15	Students' Introductions I	Jens Oluf Jensen (DTU)

Tuesday 12/09/2017

B.01	08:30	Anode Materials for Batteries	Karin Kleiner (TUM)
	09:45	coffee break	
B.02	10:00	Cathode Materials for Batteries	Rüdiger-A. Eichel (FZJ)
	11:15	break	
B.03	11:30	Electrolyte Materials for Batteries	Karin Kleiner (TUM)
	13:00	lunch	
P.07	16:00	Characterisation Methods for Fuel Cell, Electrolyser and Battery Materials	Shangfeng Du (U Bham)
	17:15	coffee break	
P.08	17:30	Exercise on Characterisation, Electrochemistry and Thermodynamics	Shangfeng Du (U Bham)
	18:45	break	
St.02	19:00	Students' Introductions II	Jens Oluf Jensen (DTU)
	20:30	dinner	

Wednesday 13/09/2017

B.04	08:30	Cell and Pack Designs for Batteries	Sébastien Martinet (CEA)
	09:45	coffee break	
B.05	10:00	Manufacturing of Batteries	Sébastien Martinet (CEA)
	11:15	break	
B.06	11:30	System Technology and Safety for Batteries	Sébastien Martinet (CEA)
	13:00	lunch	
	15:00	excursion	
	21:00	dinner	

Thursday 14/09/2017

P.09	08:30	Atomistic Modelling in fuel cell, electrolyser and battery research	Juan Maria Garcia Lastra (DTU)
	09:45	coffee break	
B.07	10:00	Exercise on Materials (/ Design)	Juan Maria Garcia Lastra (DTU)
	11:15	break	
B.08	11:30	Transport Modelling of Batteries	Juan Maria Garcia Lastra (DTU)
	13:00	lunch	
B.09	16:00	All Solid State Batteries	Rüdiger-A. Eichel (FZJ)
	17:00	coffee break	
B.10	17:15	Metal-Air Batteries	Rüdiger-A. Eichel (FZJ)
	18:30	break	
St.03	18:45	Student project time	n/a
	20:00	dinner	

Friday 15/09/2017

B.11	08:30	Beyond Lithium - Resource-Efficient Batteries	Juan Maria Garcia Lastra (DTU)
	09:45	coffee break	
B.12	10:00	Degradation and Lifetime-Prediction in Batteries	Karin Kleiner (TUM)
	11:15	break	
B.13	11:30	Exercise on In-Operando Characterization & Degradation	Karin Kleiner (TUM)
	13:00	lunch	
St.04	16:00	Optional ECTS exams	
	17:00	coffee break	
St.05	17:15	Students' Project Presentations	Robert Steinberger-Wilckens (U Bham)
	18:45	break	
P.10	19:00	Farewell	Robert Steinberger-Wilckens (U Bham)
	20:30	gala dinner	

Registration Form

Joint European Summer School for Fuel Cell, Electrolyser, and Battery Technologies

Solid Oxide Fuel Cells & Electrolysers ☐

Low Temperature Fuel Cells & Electrolysers ☐

Battery Technology ☐

Hotel Amarila

10 – 16 September 2017, Vouliagmeni (Athens), Greece

Early Bird rates apply until 31 May 2017

Deadline for registration: **31 August 2017**

Title	
First name	
Last name	
Gender	Male ☐ Female ☐
University/Institution/Company Name	
Street / P.O. Box	
Postal code	
Town/City	
Country	
V.A.T. number (if applicable)	
Phone	
E-mail :	
Athens arrival date and time	
Athens departure date and time	
Please note any <u>special dietary requirements</u> , disabilities etc. that we may need to know about	
early bird rate (until 31/05/2017)	standard rate (all rates incl. Greek VAT)
☐ single room 1.190 €	☐ single room 1.340 €
☐ double room 990 €	☐ double room 1.140 €
Shared with:	
☐ accompanying person 550 €, name:	

Place & date Signature

PLEASE RETURN BY E-MAIL OR FAX TO

Ms Manuela Drape-Stathoglou

manuela@panhellas.gr, Fax: +30 2810 300848

Or follow the registration link on the Summer School web site

<http://www.jess-summerschool.eu/JESS-2017>

You will then receive a confirmation and an invoice for the registration fee.