

**Computational Data Science**  
**Applicable to students admitted in 2023-24**

**Major Programme Requirement**

Students are required to complete a minimum of 75 units of courses as follows:

|     |   | Units |
|-----|---|-------|
| 1.  | Faculty Package:<br>ENGG1110/ESTR1002, ENGG1120/ESTR1005 or MATH1030,<br>MATH1010 or 1510[a]  | 9     |
| 2.  | Foundation Courses:<br>CSCI1120/ESTR1100, CSCI2100/ESTR2102, ENGG2440/ESTR2004,<br>STAT2001[b], 2005, 2006  | 18    |
| 3.  | Required Courses:   | 27    |
| (a) | Algorithms and Computer Systems:<br>AIST3020, CSCI3160/ESTR3104   |       |
| (b) | Machine Learning:<br>Choose 3 units from the following:<br>CSCI3230/ESTR3108, CSCI3320, RMSC4002, STAT4001  |       |
| (c) | Operating Systems:<br>CSCI3150/ESTR3102   |       |
| (d) | Sampling:<br>Choose 6 units from the following:<br>STAT3003, 3006, 4010   |       |
| (e) | Statistical Inference:<br>STAT3008, 4003  |       |
| (f) | Statistical Modeling:<br>Choose 3 units from the following:<br>STAT3005 or 4006   |       |
| 4.  | Research Component Courses[c]:<br>CDAS4998, 4999  | 6     |
| 5.  | Elective Courses  | 15    |
|     | Choose any ONE from the following four options:   |       |
| (a) | <b>Computational Data Science</b><br>Choose at least 6 units from CSCI courses, at least 6 units from<br>RMSC/STAT courses, and at least 9 units of courses at 4000 or above<br>level:<br>CENG5030, CSCI3170, CSCI3220/ESTR3110, CSCI3260, 3280, 3310,<br>CSCI4130/IERG4130/ESTR4306, CSCI4160/ESTR4104, CSCI4180/<br>ESTR4106, CSCI4230, CSCI4250/ESTR4122, CSCI4430/ESTR4120,<br>CSCI5030, 5120, 5150, 5240, 5350, 5390, 5550, 5570,<br>ENGG1130/ESTR1006 or MATH2010, ENGG5101, IERG4300/<br>ESTR4300, RMSC4001, 4003, 4004, 4005, 4006, SEEM4630, 5330,<br>5680, STAT3001, 3007, 3009, 3210, 4002, 4004, 4005, 4008, 4012 |       |
| (b) | <b>Computational Physics</b><br>Required Courses:<br>PHYS1122, 2401, 3061, 4061<br>Elective Courses:<br>Choose 3 units from the following:  |       |

- PHYS1110, 1111
- (c) **Computational Medicine**  
 Required Courses:  
 PHPC2017, 3024, 3034  
 Elective Courses:  
 (i) Choose 3 units from the following:  
 PHPC1001, 1012, 1017  
 (ii) Choose 3 units from the following:  
 CSCI3220/ESTR3110, CSCI3290, STAT3210
- (d) **Computational Social Science**  
 Required Courses:  
 SOCI3102, 3238  
 Elective Courses:  
 Choose at least 9 units from the following:  
 SOCI2116, 2203, 3002, 3204, 3208, 3227, 3229, 3237

**Total:** 75

In addition to fulfilling the above Major Programme Requirement, students may also challenge themselves by taking the ELITE Stream offered by the Faculty of Engineering:

**Engineering Leadership, Innovation, Technology and Entrepreneurship (ELITE) Stream**[d]

Elective Courses:

15 units of courses[e]:

- (i) 12 units of ESTR courses of which at most 6 units of courses at 1000 or 2000 level and at least 6 units of courses at 3000 or 4000 level[f]
- (ii) 3 units of BMEG/CENG/CSCI/ELEG/ENGG/IERG/MAEG/SEEM courses at 5000 level[g]

