**REGULATION OF OPERATION OF THE INTER-INSTITUTIONAL POSTGRADUATE PROGRAM (I.P.P.S.) entitled**

**"Postgraduate Diploma in Sports Analytics"**

**(«MSc in Sports Analytics»)**

**OF THE DEPARTMENT OF STATISTICS OF AUEB**

**&**

**OF THE DEPARTMENT OF PHYSICAL EDUCATION AND SPORTSSCIENCE OF THE NATIONAL AND KAPODISTRIAN UNIVERSITY OF ATHENS**

## General Provisions

The Department of Statistics of the Athens University of Economics and Business (AUEB) and the Department of Physical Education and Sports Science of the National and Kapodistrian University of Athens (TEFAA) will operate the Inter-Institutional Postgraduate Program (IPP) entitled "Postgraduate Diploma (M.M.E.) in Sports Analytics" (Master of Science (MSc) in Sports Analytics). Its operation is governed by the provisions of Law 4957/2022, Joint Ministerial Decision 18137/Z1/2023/Government Gazette 1079/B/28-2-2023, this Regulation, the Regulation of Postgraduate and Doctoral Study Programs of the Athens University of Economics and Business (B 3140/2023) and by the relevant decisions of the Senate of the Athens University of Economics and Business.

The Rules of Operation of the IPPS entitled "**Postgraduate Diploma in Sports Analytics"** are drawn up by decision of its competent bodies, approved by the Senate, published in the Government Gazette and posted on the website of the JPSP. The Regulation of Operation may be amended and revised periodically without losing its basic structure and content, following the above procedure.

## Article 1

## Field of Expertise

The Inter-Institutional Postgraduate Program (I.P.P.S.) entitled "Master of Science (MSc) in Sports Analytics" aims to provide specialized postgraduate level knowledge to graduates of Greek and recognized foreign universities in the basic fields of Statistics, Analytical, and Data Science in problems arising from Sports.

The subject of the IPPS is the training of postgraduate students in the following fields of knowledge: a) Statistical Modeling, b) Sports Data Analytics c) Machine Learning, d) Sports

Performance and Performance Data Analytics, e) Sports Data Science.

**Article 2**

**Official Language of the Program and Title of the Diploma Awarded**

1. The official language of instruction of the Master's degree is English.
2. The I.P.P.S. awards a Master's Degree entitled "MSc in Sports Analytics" with the following specializations:

a) Specialization 1: Sport Data Science

b) Specialization 2: Applied Sports Analytics

3. The specialization is indicated in the detailed grade and in the Diploma Supplement of the students who have attended it and not in the degree.

4. The program will be offered in two versions: Full-time and part-time. The full-time program will last 3 academic semesters with a maximum duration of two (2) years. The part-time program will last 5 academic semesters and a maximum duration of 3 years.

5. The program yields 90 credit credits (ECTS)

**Article 3**

**Program Governing Bodies**

Competent bodies for the organization and operation of .I.P.P.S. according to Law 4957/2022 are:

a) the Senate of the Foundation, which exercises the responsibilities of par. 1 of article 82 of Law 4957/2022.

b) the Curriculum Committee (E.P.S.), which exercises the responsibilities of par. 2 of article 82 of Law 4957/2022.

c) the Coordinating Committee (C.C.) of the Postgraduate Program, which exercises the responsibilities of par. 3 of article 82 of Law 4957/2022.

d) the Director of the Postgraduate Program which exercises the responsibilities of par. 4 of article 82 of Law 4957/2022.

**Article 4**

**Number of Admissions - Categories of Candidates**

1. The number of entrants to the program is set at a maximum of fifty (50) for the full-time

program and fifty (50) for the part-time program per year of admission (which will be divided into two specializations per program with a different type of study).

2. Holders of a title of the first cycle of studies of a domestic University or equivalent recognized Institutions abroad (level six (6) of the National and European Qualifications Framework in accordance with article 47 of Law 4763/2020) are admitted.

**Article 5**

**Criteria and Procedure for the Selection of Candidates**

1. The selection of admissions is made in accordance with the provisions in force and the provisions of this Regulation.
2. By decision of the Coordinating Committee, an announcement for the admission of postgraduate students is published and posted on the program's and the Institutions website. The announcement contains all the relevant details (dates and place of submission of the application, necessary supporting documents that must accompany it, selection criteria, etc.). Applications together with the necessary supporting documents are submitted electronically or submitted to the Secretariat, within a deadline set during the announcement and may be extended by decision of the Coordinating Committee.
3. The required supporting documents submitted by each candidate are as follows:

    a) An application with a recent photo.

    b) A copy of a degree with a detailed grade or a certificate of completion of studies. Seniors must submit a declaration under Law 1599/1986 that their acceptance is subject to the acquisition of a degree until the examination period of September that follows.

    c) Proof of good knowledge of the English language. Those who do not hold the required title during the application period must submit a declaration of Law 1599/1986 that their acceptance is subject to the acquisition of the required proof of knowledge of English (at least B2)

    d) Two letters of recommendation from teachers and/or employers.

    e) A detailed curriculum vitae, with references to any published scientific papers and any relevant professional experience.

    g) Candidates may submit other supporting documents that, at their discretion, can support their application (e.g. evidence of research and professional activities).

4. 4. In case of submission of an application by a candidate who holds a degree from a foreign

institution, the secretariat, in order to accept the application as eligible for examination, checks through DOATAP whether the institution is recognized, following the prescribed procedure in accordance with the applicable provisions.

5. Certificates can be submitted in English or Greek.
6. Admissions for the first specialization (Sport Data Science) will be graduates with a strong quantitative background, i.e. graduates of Statistics, Mathematics, Informatics, Polytechnic Schools, Economics departments and other related scientific subjects.
7. Applicants for the second specialization (Applied Sports Analytics) will be graduates with a strong background in Sports Sciences, Management Sciences, Economics and other related scientific subjects.
8. The criteria for the selection of candidates are:

    a) Degree grade(s).

    b) Grades in undergraduate courses, which are related to the program's courses.

    c) Performance in a diploma thesis, where this is provided for at the undergraduate level.

    d) University and Department of origin.

    e) Type of research experience.

    f) Knowledge of the English language at the level Good (B2).

    g) Letters of recommendation from faculty members or employers.

    h) Extra training programs related to the program

    i) IT knowledge

    j) Certification of mathematical background through international tests, university courses or a test given by the program.

    Additional Selection Criterion for the Partial Course of study: Previous experience in the field of Sports and/or Data Analytics.

9. The details of the application of the criteria (e.g. points, coefficients) are decided by the Coordinating Committee.
10. The selection procedure is as follows:

    a) The Coordinating Committee establishes the Candidate Evaluation Committee.

    b) The application file of each candidate is evaluated by the Candidate Evaluation Committee in accordance with the following procedure:

    c) The Secretariat initially compiles a complete list of all those who have applied.

d) The Candidate Evaluation Committee:

i) Rejects candidates who do not meet the selection criteria.

ii) Awards points to the candidates according to the criteria that have been decided.

iii) Prioritizes the candidates.

v) Invites for interview those candidates who are selected to be called. Outstanding students may be admitted without an interview.

v) Based on the candidates' final score, it compiles the final selection list.

11. The final list of successful candidates and any runners-up is validated by the Coordinating Committee.

12. The successful candidates, after being informed by the Secretariat, are invited to respond in writing within the deadline set by the Coordinating Committee, as to whether they accept their inclusion in the Program. The lapse of the above deadline is equivalent to a refusal of acceptance, after which the Secretariat informs the next in the evaluation order from the relevant list of successful candidates. To be included in the program, it is necessary to deposit an amount of € 500 as against the 1st installment of the tuition fees within 7 days from their written acceptance.

**Article 6**

**Registration**

1. The registration of admitted postgraduate students of each year takes place from **September 20 to October 15** of each year within deadlines set by the Director after approval of the Coordinating Committee.
2. The candidate, before registering, is informed of the current Regulation of Operation, the Regulation of Postgraduate and Doctoral Programs of AUEB (B 3140/2023), the Code of Ethics and Good Practice of the Athens University of Economics and Business (B' 7257/2022) and declares in writing that he/she accepts them. For reasons of exceptional necessity, the Coordinating Committee may, following a reasonable request by the interested party, decide that the registration can take place within one month from the expiration of the deadline.
3. Candidates who will not be able to meet the conditions under which they are admitted or withdraw from the program, at any time after their acceptance of the position offered to them, are not entitled to a refund of the amounts they paid. Exceptionally, by decision of the competent body, the amount paid as against the 1st installment is refunded, provided that

the candidate is accepted and enrolled at a later time in another Postgraduate Program of the AUEB. This possibility expires on August 31 of each year.

