

Enquiry for Course Details

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| CHEM4142 Symmetry, group theory and applications (6 credits) | | Academic Year | 2022 |
| Offering Department | Chemistry | Quota | 60 |
| Course Co-ordinator | Dr E C M Tse, Chemistry < ecmte@hku.hk > | | |
| Teachers Involved | (Dr E C M Tse, Chemistry) (Dr K K H Ng, Chemistry) | | |
| Course Objectives | To introduce the concepts of symmetry and group theory and to apply them in solving chemical problems. This course also provides an introductory treatment of bonding theories, inorganic electronic and vibrational spectroscopy. This course is essential for students who wish to take advanced courses in inorganic chemistry and all types of spectroscopy. | | |
| Course Contents & Topics | Symmetry elements and symmetry operations; symmetry point groups; reducible and irreducible representations; character tables; direct products; symmetry-adapted linear combinations; projection operators; hybrid orbitals; molecular orbital theory for organic, inorganic and organometallic systems; selected applications in electronic and vibrational spectroscopy. | | |
| Course Learning Outcomes | On successful completion of this course, students should be able to: | | |
| | CLO 1 | understand the basic principles and concepts of symmetry and group theory and to apply them in solving chemical problems | |
| | CLO 2 | demonstrate knowledge and understanding in the use of character tables and projection operator techniques | |
| | CLO 3 | demonstrate knowledge and understanding of bonding theories involving hybrid orbitals and molecular orbitals for organic, inorganic and organometallic systems | |
| | CLO 4 | demonstrate knowledge and understanding in the application of symmetry and group theory in electronic and vibrational spectroscopy | |
| Pre-requisites (and Co-requisites and Impermissible combinations) | Pass in CHEM3341 | | |
| Course Status with Related Major/Minor /Professional Core | 2022 Major in Chemistry (Disciplinary Elective) 2022 Major in Chemistry (Intensive) (Core/Compulsory) 2022 Minor in Chemistry (Disciplinary Elective) 2021 Major in Chemistry (Disciplinary Elective) 2021 Major in Chemistry (Intensive) (Core/Compulsory) 2021 Minor in Chemistry (Disciplinary Elective) 2020 Major in Chemistry (Disciplinary Elective) 2020 Major in Chemistry (Intensive) (Core/Compulsory) 2020 Minor in Chemistry (Disciplinary Elective) 2019 Major in Chemistry (Disciplinary Elective) 2019 Major in Chemistry (Intensive) (Core/Compulsory) 2019 Minor in Chemistry (Disciplinary Elective) 2018 Major in Chemistry (Disciplinary Elective) 2018 Major in Chemistry (Intensive) (Core/Compulsory) 2018 Minor in Chemistry (Disciplinary Elective) | | |
| Course to PLO Mapping | 2022 Major in Chemistry < PLO 2,3,4 > 2022 Major in Chemistry (Intensive) < PLO 2,3,4 > 2021 Major in Chemistry < PLO 2,3,4 > 2021 Major in Chemistry (Intensive) < PLO 2,3,4 > 2020 Major in Chemistry < PLO 2,3,4 > 2020 Major in Chemistry (Intensive) < PLO 2,3,4 > 2019 Major in Chemistry < PLO 2,3,4 > 2019 Major in Chemistry (Intensive) < PLO 2,3,4 > 2018 Major in Chemistry < PLO 2,3,4 > 2018 Major in Chemistry (Intensive) < PLO 2,3,4 > | | |
| Offer in 2022 - 2023 | Y | 1st sem | Examination Dec |
| Offer in 2023 - 2024 | Y | | |
| Course Grade | A+ to F | | |

| Grade Descriptors | <table border="1"> <tr> <td data-bbox="394 80 496 277">A</td> <td data-bbox="496 80 1495 277">Demonstrate thorough knowledge and understanding of essential facts, concepts, principles, and theories relating to symmetry and group theory and their applications in solving chemical problems, especially those related to symmetry elements and symmetry operations; symmetry point groups; reducible and irreducible representations; character tables; direct products; symmetry-adapted linear combinations; projection operators; treatment of bonding theories including hybrid orbitals and molecular orbitals for organic, inorganic and organometallic systems; and applications in electronic and vibrational spectroscopy. Show strong ability to apply and integrate knowledge and theory relating to the basic principles and concepts of symmetry and group theory and their applications in bonding, and electronic and vibrational spectroscopy. 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| Course Type | Lecture-based course | | | | | | | | | | | | | | | | |
| Course Teaching & Learning Activities | <table border="1"> <thead> <tr> <th data-bbox="394 1106 967 1128">Activities</th> <th data-bbox="967 1106 1297 1128">Details</th> <th data-bbox="1297 1106 1495 1128">No. of Hours</th> </tr> </thead> <tbody> <tr> <td data-bbox="394 1128 967 1173">Lectures</td> <td data-bbox="967 1128 1297 1173"></td> <td data-bbox="1297 1128 1495 1173">36</td> </tr> <tr> <td data-bbox="394 1173 967 1218">Tutorials</td> <td data-bbox="967 1173 1297 1218">or discussion</td> <td data-bbox="1297 1173 1495 1218">12</td> </tr> <tr> <td data-bbox="394 1218 967 1263">Reading / Self study</td> <td data-bbox="967 1218 1297 1263"></td> <td data-bbox="1297 1218 1495 1263">100</td> </tr> </tbody> </table> | Activities | Details | No. of Hours | Lectures | | 36 | Tutorials | or discussion | 12 | Reading / Self study | | 100 | | | | |
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| Assessment Methods and Weighting | <table border="1"> <thead> <tr> <th data-bbox="394 1276 603 1299">Methods</th> <th data-bbox="603 1276 933 1299">Details</th> <th data-bbox="933 1276 1134 1321">Weighting in final course grade (%)</th> <th data-bbox="1134 1276 1495 1321">Assessment Methods to CLO Mapping</th> </tr> </thead> <tbody> <tr> <td data-bbox="394 1321 603 1366">Assignments</td> <td data-bbox="603 1321 933 1366"></td> <td data-bbox="933 1321 1134 1366">25</td> <td data-bbox="1134 1321 1495 1366">CLO 1,2,3,4</td> </tr> <tr> <td data-bbox="394 1366 603 1411">Examination</td> <td data-bbox="603 1366 933 1411"></td> <td data-bbox="933 1366 1134 1411">50</td> <td data-bbox="1134 1366 1495 1411">CLO 1,2,3,4</td> </tr> <tr> <td data-bbox="394 1411 603 1456">Test</td> <td data-bbox="603 1411 933 1456">(test/project)</td> <td data-bbox="933 1411 1134 1456">25</td> <td data-bbox="1134 1411 1495 1456">CLO 1,2,3,4</td> </tr> </tbody> </table> | Methods | Details | Weighting in final course grade (%) | Assessment Methods to CLO Mapping | Assignments | | 25 | CLO 1,2,3,4 | Examination | | 50 | CLO 1,2,3,4 | Test | (test/project) | 25 | CLO 1,2,3,4 |
| Methods | Details | Weighting in final course grade (%) | Assessment Methods to CLO Mapping | | | | | | | | | | | | | | |
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| Required/recommended reading and online materials | F.A. Cotton: Chemical Applications of Group Theory (Wiley, 3rd ed., 1990) | | | | | | | | | | | | | | | | |
| Course Website | NIL | | | | | | | | | | | | | | | | |
| Additional Course Information | This course is also offered to RPg students, and the course code for RPg students is CHEM6116. | | | | | | | | | | | | | | | | |