Explanatory Notes:

1. All courses at 2000 and above level listed in the Major Programme Requirement will be included in the calculation of Major GPA for honours classification.
- [a] i) Non-JUPAS and JUPAS admittees with HKDSE Mathematics Extended Modules I or II are required to attend a Mathematics Placement Test. Students who fail or are absent from the Placement Test will be required to take MATH1020 in the same term when they take MATH1510.
- ii) JUPAS admittees without HKDSE Mathematics Extended Modules I or II are required to take MATH1020 concurrently with MATH1510.
- iii) Students who fail MATH1510 in Term 1 will have to retake the course in Term 2. The pre-assigned course, ENGG1130, will also be dropped.
- [b] Non-JUPAS and JUPAS admittees without HKDSE Mathematics Extended Modules I or II may consider taking STAT1011 in advance for enriching statistics knowledge, if necessary.
- [c] Students who have declared to specialize in the ELITE Stream will be required to complete 6 units of ESTR4998 and 4999 to substitute for CDAS4998 and 4999.
- [d] Details of the entrance and coursework requirements, and declaration procedures for the ELITE Stream can be found at the ELITE website ([www.erg.cuhk.edu.hk/erg/elite](http://www.erg.cuhk.edu.hk/erg/elite)). Non-ELITE Engineering students may be allowed to take ESTR courses. Students are required to seek approval from their respective Major Programmes for using ESTR courses taken to fulfill the Major Programme Requirement. Details are available at the ELITE website.
- [e] Students can use up to 9 units of courses which have been taken to fulfill the requirements of items 1 to 5 above to fulfill the elective requirements of the ELITE Stream. Item 4 Research Component Courses will not be included in these 9 units. A full list of ESTR courses is available at the ELITE website.

|     |   |
|-----|---|
| [f] | Students can use BMEG/CENG/CSCI/ELEG/ENGG/IERG/MAEG/SEEM courses at 5000 level to substitute for ESTR courses at 3000 or 4000 level, subject to the approval of the Stream Director and the Associate Dean (Education) of the Faculty of Engineering. |
| [g] | The requirement of at least 3 units of Engineering courses at 5000 level is a requirement for the ELITE Stream only. It should not be interpreted as a requirement of the Major Programme.  |

|   | <b>Recommended Course Pattern</b>  | <b>Units</b> |
|---|--|--------------|
| <b>First Year of Attendance</b>           | 1 <sup>st</sup> term<br>Faculty Package: ENGG1110/ESTR1002, MATH1010 or 1510<br>Major Required: STAT2001<br>Major Elective(s):   | 6<br>3       |
|   | 2 <sup>nd</sup> term<br>Faculty Package: ENGG1120/ESTR1005 or MATH1030<br>Major Required: STAT2005, 2006<br>Major Elective(s):   | 3<br>6       |
|   | 1 <sup>st</sup> term<br>Major Required: CSCI1120/ESTR1100, ENGG2440/ESTR2004, STAT3008<br>Major Elective(s):   | 9            |
|   | 2 <sup>nd</sup> term<br>Major Required: AIST3020, CSCI2100/ESTR2102<br>Major Elective(s):  | 6            |
| <b>Third Year of Attendance</b>           | 1 <sup>st</sup> term<br>Major Required: CSCI3150/ESTR3102, CSCI3160/ESTR3104, CSCI3230/ESTR3108 or CSCI3320 or RMSC4002 or STAT4001 (if not taking in the 2 <sup>nd</sup> term), one or two course(s) from STAT3003 or 3006 or 4010<br>Major Elective(s): 3 units from major electives | 9-12<br>3    |
|   | 2 <sup>nd</sup> term<br>Major Required: CSCI3230/ESTR3108 or CSCI3320 or RMSC4002 or STAT4001 (if not taken in the 1 <sup>st</sup> term), one or two course(s) from STAT3003 or 3006 or 4010<br>Major Elective(s): 3-6 units from major electives                                      | 6-9<br>3-6   |
|   | 1 <sup>st</sup> term<br>Major Required: CDAS4998, STAT3005 or 4006, 4003<br>Major Elective(s): 3-6 units from major electives  | 9<br>3-6     |
|   | 2 <sup>nd</sup> term<br>Major Required: CDAS4999<br>Major Elective(s): 6-9 units from stream required courses/major electives  | 3<br>6-9     |
| <b>Total (including Faculty Package):</b> |  | <b>75</b>    |

