



HERTFORD COLLEGE
OXFORD



Shanghai Jiao Tong University
Zhiyuan College
at
Hertford College, Oxford

Two Week Maths and Physics Programme

SUMMER 2016

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*A very warm welcome to Hertford College and to
Oxford!*



*Hertford College was founded in 1282 – it is one of the
oldest of Oxford University's 38 colleges. Located in the
centre of historic Oxford, our beautiful college boasts the
Bridge of Sighs, which is one of the most famous sights of
the city. This is an ideal setting for students wishing to
improve their language skills and knowledge of Britain and
British culture.*

**Welcome to
Oxford!**

MEALS

Meals:

- On **class days** you are offered breakfast, lunch and dinner.
- On **trip days** you are offered breakfast, a packed lunch and dinner.
- **Weekend:** Saturday you are offered breakfast. Sunday you are offered breakfast and dinner.
- On **free-weekdays** (Monday-Friday) you are offered breakfast, lunch and dinner.

The following pages outline your academic programme

WEEK ONE	9.00 –10.30am		11.00 – 12.30pm		2.00-4.00pm		Evening
ARRIVAL DAY Day 1 Sunday 7th August	<ul style="list-style-type: none"> • Arrive at Heathrow Airport, London. • Hertford College Residential Advisors (RAs) will meet you. • Travel to Oxford by private coach. You will stay in Oxford University Accommodation. • On arrival: welcome meal and information 						
Day 2 Monday 8th August	Lecture: Introduction to Oxford—the City and the University This lecture will be followed by a brief summary of the application procedure for further degrees at the University of Oxford and other UK universities. There will also be the opportunity for a Question and Answer session.	L U N C H	Welcome Tea at 3.30pm Enjoy a delicious and traditional afternoon tea in the splendid surroundings of one of Hertford College’s historic dining halls. This is a special event so please wear special clothes.	D I N N E R	Orientation: <ul style="list-style-type: none"> • Accommodation • Facilities • Connecting your computers to the internet 		
Day 3 Tuesday 9th August	Maths Lecture Preliminaries. Overview of Ordinary Differential Equations. Initial-value problems and boundary-value problems. Examples of non-existence and non-uniqueness. Mean-value Theorem, Leibniz’s Rule, Divergence Theorem. Partial Differential Equations as mechanism for prediction. Statement of equations to be studied – heat equation, Laplace’s equation, wave equation. Derivation of heat equation from energy balance and Fourier’s law. Laplace’s equation as static case of heat equation. Derivation of wave equation from Newton’s law of inertia. Initial conditions and boundary conditions.	L U N C H	Maths Lecture (contd)	D I N N E R	Cultural activities with RAs Suggestion Go punting on the river Thames with your RAs.		

	<p>Physics Lecture- Basic relativity Problems of Newtonian view, conceptual and geometrical background, speed of light and electromagnetism, kinematics, dynamics Followed by activities</p>		<p>Physics Lecture (contd)</p>		
<p>Day 4 Wednesday 10th August</p>	<p>Maths Lecture Construction of solutions to initial- and- boundary value problems for the heat equation on a finite interval via separation of variables and Fourier series and for various boundary conditions. Uniqueness of solution. Alternative proof of uniqueness via maximum principle. Asymptotic behaviour as the time tends to infinity. Construction of solutions to initial – and – boundary value problems for the wave equation on a finite interval, again via separation of variables and Fourier series. Normal modes and frequencies. Uniqueness from energy considerations.</p> <p>Physics Lecture- General Relativity Problems of Newtonian gravity, thought experiments, concept of space-time and geometry, black holes</p>	<p>L U N C H</p>	<p>Maths Lecture (contd)</p> <p>Physics Lecture- General Relativity (contd)</p>	<p>D I N N E R</p>	<p>Cultural activities with RAs Suggestion Watch a Shakespeare play in an Oxford College garden</p>
<p>Day 5 Thursday 11th August</p>	<p>Maths Lecture General solution of wave equation. Initial – value problem for wave equation on an infinite interval. D’Alembert’s formula, characteristic lines, domains of dependence and domains of influence. Solutions on semi- infinite intervals. Incident and reflected waves. Finite speed of propagation of disturbances. Characteristic diagrams.</p> <p>Physics Lecture- Astrophysics/Astronomical objects, Their creation and dynamics (life of stars, pulsars, galaxies, AGNs, clusters)</p>	<p>L U N C H</p>	<p>Lecture Introduction to London Learn about the history and cultural highlights of the capital city. You will also have the opportunity to study some of the treasures in the British Museum and National Gallery.</p>	<p>D I N N E R</p>	<p>Cultural activities with RAs Suggestion RAs prepare the students for the trip to London.</p>

