



**FACULTY OF APPLIED SCIENCES**  
**BACHELOR OF SCIENCE IN COMPUTING**  
**LEARNING MODULE OUTLINE**

|                       |                                 |               |                                                                                                                              |
|-----------------------|---------------------------------|---------------|------------------------------------------------------------------------------------------------------------------------------|
| Academic Year         | 2025/2026                       | Semester      | 1                                                                                                                            |
| Module Code           | COMP408                         |               |                                                                                                                              |
| Learning Module       | Selected Topics 3               |               |                                                                                                                              |
| Pre-requisite(s)      | Nil                             |               |                                                                                                                              |
| Medium of Instruction | English                         |               |                                                                                                                              |
| Credits               | 3                               | Contact Hours | 45 hrs                                                                                                                       |
| Instructor            | Dr. Charles Lam<br>Dr. Duo Wang | Email         | <a href="mailto:cklamsta@mpu.edu.mo">cklamsta@mpu.edu.mo</a><br><a href="mailto:duo.wang@mpu.edu.mo">duo.wang@mpu.edu.mo</a> |
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**MODULE DESCRIPTION**

This module introduces basic concepts and techniques from linear algebra that will be required in later computer science areas such as machine learning and computer graphics. Topics include systems of linear equations, matrices, determinants, vectors and vector spaces, linear in(dependence), multi-dimensional linear transformations, eigenvalues and eigenvectors.

**MODULE INTENDED LEARNING OUTCOMES (ILOS)**

On completion of this learning module, students will be able to:

|     |                                                                                       |
|-----|---------------------------------------------------------------------------------------|
| M1. | Describe the various methods in solving systems of linear equations; (SM2p)           |
| M2. | Explain matrix operations; (SM2p)                                                     |
| M3. | Explain the concepts of vectors and vector spaces; (SM2p)                             |
| M4. | Discuss linear independence and dependence; (SM2p)                                    |
| M5. | Extend the principles of matrix algebra to linear transformations; (SM2p, EA3p, EP1p) |
| M6. | Demonstrate an understanding of eigenvalues and eigenvectors. (SM2p)                  |

These ILOs aims to enable students to attain the following Programme Intended Learning Outcomes (PILOs):

| PILOs                                                                                                                           | M1 | M2 | M3 | M4 | M5 | M6 |
|---------------------------------------------------------------------------------------------------------------------------------|----|----|----|----|----|----|
| P1. Select and apply proven methods, tools and techniques to the effective and efficient implementation of information systems; |    |    |    |    |    |    |
| P2. Evaluate computer systems in a local area network, and understand the additional requirements for connection to             |    |    |    |    |    |    |



|      |                                                                                                                                                                                                                                            |   |   |   |   |   |   |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|---|
|      | other networks through wide area networks;                                                                                                                                                                                                 |   |   |   |   |   |   |
| P3.  | Be competent in system development in the Internet and the web platform;                                                                                                                                                                   |   |   |   |   |   |   |
| P4.  | Work independently to design and implement a relational database, with an emphasis on how to organise, maintain and retrieve information from a DBMS;                                                                                      |   |   |   |   |   |   |
| P5.  | Acquire essential knowledge in specific fields of computing disciplines including multimedia, security and artificial intelligence;                                                                                                        |   |   |   |   |   |   |
| P6.  | Acquire the perceptive skills needed to understand information presented in the form of UML diagram, flow chart or other industry standard formats;                                                                                        |   |   |   |   |   |   |
| P7.  | Understand the need for and use of the necessary mathematical techniques;                                                                                                                                                                  | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| P8.  | Work independently to develop an understanding of, and the knowledge and skills associated with the general support of computer systems and networks;                                                                                      |   |   |   |   |   |   |
| P9.  | Work as an effective member of a team in the analysis, design and development of software systems;                                                                                                                                         |   |   |   |   |   |   |
| P10. | Use project planning and management techniques in systems development;                                                                                                                                                                     |   |   |   |   |   |   |
| P11. | Understand the fundamental and operational issues of computer systems in business environments;                                                                                                                                            |   |   |   |   |   |   |
| P12. | Equip with adequate written, oral communication and interpersonal skills;                                                                                                                                                                  |   |   |   |   |   |   |
| P13. | Build the capacity and desire for lifelong learning and to learn advanced and emerging technologies on one's own;                                                                                                                          |   |   |   |   |   |   |
| P14. | (For Enterprise Information Systems specialization) Gain an in-depth understanding of the information technology related to enterprise information systems, with an emphasis on development of such systems to support business processes; |   |   |   |   |   |   |
| P15. | (For Gaming Technology specialization) Acquire the general and advanced knowledge of current technologies and operating environment in the gaming industry;                                                                                |   |   |   |   |   |   |
| P16. | (For Computer Education specialization) Acquire the general and practical knowledge of computer education and its practicing environment in secondary education.                                                                           |   |   |   |   |   |   |