### Course List

| <i>Course Code</i>                 | <i>Course Title</i>                                      | <i>Unit(s)</i> |
|------------------------------------|--|----------------|
| AIST3020                           | Introduction to Computer Systems                         | 3              |
| CDAS4998                           | Final Year Project I                                     | 3              |
| CDAS4999                           | Final Year Project II                                    | 3              |
| CENG5030                           | Energy Efficient Computing                               | 3              |
| CSCI1120/<br>ESTR1100              | Introduction to Computing Using C++                      | 3              |
| CSCI2100/<br>ESTR2102              | Data Structures  | 3              |
| CSCI3150/<br>ESTR3102              | Introduction to Operating Systems                        | 3              |
| CSCI3160/<br>ESTR3104              | Design and Analysis of Algorithms                        | 3              |
| CSCI3170                           | Introduction to Database Systems                         | 3              |
| CSCI3220/<br>ESTR3110              | Algorithms for Bioinformatics                            | 3              |
| CSCI3230/<br>ESTR3108              | Fundamentals of Artificial Intelligence                  | 3              |
| CSCI3260                           | Principles of Computer Graphics                          | 3              |
| CSCI3280                           | Introduction to Multimedia Systems                       | 3              |
| CSCI3290                           | Computational Imaging and Vision                         | 3              |
| CSCI3310                           | Mobile Computing and Applications Development            | 3              |
| CSCI3320                           | Fundamentals of Machine Learning                         | 3              |
| CSCI4130/<br>IERG4130/<br>ESTR4306 | Introduction to Cyber Security                           | 3              |
| CSCI4160/<br>ESTR4104              | Distributed and Parallel Computing                       | 3              |
| CSCI4180/<br>ESTR4106              | Introduction to Cloud Computing and Storage              | 3              |
| CSCI4230                           | Computational Learning Theory                            | 3              |
| CSCI4250/<br>ESTR4122              | Online Algorithms for Machine Learning and Optimizations | 3              |
| CSCI4430/<br>ESTR4120              | Data Communication and Computer Networks                 | 3              |
| CSCI5030                           | Machine Learning Theory                                  | 3              |
| CSCI5050                           | Bioinformatics and Computational Biology                 | 3              |
| CSCI5120                           | Advanced Topics in Database Systems                      | 3              |
| CSCI5150                           | Machine Learning Algorithms and Applications             | 3              |
| CSCI5240                           | Combinatorial Search and Optimization with Constraints   | 3              |
| CSCI5350                           | Advanced Topics in Game Theory                           | 3              |
| CSCI5390                           | Advanced GPU Programming                                 | 3              |
| CSCI5550                           | Advanced File and Storage Systems                        | 3              |
| CSCI5570                           | Large Scale Data Processing Systems                      | 3              |
| ENGG1110/<br>ESTR1002              | Problem Solving by Programming                           | 3              |
| ENGG1120/<br>ESTR1005              | Linear Algebra for Engineers                             | 3              |
| ENGG1130/<br>ESTR1006              | Multivariable Calculus for Engineers                     | 3              |