## Article 7

## Duration of Studies – Terms of Study – Students' Rights and Obligations

1. The duration of studies for the award of the Postgraduate Diploma (MSc) for the full-time department is set at **three (3) semesters**, which includes the time required to complete the thesis.
2. For the part-time department, the duration of studies for the award of the Postgraduate Diploma (MSc) is set at five (5) **semesters,** which includes the time required to complete the thesis.
3. The maximum allowed time for the completion of studies is set at **two (2) years** for the full-time department and **three (3) years** for the part-time department.
4. The postgraduate student, upon his/her application, may request a justified temporary suspension of studies which does not exceed **one year** in total. The time of suspension of student status is not counted in the maximum duration of regular study. Upon his/her return to study, the student continues to be subject to the study regime of his/her registration time as a postgraduate student (full-time or part-time). The continuation of studies after the suspension is done under the terms and rules of operation of the program upon its return.
5. Postgraduate students have the rights and obligations as defined in the Regulation of Postgraduate and Doctoral Programs of AUEB (article 11, B 3140/2023).
6. To improve the program's operation in the context of a student-centered approach, the mechanism for managing the complaints and objections of the postgraduate students has been put into operation, in order to ensure the quality of the educational and administrative services provided. (Decision of the Rector's Council of AUEB 19$^{the}$ meeting/23-05-2023)

## Article 8

## Course Program – Organization of the Educational Process

1. The Program starts at the beginning of each academic year. The total credits of the program are ninety (90) credits (ECTS).
2. During their studies, postgraduate students are required to attend and successfully complete postgraduate courses, prepare a thesis or undertake an internship, and possibly engage in research activities and the writing of scientific papers.

3. The teaching of the courses is carried out with a blended-learning system, in accordance with the applicable provisions. At least 70% of the educational process is implemented through distance learning, either synchronous or asynchronous, while the rest can be conducted in person. A "blended-learning system" is defined as a pedagogically documented method that combines distance and face-to-face teaching. The organization of the educational process ensures the full accessibility of people with disabilities and special educational needs.

4. The courses are held on a weekly basis and are conducted in English (with the possibility of conducting them in Greek only when there are no foreign language students). The technological equipment required for each student to attend the program and evaluate it is access to a desktop computer or portable device (laptop or tablet) and internet connection

5. To obtain the Postgraduate Diploma (MSc) it is required to complete 90 credits (ECTS) as follows:

   a) Mandatory attendance and successful completion of courses corresponding to sixty (60) European Credit Transfer System (ECTS) credits. If unjustified absences in a course exceed one-third (1/3) of the total teaching hours, the student is considered to have failed the course and must retake it once more in the immediately following period when it is offered.

   b) Preparation-Writing of a Diploma Thesis, or Internship *(by writing a relevant internship report similar to the diploma thesis)* or a combination of other educational activities *(courses, conferences, seminars, summer school, internship)* after approval by the Coordinating Committee corresponding to thirty (30) Credit Teaching Units (ECTS).

6. The courses of each academic year (two teaching semesters) are organized into three teaching periods (TP) of 10 teaching weeks each, followed by examination periods, the duration of which is determined by the Coordinating Committee. Consequently, the two teaching semesters in the full-time program are divided into three Teaching Semesters and the four teaching semesters in the part-time program are divided into six Teaching Programs. exams three times in each academic year, in the following months: December/January, March/April and June/July.

The program of taught and examined courses is defined in detail in Tables 1 & 2 below.

Table *1:* 1st Lessons ***Specialization*** (Sports Data Science)

| **Specialization Courses 1: Sports Data Science** | **ECTS** | **Remotely** | **TP Full-time** | **TP Part-time** |
|---|---|---|---|---|
| 1) Introduction to R and Python (Εισαγωγή στην R και στην Python) | 5 | >70% | 1 | 1 |
| 2) Data Analysis (Ανάλυση Δεδομένων) | 5 | >70% | 1 | 1 |
| 3) Visualization and Data Science-Story Telling (Οπτικοποίηση και Εξιστόρηση Επιστημονικών Συμπερασμάτων βασισμένη σε Δεδομένα) | 5 | >70% | 1 | 4 |
| 4) Sports Performance Analysis (Ανάλυση Αγωνιστικής Απόδοσης) | 5 | >70% | 1 | 4 |
| 5) Sports Modelling (Αθλητική Μοντελοποίηση) | 5 | >70% | 2 | 2 |
| 6) Big Data Analytics and Management (Αναλυτική και Διαχείριση Μεγάλων Δεδομένων) | 5 | >70% | 2 | 2 |
| 7) Applied Sport Economics (Εφαρμοσμένα Οικονομικά του Αθλητισμού) | 5 | >70% | 2 | 5 |
| 8) Machine Learning (Μηχανική Μάθηση) | 5 | >70% | 2 | 5 |
| 9) Basketball Data Science (Επιστήμη Δεδομένων Καλαθοσφαίρισης) | 5 | >70% | 3 | 3 |
| 10) Football Analytics (Αναλυτική του Ποδοσφαίρου) | 5 | >70% | 3 | 3 |
| 11) Choice of 10 credits (ECTS) from the following elective courses | 10 | >70% | 2/3 | 5/6 |
| | | | | |
| **Elective Courses** | **ECTS** | **Remotely** | **TP Full-time** | **TP Part-time** |
| 12) Sports Marketing (Αθλητικό Μάρκετινγκ) | 5 | >70% | 2 | 5 |
| 13) Anthology of Sports (Ανθολογία Αθλημάτων) | 2,5 | >70% | 3 | 6 |
| 14) Operational research and scheduling of athletic events | 2,5 | >70% | 3 | 6 |
| 15) Coaching by numbers | 2,5 | >70% | 3 | 6 |
| 16) Sports Law (Αθλητική Νομοθεσία) | 2,5 | >70% | 3 | 6 |
| 17) Sports Management (Αθλητικό Μάνατζμεντ) | 2,5 | >70% | 3 | 6 |
| 18) Olympic Event Organization | 2,5 | >70% | 3 | 6 |
| 19) Biomechanics of human movement (Μηχανική της Ανθρώπινης Κίνησης) | 2,5 | >70% | 3 | 6 |
| 20) Integrated Exercise Physiology (Φυσιολογία της Άσκησης) | 2,5 | >70% | 3 | 6 |
| 21) Special Topics of Sports Analytics (Ειδικά θέματα Αναλυτικής Δεδομένων) | 2,5 | >70% | 1-6 | 1-6 |
| 22) Additional courses offered in the 2nd specialization (Applied Sports Analytics) but only with the approval of the E.P.S. at the request of the interested student | 5 | >70% | 1-6 | 1-6 |

Table 2: Courses ***2nd Specialization*** (Applied Sports Analytics)

| **Specialization Courses 2: Applied Sports Analytics** | **ECTS** | **Remotely** | **TP Full-time** | **TP Part-time** |
|---|---|---|---|---|
| Introduction to Mathematics for Sports Analytics (Introduction to Mathematics for Sports Analytics) | 0 | >70% | 0 | 0 |
| 1) Introduction to R and Python (Εισαγωγή στην R και στην Python) | 5 | >70% | 1 | 1 |
| 2) Introduction to Statistical Methods (Εισαγωγή στις Στατιστικές Μεθόδους) | | >70% | 1 | 1 |
| 3) Visualization and Data Science-Story Telling (Οπτικοποίηση και Εξιστόρηση Επιστημονικών Συμπερασμάτων βασισμένη σε Δεδομένα) | 5 | >70% | 1 | 4 |
| 4) Sports Performance Analysis (Ανάλυση Αγωνιστικής Απόδοσης) | 5 | >70% | 1 | 4 |
| 5) Data Analysis (Ανάλυση Δεδομένων) | 5 | >70% | 2 | 2 |
| 6) Sports Marketing (Αθλητικό Μάρκετινγκ) | 5 | >70% | 2 | 2 |
| 7) Applied Sport Economics (Εφαρμοσμένα Οικονομικά του Αθλητισμού) | 5 | >70% | 2 | 5 |
| 8) Sustainability in Sports (Βιώσιμη Ανάπτυξη στον Αθλητικό) | 5 | >70% | 2 | 5 |
| 9) Basketball Data Science (Επιστήμη Δεδομένων Καλαθοσφαίρισης) | 5 | >70% | 3 | 3 |
| 10) Football Analytics (Αναλυτική του Ποδοσφαίρου) | 5 | >70% | 3 | 3 |
| 11) Choice of 10 credits (ECTS) from the following elective courses | 10 | | 2/3 | 5/6 |
| | | | | |
| **Elective Courses** | **ECTS** | **Remotely** | **TP Full-time** | **TP Part-time** |
| 1) Sports Modelling (Αθλητική Μοντελοποίηση) | 5 | >70% | 2 | 5 |
| 2) Machine Learning (Μηχανική Μάθηση) | 5 | >70% | 2 | 2/5 |
| 3) Big Data Analytics and Management (Αναλυτική και Διαχείριση Μεγάλων Δεδομένων) | 5 | >70% | 2 | 2/5 |
| 4) Anthology of Sports (Ανθολογία Αθλημάτων) | 2,5 | >70% | 3 | 6 |
| 5) Operational research and scheduling of athletic events | 2,5 | >70% | 3 | 6 |
| 6) Coaching by numbers | 2,5 | >70% | 3 | 6 |
| 7) Sports Law (Αθλητική Νομοθεσία) | 2,5 | >70% | 3 | 6 |
| 8) Sports Management (Αθλητικό Μάνατζμεντ) | 2,5 | >70% | 3 | 6 |
| 9) Olympic Event Organization | 2,5 | >70% | 3 | 6 |
| 10) Biomechanics of human movement (Μηχανική της Ανθρώπινης Κίνησης) | 2,5 | >70% | 3 | 6 |
| 11) Integrated Exercise Physiology (Φυσιολογία της Άσκησης) | 2,5 | >70% | 3 | 6 |
| 12) Special Topics of Sports Analytics (Ειδικά θέματα Αναλυτικής Δεδομένων) | 2,5 | >70% | 1-6 | 1-6 |

