

Content

| Course Code | Course Name           | Semester | Theory | Practice | Lab | Credit | ECTS |
|-------------|-----------------------|----------|--------|----------|-----|--------|------|
| IND371      | Operations Research I | 5        | 4      | 0        | 0   | 4      | 5    |

|                        |        |
|------------------------|--------|
| Prerequisites          | ING207 |
| Admission Requirements | ING207 |

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|-------------------------|---|
| Language of Instruction | French  |
| Course Type             | Compulsory  |
| Course Level            | Bachelor Degree   |
| Objective               | The aim of this course is to equip students with pertinent modeling and mathematical programming knowledge and skills for solving decision making problems. |

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|------------|---|
| Content    | <ul style="list-style-type: none"> <li>- Introduction</li> <li>- Stages of modeling</li> <li>- Introduction to linear programming</li> <li>- Graphical solution</li> <li>- Linear programming model</li> <li>- Assumptions of linear programming</li> <li>- Additional examples of linear programming</li> <li>- Simplex method</li> <li>- Algebra of the simplex method</li> <li>- Simplex method in tabular form</li> <li>- Artificial variables technique</li> <li>- Big M method</li> <li>- Two-phase method</li> <li>- Degeneracy; Alternative optimal solutions; Unbounded solution; Infeasible solution</li> <li>- Post-optimality analysis</li> <li>- Quiz 1</li> <li>- Theory of the simplex method</li> <li>- Revised simplex method</li> <li>- Duality</li> <li>- Duality theory</li> <li>- Economic interpretation of duality</li> <li>- Complementary slackness theorem</li> <li>- Midterm</li> <li>- Presentation of an LP solver</li> <li>- Dual simplex method</li> <li>- Sensitivity analysis</li> <li>- Bounded variables technique</li> <li>- Transportation problem</li> <li>- Definition of the transportation problem</li> <li>- Finding an initial basic feasible solution</li> <li>- Transportation simplex method</li> <li>- Assignment problem</li> <li>- Quiz 2</li> <li>- Network models</li> <li>- Terminology of networks</li> <li>- Shortest-path problem</li> <li>- Minimum spanning tree problem</li> <li>- Dynamic programming</li> <li>- Introduction</li> <li>- Principle of optimality</li> <li>- Examples of deterministic dynamic programming</li> </ul> |
| References | <ul style="list-style-type: none"> <li>- Hillier, F.S., Lieberman, G.J., Introduction to Mathematical Programming, McGraw-Hill, 1995.</li> <li>- Bazaraa, M.S., Jarvis, J.J., Sherali, H.D., Linear Programming and Network Flows, John Wiley &amp; Sons, 1990.</li> <li>- Taha, H.A., Operations Research: An Introduction, Tenth edition, Pearson, 2017.</li> </ul>   |

### Theory Topics

| Week | Weekly Contents  |
|------|--|
| 1    | Stages of modeling; Introduction to linear programming; Graphical solution                             |
| 2    | Linear programming model; Assumptions of linear programming; Additional examples of linear programming |
| 3    | Simplex method; Algebra of the simplex method; Simplex method in tabular form                          |
| 4    | Artificial variables technique; Big M method; Two-phase method   |

| Week | Weekly Contents   |
|------|---|
| 5    | Degeneracy, alternative optima, unbounded solution, infeasible solution; Post-optimality analysis |
| 6    | Theory of the simplex method; Revised simplex method  |
| 7    | Duality; Duality theory; Economic interpretation of duality; Complementary slackness theorem      |
| 8    | Midterm   |
| 9    | Presentation of an LP solver; Dual simplex method   |
| 10   | Sensitivity analysis; Bounded variables technique   |
| 11   | Transportation problem; Finding an initial basic feasible solution; Transportation simplex method |
| 12   | Assignment problem  |
| 13   | Network models; Terminology of networks; Shortest-path problem; Minimum spanning tree problem     |
| 14   | Dynamic programming; Principle of optimality; Examples of deterministic dynamic programming       |