|                       |   |   |
|-----------------------|---|---|
| ENGG2440/<br>ESTR2004 | Discrete Mathematics for Engineers                                  | 3 |
| ENGG5101              | Advanced Computer Architecture                                      | 3 |
| IERG4300/<br>ESTR4300 | Web-Scale Information Analytics                                     | 3 |
| MATH1010              | University Mathematics  | 3 |
| MATH1030              | Linear Algebra I  | 3 |
| MATH1510              | Calculus for Engineers  | 3 |
| MATH2010              | Advanced Calculus I   | 3 |
| PHPC1001              | Foundations in Public Health  | 2 |
| PHPC1012              | Biological Basis of Health  | 3 |
| PHPC1017              | Principles of Infectious Diseases                                   | 1 |
| PHPC2017              | Epidemiology  | 3 |
| PHPC3024              | Economics and Financing in Healthcare Systems                       | 3 |
| PHPC3034              | Applied Economics Evaluation in Health Care                         | 3 |
| PHYS1110              | Engineering Physics: Mechanics and Thermodynamics                   | 3 |
| PHYS1111              | Introduction to Mechanics, Fluids, and Waves (University Physics I) | 3 |
| PHYS1122              | University Physics II – Introduction to Optics and Modern Physics   | 3 |
| PHYS2401              | Introduction to Astronomy and Astrophysics                          | 3 |
| PHYS3061              | Introduction to Computer Simulation of Physical Systems             | 3 |
| PHYS4061              | Computational Physics   | 3 |
| RMSC4001              | Simulation Methods for Risk Management Science and Finance          | 3 |
| RMSC4002              | Financial Data Analytics with Machine Learning                      | 3 |
| RMSC4003              | Statistical Modelling in Financial Markets                          | 3 |
| RMSC4004              | Theory of Risk and Insurance  | 3 |
| RMSC4005              | Stochastic Calculus for Finance and Risk                            | 3 |
| RMSC4006              | Operational Risk Management   | 3 |
| SEEM4630              | E-Commerce Data Mining  | 3 |
| SEEM5330              | Speech and Language Processing                                      | 3 |
| SEEM5680              | Text Mining Models and Application                                  | 3 |
| SOCI2116              | Criminals and the Law   | 3 |
| SOCI2203              | Social Problems and Social Policy                                   | 3 |
| SOCI3002              | Social Stratification   | 3 |
| SOCI3102              | Social Networks and Social Capital                                  | 3 |
| SOCI3204              | Sociology of Crime and Deviance                                     | 3 |
| SOCI3208              | Gender and Society  | 3 |
| SOCI3227              | Social Demography   | 3 |
| SOCI3229              | Quantitative Data Analysis  | 3 |
| SOCI3237              | Medical Sociology   | 3 |
| SOCI3238              | Digital Sociology   | 3 |
| STAT2001              | Basic Concepts in Statistics and Probability I                      | 3 |
| STAT2005              | Programming Languages for Statistics                                | 3 |
| STAT2006              | Basic Concepts in Statistics and Probability II                     | 3 |
| STAT3001              | Foundation of Financial and Managerial Statistics                   | 3 |
| STAT3003              | Survey Methods  | 3 |
| STAT3005              | Nonparametric Statistics  | 3 |
| STAT3006              | Statistical Computing   | 3 |
| STAT3007              | Introduction to Stochastic Processes                                | 3 |
| STAT3008              | Applied Regression Analysis   | 3 |
| STAT3009              | Recommender Systems   | 3 |
| STAT3210              | Statistical Techniques in Life Sciences                             | 3 |

|          |  |   |
|----------|--|---|
| STAT4001 | Data Mining and Statistical Learning                               | 3 |
| STAT4002 | Applied Multivariate Analysis                                      | 3 |
| STAT4003 | Statistical Inference  | 3 |
| STAT4004 | Actuarial Science  | 3 |
| STAT4005 | Time Series  | 3 |
| STAT4006 | Categorical Data Analysis  | 3 |
| STAT4008 | Survival Modelling   | 3 |
| STAT4010 | Bayesian Learning  | 3 |
| STAT4012 | Statistical Principles of Deep Learning with Business Applications | 3 |