- For students of the 2nd specialization (Applied Sports Analytics) which, after evaluation, do not have a sufficient mathematical background, a preparatory course entitled

"*Introduction to Mathematics for Sports Analytics*" will be offered. This course does not yield Credit Credits (ECTS), will have a duration of 15 teaching hours, will be mentioned in the appendix of the degree and will be a prerequisite (with a passable grade of ≥5) for obtaining degree.

- Modification of the course schedule and redistribution between semesters can be made by decisions of the competent bodies in accordance with the Postgraduate Studies Regulation.
- **Thesis Preparation** *(see Article 10 of this Regulation)*.
- **Internship**: Students can do an internship and at the same time prepare a diploma thesis on a related subject.
- **Seminars**: The Program will offer a series of seminars.
- **Laboratories**: Students of the program will have access to the laboratories of the Department of Statistics of the Athens University of Economics and Business.
- **Other educational activities**: The postgraduate program can organize educational events for its students such as educational trips, worskhops, conferences, visits to companies, competitions.

The Annex to this Regulation briefly presents the content of the postgraduate courses as well as the minimum teaching hours per course. The detailed presentation of each postgraduate course is given in the study guide.

7. The timetable of courses/exercises and examinations is drawn up and announced at least ten days before the start of the teaching period.
8. Postgraduate students declare the courses they will attend at the beginning of each teaching period on dates announced by the Secretariat.
9. In case of an impediment to conducting a lecture, the lecturer immediately informs the Program's Director and the Secretariat, and the replacement of the lecture is scheduled. Students are informed in an appropriate manner and within a reasonable period of time about the date of the lecture substitution.
10. Attendance of courses is mandatory. If unjustified absences in a course exceed one-third (1/3) of the total teaching hours, the student is considered to have failed the course and must retake it once more in the immediately following period when it is offered. If the number of absences exceeds the limit set by the Program's Regulations and the reasons for absence are serious, the case may be examined—upon application by the postgraduate student - by the Program Committee for final approval. If the required number of attendances is not met, the student is considered to have failed the course.

11. The Interdepartmental Postgraduate Program provides postgraduate students with the possibility of recognizing courses from previous postgraduate degrees, provided that at least 75% of the course content is covered by a corresponding course in a previous Postgraduate Program. The recognition is granted by decision of the Program Committee following an application by the postgraduate student.
12. The Program will organize alternative educational activities such as conferences, workshops, summer schools and short courses (with visiting teachers). These actions can be conducted remotely or in person. The participation of students in these actions will be optional and may lead to the award of a simple additional educational certification and/or the award of educational credits (ECTS) through the elective courses. The decision to carry out an educational activity and its details (type, topic, professor or speakers, teaching units) are determined by the c of the postgraduate program.

**Article 9**

**Examination and Performance Evaluation Rules**

1. The assessment of courses is carried out through written or oral examinations, which may be conducted in person or through written or oral examinations administered via remote methods, as well as through alternative methods such as the submission of assignments, the conduct of practical tests, or a combination of the above.
2. The determination of the method and procedure for assessing students in a course (through written or oral examinations, conducted in person or via written or oral examinations administered through remote methods, as well as through alternative methods such as the submission of assignments, the conduct of practical tests, or a combination of the above) is the responsibility of the assigned instructor.
3. Formation of each course’s final grade is determined by the respective teachers. Students' individual and group assignments can contribute to this.
4. Participation in the exams on the specific date announced according to the Program is mandatory. If a student does not appear on the specific examination date of a course, he/she misses the examination period and is considered to have failed the course.
5. The grading scale is defined from zero (0) to ten (10) with gradations of the whole or half a point. Transferable grades are 5 and its highest.
6. Rescoring of an exam is not allowed in order for the student to obtain a passing grade or to improve his/her score. Correction of a grade after its announcement by the Secretariat is allowed, if the teacher has inadvertently entered an incorrect grade (a written one should be

attached). The correction will be made after the submission of a relevant application/document by the teacher and a decision of the Coordinating Committee.

7. In case a student fails a course, he/she can be re-examined in this course in a repeat examination period at most two (2) times in each course.

8. Any graduate student can take exams in courses they failed during the September exam period. If a student fails the September exam, then he/she is entitled to be examined in the next exam of the course and in case of failure he/she is deleted from the program by receiving only a certificate of attendance after a decision of the Coordinating Committee. Non-participation in the exams is considered a failure.

9. The internal operating regulations of OPA governs a) the alternative methods for assessing students with disabilities and special educational needs; b) the provisions for assessing students who are demonstrably ill or recovering from a serious illness during the examination period. Until the issuance of the Internal Operating Regulations, these matters will be regulated by the Senate of OPA.

10. The Coordinating Committee may decide to expel postgraduate students (in addition to the cases provided for in the relevant legislative regulations) in the following cases:

    a) The insufficient progress of the postgraduate student.

    b) The non-fulfillment of financial obligations until the maximum allowed time of completion of studies, including the completion of the Diploma Thesis, if provided, as defined in the Operating Regulation of the Master's Program.

    c) The improper fulfillment of other obligations defined by the relevant Regulation.

    d) Conduct that offends academic ethics according to the current legislation.

    e) Application of the postgraduate student himself/herself.

11. In case of deletion of the postgraduate student according to the above, it is not possible to refund any tuition fees paid, unless there are special reasons and the Program's Committee decides on a reasoned basis.

**Article 10**

**Dissertation Thesis (D.E.) and Internship**

The Dissertation Thesis (D.E.) is prepared after the successful completion of the courses of the program after a supervisor has been appointed and contributes 30 ECTS to the final degree and duration of one academic semester.

1. The right to supervise diploma theses is granted to the lecturers of par. a) to f) of par. 1

of article 83 of Law 4957/2022 provided that they hold a doctoral degree. By decision of the Coordinating Committee, the supervision of dissertation theses may also be assigned to Faculty members, Special Teaching Staff and Special Teaching and Research Staff of the Department, who have not undertaken teaching work in the Postgraduate Program (par. 3. Article 83 of Law 4957/2022). In exceptional cases of objective inability to exercise supervisory duties for a long period of time or the existence of another important reason, the Coordinating Committee may, after justifying its decision, replace the supervisor or Member of the Three-Member Examination Committee.

2. Specific issues related to the process of preparation and the writing of the Thesis are defined in the Guide for the Preparation of the Diploma Thesis, which is issued by decision of the Coordinating Committee and is posted on the Program's website.
3. The language of writing the thesis is English.
4. The minimum time for the preparation of the DT is three (3) months while the maximum is fifteen (15) months upon request for extension.
5. Alternatively, instead of a Ph.D., the student can do an internship in a company upon application and acceptance by the Coordinating Committee.
6. The minimum duration of the internship will be 3 months and a maximum of 6 months. Regarding working hours, a minimum of 480 hours is required, which corresponds to an eight-hour (8-hour) work week for the quarter.
7. The payroll of the internship is undertaken entirely by the cooperating company after an agreement with the interested postgraduate student, without the involvement or responsibility of the Postgraduate Program.
8. At the end of the internship, the student is obliged to submit a report describing the internship's subject and analysis.
9. For the Thesis or Internship to be evaluated, the postgraduate student must support it before the Three-Member Examination Committee.
10. In case of failure in the examination of the Thesis or the Internship, the student may be re-examined one (1) more time, not earlier than three (3) months and if he/she does not exceed the required time for completion of the program. In case of a second failure, the student is deleted from the Program following a Committee decision and is entitled to a simple certificate of successful attendance of courses following a decision of the Committee.
11. The DE or Internship will count for 30 credit credits (ECTS) and a grade will be awarded that will not be counted in the final grade of the master's degree.

