

Basic details

UID  Cohorts covered 

Earliest cohort	Latest cohort
2020-21	

Long title

New code  New short title

Brief description of module (approx. 600 chars.)

595 characters

Available as a standalone module/ short course?

Statutory details

	ECTS	CATS	Non-credit	HECOS codes
Credit value	5	10	N	<input type="text"/>
FHEQ level	5			<input type="text"/>
				<input type="text"/>

Allocation of study hours

	Hours	
Lectures	22	
Group teaching	0	<i>Incl. seminars, tutorials, problem classes.</i>
Lab/ practical	0	
Other scheduled	22	<i>Incl. project supervision, fieldwork, external visits.</i>
Independent study	81	<i>Incl. wider reading/ practice, follow-up work, completion of assessments, revisions.</i>
Placement	0	<i>Incl. work-based learning and study that occurs overseas.</i>
Total hours	125	
ECTS ratio	25.00	

Project/placement activity

Is placement activity allowed?

Module delivery

Delivery mode  Other   
 Delivery term  Other

Ownership

Primary department

Additional teaching departments **None**

Delivery campus **South Kensington**

### Collaborative delivery

Collaborative delivery? **N**

External institution **N/A**  
 External department **N/A**  
 External campus **N/A**

### Associated staff

Role	CID	Given name	Surname
Module Leader		Dmitry	Turaev

### Learning and teaching

#### Module description

Learning outcomes	<p>On completion of this module you will be able to:</p> <ul style="list-style-type: none"> <li>• Select and use appropriate mathematical methods in physics</li> <li>• Perform analytic continuation and use the residue method for evaluating integrals</li> <li>• Use the Fourier transform to solve linear equations</li> <li>• Demonstrate basic understanding of the least-action principle and Lagrangian/Hamiltonian formalism</li> <li>• Make simple use of tensor calculus</li> <li>• Apply basic numerical methods</li> </ul>
Module content	<p>The module is split into five parts:</p> <ul style="list-style-type: none"> <li>• Calculus Of Variations: Euler-Lagrange equation as a stationarity condition; Hamilton's Principle (Lagrangian mechanics); generalised coordinates and momenta, cyclic coordinates; Lagrangian for a charged particle using scalar and vector potentials; Lagrange multipliers; isoperimetric problems; Geodesics and the metric tensor.</li> <li>• Complex Variables: Complex differentiation, analytic functions, Cauchy-Riemann equations, entire functions; Complex integration, Cauchy's integral formula and applications, Taylor's theorem; poles and branching points; Residue theorem and application to computing real integrals.</li> <li>• Fourier Transforms: Review of Fourier transforms and Fourier integrals, computation of Fourier transforms using contour integration. Heaviside and sign function, delta function and Green's functions. Application of Fourier transforms to solving linear ODEs and PDEs (eg. driven oscillator ODEs and Laplace's equation in an infinite strip and half-plane).</li> <li>• Tensors: Definition of vectors via their transformation properties, cartesian tensors, tensor algebra, contraction of tensor indices. Vectors and pseudo-vectors (or polar and axial vectors), cartesian tensors, LeviCivita symbol, cross product, grad, div, curl and Laplacian. Physical examples of Cartesian tensors. Contravariant and covariant vectors. Contravariant, covariant and mixed tensors.</li> <li>• Numerical Methods: Numerical integration (trapezium rule and Simpson's rule), Newton-Raphson method, Runge-Kutta algorithm.</li> </ul>

Learning and Teaching Approach	Students will be taught using a combination of lectures, office hours, study groups and directed exercises on theoretical and computational work
Assessment Strategy	An exam in term 3 covering all learning outcomes will comprise the summative assessment and will contribute 100% of the module mark.
Feedback	Formative feedback will be provided throughout the module following formative assessment in forms such as in-class quizzes, online tests, marking of handwritten problems sheets and verbal feedback for any computational exercises. Feedback for any continuous assessment will be provided within two weeks of the submission date. General feedback on written examinations for each module is provided in the form of written reports from the examiners for the students.
Reading list	The module is self-contained and no additional books are required to be purchased by the students. Further discussion of material covered by the module, along with relevant problems can be found in: <ul style="list-style-type: none"> <li>•Churchill. Complex variables and applications.</li> <li>•Churchill. Fourier series and boundary value problems.</li> <li>•KF Riley, MP Hobson and SJ Bence, Mathematical Methods for Physics and Engineering.</li> </ul>

### Quality assurance

Date of first approval

Date of last revision

Date of this approval

### Office use only

QA Lead

Department staff

Date of collection

Module leader

Date exported

Date imported

Notes/ comments



UID	Legacy code	Module title	Requisite type

