



**HERTFORD COLLEGE**  
**OXFORD**



Shanghai Jiao Tong University  
Zhiyuan College  
*at*  
Hertford College, Oxford

*Two Week Maths and Physics Programme*

SUMMER 2016

## SUMMER 2016

*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
<b>ARRIVAL DAY</b> <b>Day 1</b>  <b>Sunday</b> <b>7th August</b>	<ul style="list-style-type: none"> <li>• Arrive at Heathrow Airport, London.</li> <li>• Hertford College Residential Advisors (RAs) will meet you.</li> <li>• Travel to Oxford by private coach. You will stay in Oxford University Accommodation.</li> <li>• On arrival: welcome meal and information</li> </ul>						
<b>Day 2</b>  <b>Monday</b> <b>8th August</b>	<b>Lecture: Introduction to Oxford—the City and the University</b> 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	<b>Welcome Tea at 3.30pm</b> 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	<b>Orientation:</b> <ul style="list-style-type: none"> <li>• Accommodation</li> <li>• Facilities</li> <li>• Connecting your computers to the internet</li> </ul>		
<b>Day 3</b>  <b>Tuesday</b> <b>9th August</b>	<b>Maths Lecture</b> 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	<b>Maths Lecture (contd)</b>	D I N N E R	<b>Cultural activities with RAs</b> Suggestion Go punting on the river Thames with your RAs.		

	<p><b>Physics Lecture- Basic relativity</b>          Problems of Newtonian view, conceptual and geometrical background, speed of light and electromagnetism, kinematics, dynamics          Followed by activities</p>		<p><b>Physics Lecture (contd)</b></p>		
<p><b>Day 4</b>   <b>Wednesday</b>  <b>10th August</b></p>	<p><b>Maths Lecture</b>          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><b>Physics Lecture- General Relativity</b>          Problems of Newtonian gravity, thought experiments, concept of space-time and geometry, black holes</p>	<p>L U N C H</p>	<p><b>Maths Lecture (contd)</b></p> <p><b>Physics Lecture- General Relativity (contd)</b></p>	<p>D I N N E R</p>	<p><b>Cultural activities with RAs</b>          Suggestion          Watch a Shakespeare play in an Oxford College garden</p>
<p><b>Day 5</b>   <b>Thursday</b>  <b>11th August</b></p>	<p><b>Maths Lecture</b>          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><b>Physics Lecture- Astrophysics/Astronomical objects,</b>          Their creation and dynamics (life of stars, pulsars, galaxies, AGNs, clusters)</p>	<p>L U N C H</p>	<p><b>Lecture</b>  <b>Introduction to London</b>          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><b>Cultural activities with RAs</b>          Suggestion          RAs prepare the students for the trip to London.</p>

<p><b>Day 6</b></p> <p><b>Friday</b> <b>12th August</b></p>	<p><b>Study Tour: London</b></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><b>Day 7</b></p> <p><b>Saturday</b> <b>13th August</b></p>	<p><b>Weekend Free Day</b></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"> <li>• London</li> <li>• Stratford upon Avon</li> <li>• Warwick Castle</li> <li>• Cambridge</li> <li>• Bath</li> <li>• Brighton</li> <li>• Liverpool</li> </ul> <p>These trips are not included in the programme price. Your RAs are available to offer advice and support regarding travel arrangements.</p>



<p><b>Day 11</b></p> <p><b>Wednesday</b> <b>17th August</b></p>	<p><b>Maths Lecture</b> 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><b>Physics Lecture- Cosmology</b> 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><b>Presentations Workshop</b> With Alan and David</p>	<p>D I N E R</p>	<p><b>Cultural activities with RAs</b> Suggestion Attend an Oxford debating evening with students from other universities, facilitated by your RAs.</p>
<p><b>Day 12</b></p> <p><b>Thursday</b> <b>18th August</b></p>	<p><b>Presentations</b> You will give short presentations in small groups in front of an audience.</p>	<p>L U N C H</p>	<p><b>End of Programme Feedback and Discussion</b></p>	<p>D I N E R</p>	<p><b>GALA DINNER</b> 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>