## Article 11

## Postgraduate Diploma Award and Grade

1. The postgraduate student completes his/her studies and receives the Postgraduate Diploma when he/she fulfills all the obligations provided for by the Program, i.e. successful examination in the courses of the program, approval of the diploma thesis or internship and payment of tuition fees, if provided. If the above is not achieved within the prescribed deadlines, the postgraduate student is entitled only to a simple certificate of successful attendance of the courses where he/she received a promotion grade, and his/her attendance in the Program ends.
2. The final grade of the Postgraduate Diploma (MSc) is derived as a weighted average of the grades of the courses weighted by credit credits (ECTS). The dissertation thesis (DE) or the internship do not contribute to the final grade.
3. The grade of the Postgraduate Diploma (MSc) certifies the successful completion of the postgraduate student's studies. The awarded Master's Degree is marked Good, Very Good, Excellent, which corresponds to:
    - "Excellent" from 8.51 to 10
    - "Very Good" from 6.51 to 8.50
    - "Good" from 5 to 6.50
4. Until the diploma is awarded, the Secretariat may issue a certificate of completion of studies stating the date of graduation.

## Article 12

## Advisor Professor of Postgraduate Students

For each postgraduate student, one faculty member is appointed by the Department's Committee as a Consultant Professor, to support him/her during his/her studies in accordance with the decision of the AUEB Senate (6th meeting/12-01-2023) and the Regulation of Postgraduate and Doctoral Studies Programs of the Institution (article 12, B 3140/2023).

## Article 13

## Funding Sources - Tuition Fees

1. The main source of funding for the Program will be from the participants' tuition fees.
2. Additional funding may come from sponsorships of Sports organizations or companies or

funding from National or International programs. Also, from donations, benefits, bequests, sponsorships, research programs, programs of the EU or other international organizations, tuition fees and other sources, as provided by the current legislation.

3. The tuition fees for attending the Program are set at eight thousand euros (€8,000) and the possibility of partial payment is provided as determined by the Program's Coordinating Committee.
4. Postgraduate students are required to pay their financial obligations in full by the beginning of the examination period of each semester.
5. If a postgraduate student has not met his financial obligations, he is not entitled to a certificate of successful completion of studies. In addition, it is possible to temporarily suspend studies or delete the student from the Program, following a decision of the Coordinating Committee.
6. Enrolled students can study free of charge in accordance with the current legislation.
7. Tuition fees for students coming from bilateral agreements (domestic or foreign) will be determined by the respective agreement.

**Article 14**

**Scholarships – Awards**

1. The Program may provide several scholarships based on objective, academic, economic and social criteria to female students, in accordance with a decision of Coordinating Committee, which determines the amount and number of scholarships, the criteria and relevant supporting documents, the procedure for granting the scholarships, as well as the obligations and rights of the scholars. In case a scholarship recipient/student does not comply with their obligations, the Program Committee proceeds with the withdrawal of their scholarship.
2. The Program may also award prizes to students with exceptional performance, in accordance with criteria and a procedure determined by decision of the Program Committee.
3. In addition, the Program may, following a reasoned decision of the Program Committee, exempt students in whole or in part from the obligation to pay tuition fees, provided that they provide work to the Program or the Institution.
4. Students who have received a scholarship may offer compensatory work (tutoring courses, contribution to the library and research and, where necessary, to the services of the University) following a decision of the Program Committee.

**Article 15**

**Instructors - Teaching assignment**

1. Each course is taught by one or more instructors. The assignment of teaching work is done in accordance with the applicable provisions.
2. The obligations of the lecturers include, among other things, the provision of information to students regarding the description of the course, the brief content and title of the lectures with citation of relevant bibliography, the way the course is examined, the supervision of the diploma thesis, the communication with the postgraduate students. Teachers are advised to use the digital platform of the University or the Program or the course they teach, in which they will include notes, presentations, aids, etc.

**Article 16**

**Graduation Ceremony**

1. A student who has successfully completed his/her postgraduate studies takes the oath in the graduation ceremony, before the Rector or the Vice-Rector as a representative of the Rector, the Dean of the School, the Head of the Department and the Director of the JPSP. The oath is not a constitutive requirement for the successful completion of studies; however, it is a prerequisite for the awarding of the postgraduate diploma.
2. For reasons of force majeure and with his/her application to the Secretariat, the graduate may request the granting of the degree without participating in the graduation ceremony or request to participate in the next. Before taking the oath or being exempted from it, graduates may be given a relevant certificate for the successful completion of their studies.
3. Graduates who do not wish to take a religious oath are allowed to simply invoke their honor and conscience.

**Article 17**

**Administrative – Financial Support**

The Program is administratively supported by the Secretariat for Postgraduate and Doctoral Studies of the School of Information Sciences and Technology of AUEB, in accordance with the provisions of the decision no. 6094/27-09-2019 of the Senate of AQA (Government Gazette 3803 B').

1. In addition, there is a special secretariat, which serves the students and teachers of the Program and assists the work of the EPS and the Director.
2. The financial management and execution of the budget is carried out by the E.L.K.E./O.P.A., in accordance with the provisions in force from time to time.

**Article 18**

**Validity**

The Program entitled "MSc in in Sports Analytics" in its current form will operate until the academic year 2034-2035 with the possibility of renewal in accordance with the applicable provisions. and subject to its certification during the periodic evaluation of the Department.

**Article 19**

**Transitional provisions**

1. This Regulation applies to students who enroll and begin their studies in the academic year 2025-2026.
2. Any issues not regulated in this Regulation will be regulated by decisions of the competent bodies in accordance with the applicable legislation.

THE RECTOR OF THE NATIONAL AND KAPODISTRIAN UNIVERSITY OF ATHENS

Professor Gerasimos Siasos

THE RECTOR OF THE ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS

Professor Vassilios Vasdekis

**APPENDIX – Course Content – Minimum Teaching Hours**

**Specialization Courses 1: Sports Data Science**

### Introduction to R and Python

(Duration 30 Hours, Teaching Credits: 5 ECTS)

Fundamentals of Programming. Introduction to R: basic package elements, command-line interface, and graphical interface. Arithmetic operations and expressions. Objects, object types, and data types. Loop syntax: for, while, and repeat loops. Program creation and result lists. Special commands. Plotting in R, including multiple plots. Functions.

Introduction to Python. History, uses, and advantages. Basic syntax. Variables and data types: numbers, strings, lists, tuples, and dictionaries. Basic operations: assignment, arithmetic operations, printing text.

Conditional statements: if-else. Loops: for and while. Creating and calling functions. Introduction to data processing: reading and writing files, data manipulation (sorting, filtering, etc.). Application of programming concepts: development of a simple end-to-end project as an example.

*Suggested Bibliography*


- Wickham, H., & Grolemund, G. (2017). R for Data Science. O'Reilly Media.
- Matthes, E. (2019). Python Crash Course: A Hands-On, Project-Based Introduction to Programming. No Starch Press.


### Data Analysis (Ανάλυση Δεδομένων)

(Duration 30 Hours, Teaching Credits: 5 ECTS)

Statistical methods are presented through simple problems using R: descriptive analysis, graphical representation, simulation of random numbers from theoretical distributions, confidence intervals, hypothesis tests for one and two independent samples, hypothesis tests for two paired samples, contingency tables, simple and multiple regression analysis, and analysis of variance (ANOVA) for one and two factors. Case studies and analysis of real datasets from various scientific fields (Economics, Marketing, Social Sciences, Sports, Medicine, Psychology, and others) are included. Basic principles of report writing and presenting data analyses are also covered.

*Suggested Bibliography*


- Field, A., Miles, J., & Field, Z. (2012). Discovering Statistics using R. SAGE Publications Ltd.


### Visualization and Data Science-Story Telling

(Duration 30 Hours, Teaching Credits: 5 ECTS)

This course teaches students the essential skills to become effective data storytellers. They will learn how to identify and acquire datasets, extract insights from the data, and present their findings in a variety of formats. Students will learn how to "connect the dots" within a dataset through data visualization and uncover the narrative thread that explains what is happening, engaging their audience in a compelling data-driven story. Additionally, students will learn how to tailor their data storytelling to different audiences and stakeholders, adapting the presentation to maximize understanding and impact.

*Suggested bibliography*


- Knaflic, C. N. (2015). *Storytelling with data: A data visualization guide for business professionals*. John Wiley & Sons.


