**FI461 Computational Physics**

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| Module name: | Computational Physics | |
| Module level, if applicable: | Undergraduate | |
| Code: | FI461 | |
| Sub-heading, if applicable: | - | |
| Classes, if applicable: | - | |
| Semester: | 5th | |
| Module coordinator: | Waslaluddin | |
| Lecturer(s): | Waslaluddin | |
| Language: | Bahasa Indonesia | |
| Classification within the curriculum | Compulsory course | |
| Type of Teaching | Contact hours per week during the semester | Class Size |
| 1. Lecture (conceptual, contextual, and problem-solving approaches through expository, discussions and practical methods).<br>2. Structured activities (assignments based on conceptual, contextual, and problem-solving approaches)<br>3. Self-study (Experiment and Computing Numerical) | 3 hour 20 minutes | 35 |
| Workload: | The total workload is 181 hours 20 minutes (6.4 ECTS) per semester, consisting of 40 hours/2400 minutes lectures (1.41 ECTS), 56 hours/3360 minutes structured activities (1.98 ECTS) and 56 hours/3360 minutes self-study (1.98 ECTS) per week for 12 weeks, 29 hour 11 minutes for two exams and two exam preparations (1.03 ECTS) | |
| Credit points: | 6.4 ECTS | |
| Pre-requisites course(s): | FI121 Basic Physics I, FI122 Basic Physics II, FI222 Mathematical Physics I, FI240 Mathematical Physics II, FI242 Algorithm and Programming | |
| Course Learning Outcomes (CLO): | After taking this course the students have ability to:<br>CLO1. Explain arithmetic and logic in computer systems, analysing errors in data storage and processing.<br>CLO2. Describes characteristic number of decimals, binary, and floating-point number in computer systems<br>CLO3. Explain arithmetic and logic in Python system.<br>CLO4. Apply microprocessor technology as *Scientific Tools* for Computational Physics (Mathematical modelling, | |

<table>
<tr><td></td><td>Programming using Python, Running and displays results)<br>CLO5. Apply microprocessor technology as a numerical method solution for computational physics principles and applications<br>CLO6. Apply the technology of micro- processor as the basis of data analysis computation results<br>CLO7. Apply theICT in using microprocessor technology as a computing instrument<br>CLO8. Explain Numerical Method Analysis of Non-Linear Equations, Interpolation and Approximation<br>CLO9. Explain Numerical Analysis for Differential and Numerical Integral<br>CLO10. Create numerical models for physical systems whose solutions use mathematical systems as a tool.<br>CLO11. Explain Numerical analysis for PDP system<br>CLO12. Explain Numerical analysis for physical systems<br>CLO13. Report the results of solving problems with numerical methods for relevant physics cases<br>CLO14. Report the results of solving problems using numerical methods for chaos and fractal cases</td></tr>
<tr><td>Content:</td><td>The material discussed in this lecture includes Arithmetic and Logic in Python , Numerical Computing (Mathematical Models, Selection of Methods, Algorithms, Programming, Running, Interpretation of Results) Numerical Methods (Solution of Non-linear Equations, Systems of Linear Equations, Interpolation and Approximation, Differential and Numerical Integrals, Ordinary Differential Equations, Systems of Differential Equations, Partial Differential Equations) Case Studies Numerical computing in physics (Motion, Magnetism, Kinetic Theory of Gases, Thermodynamics, Sound, Modern Physics and Chaos and fractals)</td></tr>
<tr><td>Study/exam achievements:</td><td>The final mark will be weight as follow:
<table>
<tr><th>No</th><th>CLO</th><th>Assessment Object</th><th>Assessment Techniques</th><th>Weight</th></tr>
<tr><td>1</td><td>CLO1 – 12<br><br>CLO1 – 6<br>CLO6 – 12<br>CLO13-14</td><td>Subject specific competences:<br>a. Individual assignments<br>b. Exam<br>- Mid exam<br>- Final exam<br>c. Class activity<br>d. Project</td><td>Written<br><br>Written test<br>Written test<br>Performance<br>Report</td><td>20 %<br><br>25%<br>25%<br>10%<br>20%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
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<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer, Demonstration, LMS</td></tr>
<tr><td>Literature:</td><td>1. Gezerlis, A. (2020). Numerical methods in physics with Python. Cambridge University Press.<br>2. Boudreau, J. F., Swanson, E. S., & Bianchi, R. M. (2017). Applied computational physics.<br>3. Landau, R. H., Páez, M. J., & Bordeianu, C. C. (2015). Computational Physics. John Wiley & Sons.<br>4. Epperson, J. F. (2013). An introduction to numerical methods</td></tr>
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| | and analysis. Wiley-Interscience.<br>5. Gerald, C. F., & Wheatley, P. O. (2007). Applied numerical analysis. Pearson, Addison Wesley.<br>6. Rao, S. S. (2002). Applied numerical methods for engineers and scientists. Prentice Hall. |

**PLO and CLO mapping**

| | PLO1 | PLO 2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLO1 | √ | | | | | | | | | | | |
| CLO2 | √ | | | | | | | | | | | |
| CLO3 | √ | | | | | | | | | | | |
| CLO4 | | | √ | | | | | | | | | |
| CLO5 | | | √ | | | | | | | | | |
| CLO6 | | | √ | | | | | | | | | |
| CLO7 | | | | √ | | | | | | | | |
| CLO8 | | | | | √ | | | | | | | |
| CLO9 | | | | | √ | | | | | | | |
| CLO10 | | | | | √ | | | | | | | |
| CLO11 | | | | | √ | | | | | | | |
| CLO12 | | | | | √ | | | | | | | |
| CLO13 | | | | | √ | | | | | | | |
| CLO14 | | | | | √ | | | | | | | |