#### MODULE SCHEDULE, COVERAGE AND STUDY LOAD

| Week | Content Coverage                          | Contact Hours |
|------|-------------------------------------------|---------------|
| 1-2  | 1. Matrices and Vectors                   | 6             |
|      | Matrix addition and scalar multiplication |               |
|      | Matrix multiplication                     |               |
|      | Special Matrices                          |               |



|       |                                                     |   |
|-------|-----------------------------------------------------|---|
|       | Transpose of a matrix                               |   |
|       | Matrix Algebra                                      |   |
|       | Magnitude and direction of vectors                  |   |
|       | Unit vectors                                        |   |
|       | Vector operations                                   |   |
|       | Inner product                                       |   |
| 3-4   | Systems of Linear Equations                         | 6 |
|       | 2.1 Augmented matrix                                |   |
|       | 2.2 Elementary row operations                       |   |
|       | 2.3 Gaussian elimination method                     |   |
|       | 2.4 Gauss-Jordan elimination method                 |   |
|       | 2.5 Homogeneous system of linear equations          |   |
|       | 2.6 Null space, rank and nullity                    |   |
| 5-7   | Matrix Inversion and Determinants                   | 9 |
|       | 3.1 Determinant of a matrix                         |   |
|       | 3.2 Properties of determinants                      |   |
|       | 3.3 Matrix inversion using determinant              |   |
|       | 3.4 Matrix inversion using adjoint method           |   |
|       | 3.5 Matrix inversion using Gauss-Jordan elimination |   |
| 8-10  | Vector Spaces                                       | 9 |
|       | 4.1 Property of vector spaces                       |   |
|       | 4.2 Subspace                                        |   |
|       | 4.3 Linear combinations of vectors                  |   |
|       | 4.4 Span and Spanning Set                           |   |
|       | 4.5 Linear independence and dependence              |   |
|       | 4.6 Basis and dimension                             |   |
| 11-13 | Linear Transformations                              | 9 |
|       | 5.1 Introduction to linear transformations          |   |
|       | 5.2 Domain and codomain                             |   |



|       |                                                      |   |
|-------|------------------------------------------------------|---|
|       | 5.3 Range and null space                             |   |
|       | 5.4 Matrix representations of linear transformations |   |
|       | 5.5 Reflection, projection, rotation, and scaling    |   |
|       | 5.6 Composition of linear transformations            |   |
|       | 5.7 One-to-one linear transformations                |   |
|       | 5.8 Onto linear transformations                      |   |
| 14-15 | Eigenvalues and Eigenvectors                         | 6 |
|       | 6.1 Introduction to eigenvalues and eigenvectors     |   |
|       | 6.2 Characteristic polynomial                        |   |
|       | 6.3 Characteristic equation                          |   |
|       | 6.4 Computing eigenvalues and eigenvectors           |   |

### TEACHING AND LEARNING ACTIVITIES

In this learning module, students will work towards attaining the ILOs through the following teaching and learning activities:

| Teaching and Learning Activities | M1 | M2 | M3 | M4 | M5 | M6 |
|----------------------------------|----|----|----|----|----|----|
| T1. Lectures                     | ✓  | ✓  | ✓  | ✓  | ✓  | ✓  |
| T2. In-class exercises           | ✓  | ✓  | ✓  | ✓  | ✓  | ✓  |

### ATTENDANCE

Attendance requirements are governed by the Academic Regulations Governing Bachelor's Degree Programmes of the Macao Polytechnic University. Students who do not meet the attendance requirements for the learning module shall be awarded an 'F' grade.

### ASSESSMENT

In this learning module, students are required to complete the following assessment activities:

| Assessment Activities      | Weighting (%) | AHEP3 LOs        | ILOs to be Assessed    |
|----------------------------|---------------|------------------|------------------------|
| A1. Assignment / Classwork | 25%           | SM2p, EA3p, EP1p | M1, M2, M3, M4, M5, M6 |
| A2. Tests                  | 25%           | SM2p, EA3p, EP1p | M1, M2, M3, M4, M5, M6 |
| A3. Examination            | 50%           | SM2p, EA3p, EP1p | M1, M2, M3, M4, M5, M6 |



The assessment will be conducted following the University's Assessment Strategy (see [www.mpu.edu.mo/teaching\\_learning/en/assessment\\_strategy.php](http://www.mpu.edu.mo/teaching_learning/en/assessment_strategy.php)). Passing this learning module indicates that students will have attained the ILOs of this learning module and thus acquired its credits.

Students with an overall score of less than 35 in the coursework must take the re-sit examination even if the overall score for the module is 50 or above.

Students with a score of less than 35 in the final examination must take the re-sit examination even if the overall score for the module is 50 or above.

Students with an overall final grade of less than 35 are NOT allowed to take the re-sit examination.

### **REQUIRED READINGS**

1. Strang, G. (2016). Introduction to Linear Algebra (5th ed.). MIT Press.

### **REFERENCES**

1. Lay, D., Lay, S., and McDonald, J. (2015). Linear Algebra and Its Applications (4th ed.). Pearson Education.

### **STUDENT FEEDBACK**

At the end of every semester, students are invited to provide feedback on the learning module and the teaching arrangement through questionnaires. Your feedback is valuable for instructors to enhance the module and its delivery for future students. The instructor and programme coordinators will consider all feedback and respond with actions formally in the annual programme review.

### **ACADEMIC INTEGRITY**

The Macao Polytechnic University requires students to have full commitment to academic integrity when engaging in research and academic activities. Violations of academic integrity, which include but are not limited to plagiarism, collusion, fabrication or falsification, repeated use of assignments and cheating in examinations, are considered as serious academic offenses and may lead to disciplinary actions. Students should read the relevant regulations and guidelines in the Student Handbook which is distributed upon the admission into the University, a copy of which can also be found at [www.mpu.edu.mo/student\\_handbook/](http://www.mpu.edu.mo/student_handbook/).