### Sport Performance Analysis

(Duration 30 Hours, Teaching Credits: 5 ECTS)

The Sport Performance Analysis course is an applied sports science program focused on understanding, improving, and analyzing performance in sports. The curriculum gradually develops students' knowledge in tactical analysis, measurement of technical effectiveness, and analysis of specific technical skills within actual athletic performance, using a range of modern techniques and technologies. Additionally, the course includes familiarity with coach and athlete behavior analysis and the application of athlete monitoring techniques. Core topics in Sport Performance Analysis are complemented by content from related fields such as coaching, pedagogy, and exercise science. These elements give the course a unique perspective, allowing students to understand both the theoretical principles and the applied skills that underpin effective performance analysis.

*Suggested bibliography*


- O'Donoghue, P. (2014). *An introduction to performance analysis of sport*. Routledge.
- Memmert, D. (Ed.). (2021). *Match analysis: how to use data in professional sport*.

Routledge.

### Sports modelling

(Duration 15 Hours, Teaching Credits: 2.5 ECTS)

The course focuses on the application of statistical modeling in the field of sports. First, the simple and multiple linear regressions are analyzed, with a focus on fitting the model using the least squares method. Variable selection and model selection, as well as the diagnosis and treatment of deviations from model assumptions are also analyzed. Finally, applications will be presented in performance analysis data as well as prediction and inference techniques in match results in sports such as basketball. Continuing, the extension of regression models to special datasets suitable for sports modeling is analyzed. Logistic regression is then examined, with different models for two-valued responses and applications for sports with two-valued outcomes, such as most sports that do not allow for tied endings. This is followed by polynomial regression for categorical outcomes with an emphasis on sports that allow for a draw as a final result such as football.

*Suggested bibliography*

- Wasserman, L. (2013). All of statistics: a concise course in statistical inference. Springer Science & Business Media.
- Krzanowski, W. J. (1998). An introduction to statistical modelling.
- Morgan, B. J. (2008). Applied stochastic modelling. CRC press.

### Machine Learning (Μηχανική Μάθηση)

(Duration 30 Hours, Teaching Credits: 5 ECTS)

The course examines fundamental concepts related to Machine Learning. Topics include overfitting and the bias–variance trade-off, as well as the distinction between prediction and inference. Cross-validation techniques are discussed, including train/test/validation splits and Bootstrap methods. Various learning approaches are also covered, such as supervised and unsupervised learning, along with classification methods including LDA, k-NN, neural networks, decision trees, random forests, support vector machines (SVM), and Naive Bayes.

The course also addresses model performance evaluation using metrics such as accuracy, misclassification rate, sensitivity, specificity, ROC curves, AUC, Lift, Brier score, and F1. Clustering techniques are introduced, including distance-based methods, hierarchical

clustering, k-means, stochastic model-based clustering, and density-based clustering. Finally, dimensionality reduction methods, such as Principal Component Analysis (PCA) and Singular Value Decomposition (SVD), as well as shrinkage and variable selection techniques like LASSO, are analyzed.

*Suggested bibliography*


- Hastie, T., Tibshirani, R., & Friedman, J. (2009). The elements of statistical learning: Data mining, inference, and prediction. Springer.
- James, G., Witten, D., Hastie, T., & Tibshirani, R. (2013). An introduction to statistical learning: With applications in R. Springer.
- Murphy, K. P. (2012). Probabilistic machine learning: An introduction. MIT Press.


### Basketball Data Science

(Duration 30 Hours, Teaching Credits: 5 ECTS)

The detailed curriculum in Basketball data science combines programming skills and specialization in the field, with knowledge of mathematics and statistics to extract meaningful basketball-related insights from data. At the most elite level of basketball, teams use tracking cameras positioned at all angles of the court to monitor every movement each player makes on the floor. This data is then synchronized with player statistics to provide a comprehensive analysis of player performance.

*Suggested bibliography*


- Zuccolotto, P., & Manisera, M. (2020). *Basketball data science: With applications in R*. CRC Press.
- Shea, S. M., & Baker, C. E. (2013). *Basketball analytics: Objective and efficient strategies for understanding how teams win*. Advanced Metrics.


### Football Analytics

(Duration 30 Hours, Teaching Credits: 5 ECTS)

Performance analysis in football has developed in recent years to the point where all professional teams have access to some level of data and employ performance analysts to assist coaches, analysts, players, and staff in working with new available technologies, particularly video. However, as detailed data and analytical insights become integrated into club processes, it is essential for personnel to have the skills not only to interpret and apply this

information correctly but also to present and support knowledge to decision-makers. Teams also gather large databases containing their own subjective player information, but these data are often not managed properly, and clubs still have limited knowledge of how to use data for strategic planning. The Football Analytics course aims to develop managers who can make decisions—based on provided models—regarding match selections as well as the evaluation of both players and teams.

*Suggested bibliography*


- Memmert, D., & Raabe, D. (2018). *Data analytics in football: Positional data collection, modelling and analysis*. Routledge.
- Memmert, D., Strauss, B., & Theweleit, D. (2023). *Mind Match Soccer: The Final Step to Become a Champion*. Springer Nature.


### Applied Sport Economics

(Duration 30 Hours, Teaching Credits: 5 ECTS)

The aim of the course is to apply the principles and methodology of economic analysis to various aspects of sports, including professional leagues, teams, athletes, facilities, events, and fan consumer behavior. Key topics addressed include competition, understanding pricing strategies, demand elasticity and its influencing factors, collective bargaining of player contracts and salaries, revenue distribution mechanisms, assessment of the economic impact of facilities and events, and the rights and broadcasting market.

Overall, applied sports economics can provide valuable insights into the complex interactions between economic forces and competitive strategies within the sports industry, significantly contributing to the decision-making process for all stakeholders—from investors and team owners to league administrators, policymakers, and fans.

*Suggested Bibliography*


- Késenne, S. (2014). *The economic theory of professional team sports: An analytical treatment*. Edward Elgar Publishing.
- Leeds, M. A., Von Allmen, P., & Matheson, V. A. (2022). *The economics of sports*. Routledge


### Big Data Analytics and Management

(Duration 30 Hours, Teaching Credits: 5 ECTS)

The course examines the analysis and management of large-scale data. It also explores the problems and challenges that arise in the era of Big Data. Technologies and trends in the field of Big Data are analyzed, including large databases, the Map-Reduce paradigm, Big Data mining, and Big Data platforms.

Definitions and explanations of fundamental database concepts and their basic design schemas are provided. A brief introduction to the SQL language is also included.

In addition, the course covers data engineering and data cleaning, with emphasis on handling missing values and collecting data from websites (web scraping)..

*Suggested bibliography*


- Chen, M., Mao, S., & Liu, Y. (2014). Big data: Related technologies, challenges and future prospects. Springer.
- Marz, N., & Warren, J. (2015). Big data: Principles and best practices of scalable realtime data systems. Manning Publications.

**Specialization Electives 1: Sports Data Science**

### Anthology of Sports

(Duration 15 Hours, Teaching Credits: 2.5 ECTS)

This course aims to introduce students to the specific characteristics of data analysis across various sports, as well as to the challenges related to data collection, data issues, and analysis. The course will cover track and field sports (prediction, movement and technique evaluation), net & wall sports (such as tennis and volleyball), and American sports (baseball, American football, and hockey). It will also examine the challenges that arise in e-games, where there is an abundance of available data (ranging from player behavior patterns to strategic choices). Finally, a comparison will be made between one-on-one individual sports and team sports. Case studies using data from different sports will be included.

Through this course, students will gain an understanding of the application of data analysis methods in different sports, as well as the challenges that emerge from this process. This knowledge will equip them with the tools needed to develop and implement analytical strategies in the field of sports.

*Suggested bibliography*


- Albert, J., & Bennett, J. and Cochran, J.J. (2007). *Anthology of Statistics in Sports*. ASA-SIAM Series on Statistics and Applied Probability. Society for Industrial and Applied Mathematics.
- Albert J., Glickman M.E., Swartz T.B, Koning R.H. (2019). *Handbook of Statistical Methods and Analyses in Sports*, Handbooks of Modern Statistical Methods, Chapman & Hall/CRC
- Statistics Meets Sports Hardcover – March 1, 2023
- Dominicy Y. and Ley C. (2023). *Statistics Meets Sports*. Cambridge Scholars Publishing; 1st edition (March 1, 2023)


### Operational research and scheduling of athletic events

(Duration 15 Hours, Teaching Credits: 2.5 ECTS)

This course aims to introduce students to the applications of Operations Research in sports scheduling. Students will acquire knowledge in modeling and problem-solving techniques related to creating fair, efficient, and engaging match schedules across various sports.

Introduction to Operations Research: Fundamental concepts and methodologies, and mathematical decision-making models.

