1. **Course Number and Course Title**
   COE 476 – Neural Networks and Deep Learning
2. **Credit Hours**
   3-0-3

3. **Prerequisites and/or Co-Requisites:**
   Prerequisites: CMP 305 (Data Structures) and MTH 221 (Linear Algebra)

4. **Name and Contact Information of Instructor:**
   Dr. Imran Zualkernan
   Office: ESB-2063
   Email: izualkernan@aus.edu
   Phone: (06)515-2953
   Office Hours: Posted on office door

5. **Course Description (Catalog Description):**
   Covers tensors, neural network modelling, gradient descent optimization and loss functions, feature engineering, and evaluation of neural networks. Focusses on various types of neural networks including feedforward networks, auto-encoders, convolutional neural networks, recurrent neural networks. Discusses topics in generative deep learning.

6. **Textbook and other Supplemental Material:**

   Textbook:
   - François Chollet, Deep Learning with Python, November 2017, Manning Press.

   Other supplemental material:
   - Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, 2016, The MIT Press.
   - Aurélien Géron, Hands-On Machine Learning with Scikit-Learn and TensorFlow Concepts, Tools, and Techniques to Build Intelligent Systems, 2017, O'ReillyMedia.

   The supplemental material is available on reserve in the AUS library.

7. **Learning Outcomes:**
   Upon completion of the course, students will be able to:

   1. Build feedforward neural networks
   2. Demonstrate an understanding of issues in feature modelling and overfitting
   3. Apply neural network evaluation techniques
   4. Design auto-encoders
   5. Design convolution neural networks
   6. Design recurrent neural networks
   7. Apply generative deep learning techniques to create synthetic data

8. Teaching and Learning Methodologies:

Methods include lectures; problem and project-based learning methods (homework, simulation-based projects) and class discussions.

9. Course Topics and Schedule:

Topic Week	Topic Week
Introduction and history of Neural Networks	Week #1
Data for Neural Networks	Week #2
Data for Neural Networks	Week #3
Solving Regression Problems using Neural Networks	Week #4
Solving Regression Problems using Neural Networks	Week #5
Solving Classification Problems using Neural Networks	Week #6
Backpropagation and its implementation	Week #7
Backpropagation and its implementation	Week #8
1D Convolutional Neural Networks and Applications	Week #9
2D Convolutional Neural Networks - Image Processing	Week #10
2D Convolutional Neural Networks – Audio Processing	Week #11
Transfer Learning for Neural Networks	Week #12
Recurrent Neural Networks and Applications	Week #13
Autoencoders and Applications	Week #14
Generative modelling	Week #15
Final Exam	Week #16
Total:	**16**

10. Schedule of Laboratory and other Non-Lecture Sessions:

The class project requires students to apply what they learnt in the course to a relatively large data set. The focus of the project will vary from semester to semester. The project will assess learning outcomes 2 and 3 every semester, and one or more of outcomes 4 to 7 depending on the project focus each semester. The students work in teams of two or three students.

11. Out-of-Class Assignments with Due Dates:

Assignments (tentative)	Due Date
Data For Neural Networks	About Week 3
Regression Problems	About Week 5
Classification Problems	About Week 7
Using Convolutional Neural Networks	About Week 11

12. Student Evaluation:

Assessment	Weight	Due Date
Homework	10%	See schedule c.f. 11
Class Project	25%	Monday Nov 24 before 5 p.m. Oral Presentations: Tuesday Nov 25 to Thursday Nov 27, 2025.
Quizzes (x 4). Each quiz is worth 2.5% of your total grade.	10 %	Wednesday, Sept 17, in class Wednesday, Oct 1, in class Wednesday, Oct 29, in class Wednesday, Nov 12, in class
Midterm Exam	20 %	Wednesday, Oct 16, in class
Final Exam	35%	TBA

13. Assessment Instruments:

Assessment	Course Learning Outcomes
Class project	O2-O7
Midterm Exam	O1-O4
Quizzes	O1-O5
Final Exam	O1-O7
Homework	O1-O7

14. Contribution of Course to Program Outcome:

This course contributes to the accomplishment of the following program outcomes:

BSCS Program Outcomes	Emphasis in this course	Course Learning Outcomes
(1) Analyze a complex computing problem, and to apply principles of computing and other relevant disciplines to identify solutions.	◑	3, 4, 5, 6, 7
(2) Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.	◑	3, 4, 5, 6, 7
(3) Communicate effectively in a variety of professional contexts.	○	1
(4) Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.		
(5) Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline		
(6) Apply computer science theory and software development fundamentals to produce computing-based solutions	○	2

Emphasis: • High; ◑ Medium; o Low; Blank – Nothing Specific Expected

BSCoE Program Outcomes	Emphasis in this course	Course Learning Outcomes
(1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	◑	3, 4, 5, 6, 7
(2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors		
(3) an ability to communicate effectively with a range of audiences	○	1
(4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts		

(5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives		
(6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw	◑	2
(7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	○	4, 5, 6, 7

Emphasis: • High; ◑ Medium; o Low; Blank – Nothing Specific Expected

15. Grading Scheme:

Grade	Range of total score
A	>= 93
A-	>=89 and <93
B+	>=84 and <89
B	>=80 and <84
B-	>=75 and <80
C+	>=70 and <75
C	>=66 and <70
C-	>=60 and <66
D	>=50 and <60
F	<50

As per CAA requirements there is no "curving" in the course. All grades are based on absolute lines. For example, a score of 92.99999 earns you an A-.

16. Attendance:

The AUS attendance policy of 15% maximum absences allowed will be enforced. Upon breaching 15% absence rule the student will be automatically dropped from the course with a grade of W. Attendance will be taken using the CSE Attendance App during the middle of the lecture. It is the student's responsibility to ensure that the CSE Attendance App is functional on their mobile device.

17. Academic Integrity:

AUS academic integrity code will be strictly enforced. In addition, unsanctioned use of any generative Artificial Intelligence model (e.g., ChatGPT) in attempting quizzes, labs, exams, or homework assignments will be considered a violation of the AUS academic integrity code.

You are allowed and encouraged to use Generative AI to explore solutions to various problems in your course project only. However, when using such tools you must give credit to using this tool in your work.

All quizzes and exams are closed book, closed notes and closed internet. We will use the lockdown browser.

Additional Classes – Sunday, September 28, 2025