<p>Day 6</p> <p>Friday 12th August</p>	<p>Study Tour: London</p> <p>Enjoy a trip to the capital city and experience all the magical sights and sounds of London in the comfort and safety of your private coach. You will also visit the National Gallery and the British Museum. Afterwards you are free to spend the afternoon in London with your RAs.</p>
<p>Day 7</p> <p>Saturday 13th August</p>	<p>Weekend Free Day</p> <p>At the weekend you have free time. If you wish to stay in Oxford, your RAs are available for Oxford activities, such as punting, walking tours, shopping, college and museum visits.</p> <p>Alternatively, some students choose to travel independently to a nearby place of interest such as:</p> <ul style="list-style-type: none"> • London • Stratford upon Avon • Warwick Castle • Cambridge • Bath • Brighton • Liverpool <p>These trips are not included in the programme price. Your RAs are available to offer advice and support regarding travel arrangements.</p>

Day 8 Sunday 14th August	Weekend Free Day Free time, as explained on Day 7						
WEEK TWO	9.00 – 10.30am		11.00 – 12.30pm		2.00 – 4.00pm	Evening	
Day 9 Monday 15th August	Field Trip Jericho Explore this fascinating part of Oxford on a walking tour with an expert on the economic, social and historical aspects of this unique area.			L U N C H	Bodleian Library Tour A guided tour of one of the world's most renowned libraries You will visit the beautiful Divinity School, which was used as a location for the Harry Potter movies.	D I N N E R	Cultural activities with RAs Suggestion Inter-collegiate sports evening
Day 10 Tuesday 16th August	Maths Lecture Laplace's equation in the plane. Boundary – value problems of Dirichlet type and Neumann type. Uniqueness via Green's theorem Alternative proof of uniqueness via maximum principle. Construction of solutions for regions of simple shape – rectangles, discs, annuli, exteriors of discs – using separation of variables and Fourier series Physics Lecture- Astroparticle Physics Dark matter (evidence, candidates), dark energy (evidence, models), neutrinos, cosmic-rays, open problems			L U N C H	Maths Lecture (cont.) Physics Lecture (cont)	D I N N E R	Cultural activities with RAs Suggestion Go to a gig (jazz, blues, rock, pop) in Oxford with your RAs.

<p>Day 11</p> <p>Wednesday 17th August</p>	<p>Maths Lecture Well-posed problems for Partial Differential Equations. Proof that the initial-value problem for the wave equation on an infinite interval IS well – posed. Proof that the initial – value problem for Laplace’s equation in the half – plane IS NOT well – posed. Solution of the initial – value problem for the heat equation on an infinite interval using Fourier and Laplace transforms.</p> <p>Physics Lecture- Cosmology Philosophical/historical background, beginning, history and end of the universe, experiments and the content of the universe, open questions</p>	<p>L U N C H</p>	<p>Presentations Workshop With Alan and David</p>	<p>D I N E R</p>	<p>Cultural activities with RAs Suggestion Attend an Oxford debating evening with students from other universities, facilitated by your RAs.</p>
<p>Day 12</p> <p>Thursday 18th August</p>	<p>Presentations You will give short presentations in small groups in front of an audience.</p>	<p>L U N C H</p>	<p>End of Programme Feedback and Discussion</p>	<p>D I N E R</p>	<p>GALA DINNER Celebrate your success at a memorable candle-lit dinner in the historic dining hall at Hertford College where you will be presented with a certificate at the end-of-course ceremony. This is a special event so please wear smart clothes.</p>