Sports Event Scheduling: Objectives and constraints, factors affecting schedule creation (e.g., facility availability, team travel, spectator attendance).

Problem Modeling: Linear optimization models for sports scheduling.

Nonlinear Models and Solution Algorithms: Techniques such as genetic algorithms and simulated annealing.

Schedule Evaluation and Analysis: Performance metrics for sports scheduling, including fairness, balance, and commercial viability.

Software Applications: Tools for developing and analyzing schedules.

Applications Across Different Sports: Case studies drawn from real-world sports practice.

*Suggested bibliography*


- Lawrence, J.A. and Pasternack, B.A. (2002). Applied Management Science: Modeling, Spreadsheet Analysis, and Communication for Decision Making. Wiley & Sons
- Ribeiro C.C., Urrutia S., de Werra D. (2023). Combinatorial Models for Scheduling Sports Tournaments. EURO Advanced Tutorials on Operational Research Series. Springer Nature Switzerland; DOI: https://doi.org/10.1007/978-3-031-37283-4
- Serbin B.J. (2019). A Schedule Quick: Quick & Easy Scheduling for Recreational Sports Leagues.


### Coaching by numbers

(Duration 15 Hours, Teaching Credits: 2.5 ECTS)

In today's data-driven world, sports teams increasingly rely on analytics to gain a competitive edge. While coaches have traditionally depended on experience and intuition, the emergence of sports data analytics has revolutionized the way teams approach game strategies and player development.

Sports data is part of a process of collecting, analyzing, and interpreting information related to athletic performance. Coaches and players use it to gain insights and make evidence-based decisions.

Sports analytics data can be collected from various sources, such as video, wearable devices, tracking systems, and statistical databases. By identifying patterns in player performance, coaches can adjust training programs to address specific weaknesses or enhance existing strengths.

*Suggested bibliography*


- O'Donoghue, P., & Holmes, L. (2014). *Data analysis in sport*. Routledge.
- Passos, P., Araújo, D., & Volossovitch, A. (2016). *Performance analysis in team sports*. Taylor & Francis.

### International Sports Law (Διεθνές Αθλητικό Δίκαιο)

(Duration 15 Hours, Teaching Credits: 2.5 ECTS)

The course is an introduction to the basic concepts that are formed in the international legal order through the highlighting of cases from international competitive and sports activity. It includes the basic methods and procedures for the interpretation of provisions, the institutional framework of sport, the issue of doping, the methods of resolving sports disputes, the supranational character and the limits of autonomy and independence of international sports law. The ultimate goal of the course is to understand how rules work in sports from their creation to their implementation.

*Suggested bibliography*

- Nafziger, J. (2021). International sports law. In *International Sports Law, 2d ed*. Brill Nijhoff.

### Sports Management

(Duration 15 Hours, Teaching Credits: 2.5 ECTS)

The Sports Management course focuses on the organization, management, and coordination of various aspects of the sports industry. Its aim is to provide students with the knowledge and skills necessary for the smooth operation and success of sports organizations, events, facilities, and enterprises, with an emphasis on the core functions of sports management. The course covers the understanding of fundamental management principles, the importance of strategic planning, and the implementation of policies and procedures to achieve organizational objectives effectively. It also emphasizes human resource development and management processes, as well as understanding the legal and ethical aspects that influence sports and the administration of sports organizations.

*Suggested bibliography*

- Masteralexis, L. P. (2023). Principles and practice of sport management. Jones & Bartlett Learning.
- Slack, T., & Parent, M. M. (2006). *Understanding sport organizations: The application of organization theory*. Human Kinetics.

### Olympic Event Organization

(Duration 15 Hours, Teaching Credits: 2.5 ECTS)

The course focuses on the key issues involved in the successful organization of Olympic events, spanning the bidding process, coordination and collaboration among various stakeholders, and post-event evaluation. It emphasizes the factors that shape the overall experience of both

participating athletes and spectators, particularly regarding infrastructure, security, marketing, and promotion. The course also includes case studies on the connection with local communities within the framework of sustainable sports event management.

*Suggested bibliography*

- Parent, M. M., & Ruetsch, A. (2020). *Managing major sports events: Theory and practice*. Routledge.

### Biomechanics of human movement

(Duration 15 Hours, Teaching Credits: 2.5 ECTS)

The course focuses on the concepts of biomechanical modeling for the analysis of human movement. It addresses students' needs regarding mechanical modeling from the perspective of analyzing sports skills, the development of key concepts in human body kinematics and movement dynamics, as well as an introduction to modeling the human musculoskeletal system.

*Suggested bibliography*

- McGinnis, P. M. (2013). *Biomechanics of sport and exercise*. Human Kinetics.

### Integrated Exercise Physiology

(Duration 15 Hours, Teaching Credits: 2.5 ECTS)

The aim of this course is to enable students to understand, monitor, and analyze biological and physiological data that can be included in athlete monitoring for performance and/or health purposes. Upon completion of the course, students will be able to recognize physiological adaptations to exercise and training, manage methods and tools for assessing biological and physiological parameters, identify all relevant biological data that can be included in an athlete's monitoring record for medical or performance purposes, and analyze athletic activity by applying scientific knowledge.

*Suggested bibliography*

- Kraemer, W. J., Fleck, S. J., & Deschenes, M. R. (2011). *Exercise physiology: integrating theory and application*. Lippincott Williams & Wilkins.

### Sports Marketing

(Duration 15 Hours, Teaching Credits: 2.5 ECTS)

The purpose of the course is to familiarize students with the application of marketing principles and functions in the sports sector. Through the course, students analyze and gain deeper insight into topics and practices related to sports events, teams, athletes, and sports products or services. Emphasis is placed on understanding sports consumer behavior, the importance and methods of market research, and the creation and promotion of both sports programs and sponsorship initiatives.

*Suggested bibliography*


- Dees, W., Walsh, P., McEvoy, C. D., McKelvey, S., Mullin, B. J., Hardy, S., & Sutton, W. A. (2022). *Sport marketing*. Human Kinetics.


### Special Topics of Sports Analytics

(Duration 30 Hours, Teaching Credits: 5 ECTS)

- The course "Special Topics in Sports Analytics" aims to expose students to advanced, innovative, and contemporary topics in Sports Analytics through specialized lectures delivered by internationally recognized scientists and industry professionals. The course serves as a platform for introducing cutting-edge techniques and applications that are not fully covered in the program's core courses.
- Additionally, this course incorporates activities such as thematic workshops, seminars, conferences, and hands-on project-based exercises that connect theory with practice.
- Indicative Topics: (topics may vary each year/semester depending on collaborations and guest lectures)
-
- Advanced Player Tracking Analytics
- Tactical and Spatial Analysis in Team Sports
- Machine Learning for Performance and Injury Prediction
- Wearable Technologies and Data Interpretation
- Biomechanics and Sports Data
- Bayesian Models in Sports
- Psychology and Cognitive Analytics in Sport Performance
- Salary Cap and Financial Decision Modeling in Sports
- e-Sports Analytics and Gaming Data
- Decision Support Systems for Coaching and Scouting

*Suggested bibliography*

- Severini, T. A. (2020). Analytic methods in sports: Using mathematics and statistics to understand data from baseball, football, basketball, and other sports. 2nd Edition. CRC Press.
- Dominicy, Y., & Ley, C. (Eds.). (2023). Statistics Meets Sports: What We Can Learn from Sports Data. Cambridge Scholars Publishing

**Specialization Course 2: Applied Sports Analytics**

## Introduction to Mathematics for Sports Analytics

(Preparation Course, Duration 15 Hours, Teaching Credits: 0 ECTS)

The purpose of this introductory course is to refresh the knowledge of students (who do not come from science fields) in basic mathematical concepts. During this course we will cover: the concepts of deduction, integral, maximization of a function, and basic concepts of linear algebra and matrices (matrix operations, matrix inversion, matrix determinant).

*Suggested bibliography*

- Kraljevic, A. H. (2006). Calculus for Non-Mathematics Majors. Pearson.
- Harville, D. A. (2008). Matrix Algebra From a Statistician's Perspective. Springer.

## Introduction to R and Python

(Duration 30 Hours, Teaching Credits: 5 ECTS)

Fundamentals of Programming. Introduction to R: basic package elements, command-line interface, and graphical interface. Arithmetic operations and expressions. Objects, object types, and data types. Loop syntax: for, while, and repeat loops. Program creation and result lists. Special commands. Plotting in R, including multiple plots. Functions.

Introduction to Python. History, uses, and advantages. Basic syntax. Variables and data types: numbers, strings, lists, tuples, and dictionaries. Basic operations: assignment, arithmetic operations, printing text.

