Imperial College London

# Module Specification (Curriculum Review)

## Basic details

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|---|---|---|---|
| UID | | Cohorts covered | Earliest cohort: 2024-25; Latest cohort: |
| Long title | Optical Design | | |
| New code | PHYS70029 | New short title | |
| Brief description of module *(approx. 600 chars.)* | The module introduces Seidel aberration theory to describe and enumerate the aberrations that arise in optical imaging systems such as compound lenses and mirrors. It studies arrangements of optical surfaces that are able to control or minimise aberrations and investigates both theoretical and practical design processes using an industry standard computer aided design package. | | |
| | 380 characters | | |
| Available as a standalone module/ short course? | N | | |

## Statutory details

| | ECTS | CATS | Non-credit | |
|---|---|---|---|---|
| Credit value | 5 | 10 | N | HECOS codes |
| FHEQ level | Level 7 | | | |

## Allocation of study hours

| | Hours | |
|---|---|---|
| Lectures | 12 | |
| Group teaching | | *Incl. seminars, tutorials, problem classes.* |
| Lab/ practical | 30 | |
| Other scheduled | | *Incl. project supervision, fieldwork, external visits.* |
| Independent study | 83 | *Incl. wider reading/ practice, follow-up work, completion of assessments, revisions.* |
| Placement | | *Incl. work-based learning and study that occurs overseas.* |
| Total hours | 125 | |
| ECTS ratio | 25.00 | |

## Project/placement activity

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|---|---|
| Is placement activity allowed? | No |

## Module delivery

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|---|---|---|---|
| Delivery mode | Taught/ Campus | Other | |
| Delivery term | Term 2 | Other | |

## Ownership

| | |
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| Primary department | Physics |
| Additional teaching departments | |
| Delivery campus | South Kensington |

## Collaborative delivery

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|---|---|
| Collaborative delivery? | N |
| External institution | N/A |

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|---|---|
| External department | N/A |
| External campus | N/A |

## Associated staff

| Role | CID | Given name | Surname |
|---|---|---|---|
| Module Leader | | Mark | Neil |
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## Learning and teaching

### Module description

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| Learning outcomes | On completion of this modules students will be able to:<br>- evaluate the aberrations arising in optical systems and characterise those present in terms of the primary aberrations<br>- demonstrate and evaluate how refractive and reflective elements can be combined to minimise certain aberrations<br>- identify the fundamental limitations to the performance of certain design combinations<br>- critically analyse and refine the performance of optical systems using industry standard techniques based on |
| Module content | Seidel aberration theory and the effect on Seidel aberrations of shifting the stop<br>Refractive index and dispersion in real glasses<br>Controlling aberrations in thin singlet and doublet lenses<br>Optimising lens designs on a computer using finite raytracing<br>More complex compound lens designs including Petzval, Telephotos, Triplets and Double Gauss<br>Aberrations in mirror systems |
| Learning and Teaching Approach | The module will be delivered as a combination of formal lectures (12 hours) covering lens design theory and practical sessions (30 hours) using lens design software to both evaluate optical system performance and then to optimise that performance. The practical component will be delivered as a set of exercises that link with and are interspersed with the theory taught in the lectures. |
| Assessment Strategy | Practical optical design is the application of theoretical principles, using practical computational skills and problem solving skills. To ensure the assessment covers all intended learning outcomes, a short report is assessed part way through the course on specific design exercises and a formal 2 hour written examination, incorporating written and practical (computational) problems, is provided at the end of the course. The examination carries twice the weight of the practical report. |
| Feedback | A set of problems are provided that students work through in the practical sessions. These interactive sessions provide an opportunity for group discussion and for students to receive formative feedback on the practical exercises as the different exercises are completed.<br><br>A summative assessment on a short report - submitted by the student on a subset of the exercises in the practical sessions - completed part way through the course. Formative feedback is provided on the report. |
| Reading list | Comprehensive notes will be provided to cover both the lectures and the practical exercises.<br>Lens design:<br>JM Geary: Introduction to lens design<br>R Kingslake: Lens design fundamentals<br>WJ Smith: Modern Optical Engineering<br>AE Conrady: Applied optics and optical design<br>Geometrical optics:<br>M Herzenberger: Modern geometrical optics<br>JE Greivenkamp: Field guide to geometrical optics<br>WT Welford: Aberrations in optical systems<br>Reference book: H Gross: Handbook of optical systems<br>Text book: JJM Braat & P Török: Imaging optics |
| Required equipment/ software | |

## Quality assurance

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| Date of first approval | |
| Date of last revision | February 2024 |

## Office use only

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| QA Lead | |
| Department staff | |

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|---|---|---|---|
| Date of this approval | | Date of collection | |
| | | Date exported | |
| Module leader | Mark Neil | Date imported | |
| Notes/ comments | | | |

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