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| Course Code | PHYS8654 (RPG) | | |
| Title | General relativity | | |
| Offering Department | Physics | | |
| Course Co-ordinator | Dr K M Lee Physics | | |
| Course Co-ordinator Email | kmlee@lily.physics.hku.hk | | |
| Teachers Involved | Name | Department | Percentage |
| | Dr K M Lee | Physics | 100 |
| Course Objectives | This course serves as a graduate level introduction to general relativity. It provides conceptual skills and analytical tools necessary for astrophysical and cosmological applications of the theory. | | |
| Course Contents & Topics | Topics include: The principle of equivalence; inertial observers in a curved space-time; vectors and tensors; parallel transport and covariant differentiation; the Riemann tensor; the stress-energy tensor; the Einstein gravitational field equations; the Schwarzschild solution; black holes; gravitational waves detected by LIGO, and Friedmann equation. | | |
| Course Learning Outcomes (CLO) | On successful completion of this course, students should be able to:<br>CLO 1 apply the mathematical and physical ideas of the theory of general relativity for the study of various systems in astrophysics and cosmology<br>CLO 2 explain the observational effects at the scale of the Solar System that cannot be described by Newtonian gravity from a general relativistic point of view<br>CLO 3 demonstrate knowledge and discuss the dynamic interactive physical processes in astrophysics by using a general relativistic approach | | |
| Pre-requisites (and Co-requisites and Impermissible combinations) | Nil | | |
| Offer in 2024 - 2025 | Y 1st sem | Examination | Dec |
| Course Grade | A+ to F | | |
| Grade Descriptors | A: Demonstrate thorough mastery at an advanced level of extensive knowledge and skills required for attaining all the course learning outcomes. Show strong analytical and critical abilities and logical thinking, with evidence of original thought, and ability to apply knowledge to a wide range of complex, familiar and unfamiliar situations. Apply highly effective organizational and presentational skills.<br>B: Demonstrate substantial command of a broad range of knowledge and skills required for attaining at least most of the course learning outcomes. Show evidence of analytical and critical abilities and logical thinking, and ability to apply knowledge to familiar and some unfamiliar situations. Apply effective organizational and presentational skills.<br>C: Demonstrate general but incomplete command of knowledge and skills required for attaining most of the course learning outcomes. Show evidence of some analytical and critical abilities and logical thinking, and ability to apply knowledge to most familiar situations. Apply moderately effective organizational and presentational skills.<br>D: Demonstrate partial but limited command of knowledge and skills required for attaining some of the course learning outcomes. Show evidence of some coherent and logical thinking, but with limited analytical and critical abilities. Show limited | | |

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<tr><td></td><td colspan="3">ability to apply knowledge to solve problems. Apply limited or barely effective organizational and presentational skills.<br>Fail: Demonstrate little or no evidence of command of knowledge and skills required for attaining the course learning outcomes. Lack of analytical and critical abilities, logical and coherent thinking. Show very little or no ability to apply knowledge to solve problems. Organization and presentational skills are minimally effective or ineffective.</td></tr>
<tr><td>Course Type</td><td colspan="3">Lecture-based elective course</td></tr>
<tr><td rowspan="4">Course Teaching & Learning Activities</td><td>Activities</td><td>Details</td><td>No. of Hours</td></tr>
<tr><td>Lectures</td><td></td><td>36</td></tr>
<tr><td>Tutorials</td><td></td><td>12</td></tr>
<tr><td>Reading/Self study</td><td></td><td>80</td></tr>
<tr><td rowspan="4">Assessment Methods and Weighting</td><td>Methods</td><td>Details</td><td>Weighting in final course grade (%)</td></tr>
<tr><td>Assignments</td><td></td><td>20</td></tr>
<tr><td>Examination</td><td>2-hour written exam</td><td>50</td></tr>
<tr><td>Test</td><td></td><td>30</td></tr>
<tr><td>Quota</td><td colspan="3">9999 (9999 if no quota)</td></tr>
<tr><td>Required/recommended reading and online materials</td><td colspan="3">Lecture notes provided by Course Coordinator<br>R. M. Wald: General Relativity (University of Chicago Press, 1984)<br>T. A. Moore: A General Relativity Workbook (Univ Science Books, 2012)<br>J. B. Hartle: Gravity: An Introduction to Einstein's General Relativity (Addison-Wesley, 2003)<br>B. Schutz: A First Course in General Relativity (Cambridge University Press, 2009)</td></tr>
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