Conditional statements: if-else. Loops: for and while. Creating and calling functions. Introduction to data processing: reading and writing files, data manipulation (sorting, filtering, etc.). Application of programming concepts: development of a simple end-to-end project as an example.

*Suggested bibliography*

- Wickham, H., & Grolemund, G. (2017). R for Data Science. O'Reilly Media.
- Matthes, E. (2019). Python Crash Course: A Hands-On, Project-Based Introduction to Programming. No Starch Press.

## Introduction to Statistical Methods

(Duration 30 Hours, Teaching Credits: 5 ECTS)

This course introduces students to essential tools and techniques for analyzing and interpreting data, supporting informed decision-making. Through the application of statistical methods in

SPSS, students develop skills to identify patterns, trends, and relationships in data, and enhance their ability to anticipate future behavioral changes.

*Suggested bibliography*


- Field, A., Miles, J., & Field, Z. (2012). Discovering Statistics using R. SAGE Publications Ltd.


### Data Analysis

(Duration 30 Hours, Teaching Credits: 5 ECTS)

Statistical methods are presented through simple problems using R: descriptive analysis, graphical representation, simulation of random numbers from theoretical distributions, confidence intervals, hypothesis tests for one and two independent samples, hypothesis tests for two paired samples, contingency tables, simple and multiple regression analysis, and analysis of variance (ANOVA) for one and two factors. Case studies and analysis of real datasets from various scientific fields (Economics, Marketing, Social Sciences, Sports, Medicine, Psychology, and others) are included. Basic principles of report writing and presenting data analyses are also covered.

*Suggested bibliography*


- Field, A., Miles, J., & Field, Z. (2012). Discovering Statistics using R. SAGE Publications Ltd.


### Visualization and Data Science-Story Telling

(Duration 30 Hours, Teaching Credits: 5 ECTS)

This course teaches students the essential skills to become effective data storytellers. They will learn how to identify and acquire datasets, extract insights from the data, and present their findings in a variety of formats. Students will learn how to “connect the dots” within a dataset through data visualization and uncover the narrative thread that explains what is happening, engaging their audience in a compelling data-driven story. Additionally, students will learn how to tailor their data storytelling to different audiences and stakeholders, adapting the presentation to maximize understanding and impact.

*Suggested bibliography*


- Knaflic, C. N. (2015). *Storytelling with data: A data visualization guide for business professionals*. John Wiley & Sons.


### Sport Performance Analysis

(Duration 30 Hours, Teaching Credits: 5 ECTS)

The Sport Performance Analysis course is an applied sports science program focused on understanding, improving, and analyzing performance in sports. The curriculum gradually develops students' knowledge in tactical analysis, measurement of technical effectiveness, and analysis of specific technical skills within actual athletic performance, using a range of modern techniques and technologies. Additionally, the course includes familiarity with coach and athlete behavior analysis and the application of athlete monitoring techniques. Core topics in Sport Performance Analysis are complemented by content from related fields such as coaching, pedagogy, and exercise science. These elements give the course a unique perspective, allowing students to understand both the theoretical principles and the applied skills that underpin effective performance analysis.

*Suggested bibliography*


- O'Donoghue, P. (2014). *An introduction to performance analysis of sport*. Routledge.
- Memmert, D. (Ed.). (2021). *Match analysis: how to use data in professional sport*. Routledge.


### Sports Marketing

(Duration 30 Hours, Teaching Credits: 5 ECTS)

The purpose of the course is to familiarize students with the application of marketing principles and functions in the sports sector. Through the course, students analyze and gain deeper insight into topics and practices related to sports events, teams, athletes, and sports products or services. Emphasis is placed on understanding sports consumer behavior, the importance and methods of market research, and the creation and promotion of both sports programs and sponsorship initiatives.

*Suggested bibliography*


- Dees, W., Walsh, P., McEvoy, C. D., McKelvey, S., Mullin, B. J., Hardy, S., & Sutton, W. A. (2022). *Sport marketing*. Human Kinetics.


### Basketball Data Science

(Duration 30 Hours, Teaching Credits: 5 ECTS)

The detailed curriculum in Basketball data science combines programming skills and specialization in the field, with knowledge of mathematics and statistics to extract meaningful basketball-related insights from data. At the most elite level of basketball, teams use tracking cameras positioned at all angles of the court to monitor every movement each player makes on the floor. This data is then synchronized with player statistics to provide a comprehensive analysis of player performance.

*Suggested bibliography*

- Zuccolotto, P., & Manisera, M. (2020). *Basketball data science: With applications in R*. CRC Press.
- Shea, S. M., & Baker, C. E. (2013). *Basketball analytics: Objective and efficient strategies for understanding how teams win*. Advanced Metrics.

### Football Analytics

(Duration 30 Hours, Teaching Credits: 5 ECTS)

Performance analysis in football has developed in recent years to the point where all professional teams have access to some level of data and employ performance analysts to assist coaches, analysts, players, and staff in working with new available technologies, particularly video. However, as detailed data and analytical insights become integrated into club processes, it is essential for personnel to have the skills not only to interpret and apply this information correctly but also to present and support knowledge to decision-makers. Teams also gather large databases containing their own subjective player information, but these data are often not managed properly, and clubs still have limited knowledge of how to use data for strategic planning. The Football Analytics course aims to develop managers who can make decisions—based on provided models—regarding match selections as well as the evaluation of both players and teams.

*Suggested bibliography*

- Memmert, D., & Raabe, D. (2018). *Data analytics in football: Positional data collection, modelling and analysis*. Routledge.
- Memmert, D., Strauss, B., & Theweleit, D. (2023). *Mind Match Soccer: The Final Step to Become a Champion*. Springer Nature.

### Sustainability in Sports

(Duration 30 Hours, Teaching Credits: 5 ECTS)

The aim of this course is to train students in the implementation of Sustainable Development programs within sports organizations. Specifically, students will become familiar with strategies to reduce the environmental footprint of sports organizations, as well as the implementation of social sustainability programs. The course focuses on the following thematic areas: Introduction to Sustainable Development in Sports. The Environmental Footprint of Sports. Environmental Sustainability in Sports. Social Sustainability in Sports. Economic Sustainability in Sports. Benefits of Implementing Sustainable Practices. Data Management and Statistical Applications for Environmental Sustainability. Marketing of Environmental Practices and Sponsorship

Attraction. Changing Perceptions through Ecology and Sports. Measuring the Environmental Footprint of a Sports Event Using Survey-Based Methods.

*Suggested bibliography*


- Parnell, D., & Widdop, P. (Eds.). (2015). Sport and Sustainability: Environmental Challenges and Strategic Solutions. Routledge.

**Specialization Elective Courses 2: Applied Sports Analytics**

### Anthology of Sports

(Duration 15 Hours, Teaching Credits: 2.5 ECTS)

This course aims to introduce students to the specific characteristics of data analysis across various sports, as well as to the challenges related to data collection, data issues, and analysis. The course will cover track and field sports (prediction, movement and technique evaluation), net & wall sports (such as tennis and volleyball), and American sports (baseball, American football, and hockey). It will also examine the challenges that arise in e-games, where there is an abundance of available data (ranging from player behavior patterns to strategic choices). Finally, a comparison will be made between one-on-one individual sports and team sports. Case studies using data from different sports will be included.

Through this course, students will gain an understanding of the application of data analysis methods in different sports, as well as the challenges that emerge from this process. This knowledge will equip them with the tools needed to develop and implement analytical strategies in the field of sports.

*Suggested bibliography*


- Lawrence, J.A. and Pasternack, B.A. (2002). Applied Management Science: Modeling, Spreadsheet Analysis, and Communication for Decision Making. Wiley & Sons
- Ribeiro C.C., Urrutia S., de Werra D. (2023). Combinatorial Models for Scheduling Sports Tournaments. EURO Advanced Tutorials on Operational Research Series. Springer Nature Switzerland; DOI: https://doi.org/10.1007/978-3-031-37283-4
- Serbin B.J. (2019). A Schedule Quick: Quick & Easy Scheduling for Recreational Sports Leagues.


### Operational research and scheduling of athletic events

(Duration 15 Hours, Teaching Credits: 2.5 ECTS)

This course aims to introduce students to the applications of Operations Research in sports scheduling. Students will acquire knowledge in modeling and problem-solving techniques related to creating fair, efficient, and engaging match schedules across various sports.

Introduction to Operations Research: Fundamental concepts and methodologies, and mathematical decision-making models.

Sports Event Scheduling: Objectives and constraints, factors affecting schedule creation (e.g., facility availability, team travel, spectator attendance).

Problem Modeling: Linear optimization models for sports scheduling.

Nonlinear Models and Solution Algorithms: Techniques such as genetic algorithms and simulated annealing.

Schedule Evaluation and Analysis: Performance metrics for sports scheduling, including fairness, balance, and commercial viability.

Software Applications: Tools for developing and analyzing schedules.

Applications Across Different Sports: Case studies drawn from real-world sports practice.

*Suggested bibliography*


- Lawrence, J.A. and Pasternack, B.A. (2002). Applied Management Science: Modeling, Spreadsheet Analysis, and Communication for Decision Making. Wiley & Sons
- Ribeiro C.C., Urrutia S., de Werra D. (2023). Combinatorial Models for Scheduling Sports Tournaments. EURO Advanced Tutorials on Operational Research Series. Springer Nature Switzerland; DOI: https://doi.org/10.1007/978-3-031-37283-4
- Serbin B.J. (2019). A Schedule Quick: Quick & Easy Scheduling for Recreational Sports Leagues.


### Coaching by numbers

(Duration 15 Hours, Teaching Credits: 2.5 ECTS)

In today's data-driven world, sports teams increasingly rely on analytics to gain a competitive edge. While coaches have traditionally depended on experience and intuition, the emergence of sports data analytics has revolutionized the way teams approach game strategies and player development.

Sports data is part of a process of collecting, analyzing, and interpreting information related to athletic performance. Coaches and players use it to gain insights and make evidence-based decisions.

Sports analytics data can be collected from various sources, such as video, wearable devices, tracking systems, and statistical databases. By identifying patterns in player performance, coaches can adjust training programs to address specific weaknesses or enhance existing strengths.

*Suggested bibliography*


- O'Donoghue, P., & Holmes, L. (2014). *Data analysis in sport*. Routledge.
- Passos, P., Araújo, D., & Volossovitch, A. (2016). *Performance analysis in team sports*. Taylor & Francis.

### International Sports Law

(Duration 15 Hours, Teaching Credits: 2.5 ECTS)

The course is an introduction to the basic concepts that are formed in the international legal order through the highlighting of cases from international competitive and sports activity. It includes the basic methods and procedures for the interpretation of provisions, the institutional framework of sport, the issue of doping, the methods of resolving sports disputes, the supranational character and the limits of autonomy and independence of international sports law. The goal of the course is to understand how rules work in sports from their creation to their implementation.

*Suggested bibliography*

- Nafziger, J. (2021). International sports law. In *International Sports Law, 2d ed*. Brill Nijhoff.

### Sports Management

(Duration 15 Hours, Teaching Credits: 2.5 ECTS)

The Sports Management course focuses on the organization, management, and coordination of various aspects of the sports industry. Its aim is to provide students with the knowledge and skills necessary for the smooth operation and success of sports organizations, events, facilities, and enterprises, with an emphasis on the core functions of sports management. The course covers the understanding of fundamental management principles, the importance of strategic planning, and the implementation of policies and procedures to achieve organizational objectives effectively. It also emphasizes human resource development and management processes, as well as understanding the legal and ethical aspects that influence sports and the administration of sports organizations.

*Suggested bibliography*

- Masteralexis, L. P. (2023). Principles and practice of sport management. Jones & Bartlett Learning.
- Slack, T., & Parent, M. M. (2006). *Understanding sport organizations: The application of organization theory*. Human Kinetics.

### Olympic Event Organization (Διοργάνωση Ολυμπιακών Γεγονότων)

(Duration 15 Hours, Teaching Credits: 2.5 ECTS)

The course focuses on the most important issues of the successful organization of Olympic events that extend from the bidding process, the coordination and cooperation of the various bodies and the evaluation. It focuses on the dimensions that shape the overall experience of

both participating athletes and spectators, primarily in infrastructure, safety, marketing, and promotion. The course includes case studies on the interconnection with the local community in the context of sustainable management of sporting events.

*Suggested Bibliography*

- Parent, M. M., & Ruetsch, A. (2020). *Managing major sports events: Theory and practice*. Routledge.

### Biomechanics of human movement

(Duration 15 Hours, Teaching Credits: 2.5 ECTS)

The course focuses on the concepts of biomechanical modeling for the analysis of human movement. It addresses students' needs regarding mechanical modeling from the perspective of analyzing sports skills, the development of key concepts in human body kinematics and movement dynamics, as well as an introduction to modeling the human musculoskeletal system.

*Suggested bibliography*

- McGinnis, P. M. (2013). *Biomechanics of sport and exercise*. Human Kinetics.

### Integrated Exercise Physiology

(Duration 15 Hours, Teaching Credits: 2.5 ECTS)

The aim of this course is to enable students to understand, monitor, and analyze biological and physiological data that can be included in athlete monitoring for performance and/or health purposes. Upon completion of the course, students will be able to recognize physiological adaptations to exercise and training, manage methods and tools for assessing biological and physiological parameters, identify all relevant biological data that can be included in an athlete's monitoring record for medical or performance purposes, and analyze athletic activity by applying scientific knowledge.

*Suggested bibliography*

- Kraemer, W. J., Fleck, S. J., & Deschenes, M. R. (2011). *Exercise physiology: integrating theory and application*. Lippincott Williams & Wilkins.

### Sports modelling

(Duration 15 Hours, Teaching Credits: 2.5 ECTS)

The course focuses on the application of statistical modeling in the field of sports. It begins with an analysis of simple and multiple linear regression, emphasizing model fitting using the least squares method. Topics include variable selection, model selection, and the diagnosis and

handling of deviations from model assumptions. Applications are presented using performance analysis data, as well as prediction and inference techniques for game outcomes in sports such as basketball.

The course then explores the extension of regression models to specialized datasets suitable for sports modeling. Logistic regression is introduced for binary outcomes, with applications in sports that do not allow draws. Finally, multinomial regression is covered for categorical outcomes, with an emphasis on sports that permit draws as final results, such as football.

*Suggested bibliography*


- Wasserman, L. (2013). All of statistics: a concise course in statistical inference. Springer Science & Business Media.
- Krzanowski, W. J. (1998). An introduction to statistical modelling.
- Morgan, B. J. (2008). Applied stochastic modelling. CRC press.


### Machine Learning

(Duration 30 Hours, Teaching Credits: 5 ECTS)

The course examines fundamental concepts related to Machine Learning. Topics include overfitting and the bias–variance trade-off, as well as the distinction between prediction and inference. Cross-validation techniques are discussed, including train/test/validation splits and Bootstrap methods. Various learning approaches are also covered, such as supervised and unsupervised learning, along with classification methods including LDA, k-NN, neural networks, decision trees, random forests, support vector machines (SVM), and Naive Bayes.

The course also addresses model performance evaluation using metrics such as accuracy, misclassification rate, sensitivity, specificity, ROC curves, AUC, Lift, Brier score, and F1. Clustering techniques are introduced, including distance-based methods, hierarchical clustering, k-means, stochastic model-based clustering, and density-based clustering. Finally, dimensionality reduction methods, such as Principal Component Analysis (PCA) and Singular Value Decomposition (SVD), as well as shrinkage and variable selection techniques like LASSO, are analyzed.

*Suggested bibliography*


- Hastie, T., Tibshirani, R., & Friedman, J. (2009). The elements of statistical learning: Data mining, inference, and prediction. Springer.
- James, G., Witten, D., Hastie, T., & Tibshirani, R. (2013). An introduction to statistical learning: With applications in R. Springer.
- Murphy, K. P. (2012). Probabilistic machine learning: An introduction. MIT Press.

### Special Topics of Sports Analytics

(Duration 30 Hours, Teaching Credits: 5 ECTS)

The course “Special Topics in Sports Analytics” aims to expose students to advanced, innovative, and contemporary topics in Sports Analytics through specialized lectures delivered by internationally recognized scientists and industry professionals. The course serves as a platform for introducing cutting-edge techniques and applications that are not fully covered in the program’s core courses.

Additionally, this course incorporates activities such as thematic workshops, seminars, conferences, and hands-on project-based exercises that connect theory with practice.

Indicative Topics: (topics may vary each year/semester depending on collaborations and guest lectures)

- Advanced Player Tracking Analytics
- Tactical and Spatial Analysis in Team Sports
- Machine Learning for Performance and Injury Prediction
- Wearable Technologies and Data Interpretation
- Biomechanics and Sports Data
- Bayesian Models in Sports
- Psychology and Cognitive Analytics in Sport Performance
- Salary Cap and Financial Decision Modeling in Sports
- e-Sports Analytics and Gaming Data
- Decision Support Systems for Coaching and Scouting

*Suggested bibliography*


- Severini, T. A. (2020). Analytic methods in sports: Using mathematics and statistics to understand data from baseball, football, basketball, and other sports. 2nd Edition. CRC Press.
- Dominicy, Y., & Ley, C. (Eds.). (2023). Statistics Meets Sports: What We Can Learn from Sports Data. Cambridge Scholars Publishing