

Course Specification

(Postgraduate Programs)

Course Title: Generative Models and Systems

Course Code: CE6035

Program: Master of Science in Computer Engineering

Department: Computer and Network Engineering

College: College of Computing

Institution: Umm Al-Qura University

Version: 1.0

Last Revision Date: 12/4/2025



Table of Contents

A. General information about the course:	3
B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:	4
C. Course Content:.....	5
D. Students Assessment Activities:.....	6
E. Learning Resources and Facilities:	6
F. Assessment of Course Quality:	7
G. Specification Approval Data:	7



A. General information about the course:

1. Course Identification:

1. Credit hours: (3)

2. Course type

A. University College Department Track

B. Required Elective

3. Level/year at which this course is offered: (Level 3 or 4)

4. Course General Description:

This course provides an in-depth exploration of Generative Artificial Intelligence (AI) with a focus on applications relevant to computer engineering. Students will gain a comprehensive understanding of generative models, including their theoretical foundations, practical implementations, and real-world applications.

5. Pre-requirements for this course (if any):

None

6. Co-requisites for this course (if any):

None

7. Course Main Objective(s):

This course aims for the following goals.

1. Master Generative AI Foundations: Provide students with a deep understanding of the theoretical and mathematical principles underlying generative AI models.
2. Implement and Optimize Generative Models: Equip students with practical skills to design, implement, and optimize generative AI systems using modern frameworks.
3. Understand Hardware and Computational Aspects: Educate students on the hardware requirements, computational challenges, and optimization techniques relevant to generative AI.
4. Explore Ethical and Societal Implications: Raise awareness about the ethical considerations and societal impact of generative AI technologies.



5. Develop Real-World Applications: Enable students to apply generative AI models in various domains, integrating them into practical applications.

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100
2	E-learning		
3	Hybrid <ul style="list-style-type: none"> Traditional classroom E-learning 		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	30
2.	Laboratory/Studio	
3.	Field	
4.	Tutorial	15
5.	Others (specify).....	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Articulate the principles and mechanisms of various generative models.	K2	Lectures and discussions	Quizzes
1.2	Identify applications and challenges of generative AI.	K1	Lectures and discussions	Quizzes
2.0	Skills			
2.1	Develop and code generative AI models using industry-standard frameworks.	S1	Tutorials and discussions	Programming assignments and project



Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
2.2	Analyze and enhance the computational efficiency of generative models.	S1	Tutorials and discussions	Programming assignments and project
2.3	Evaluate the performance of generative models using appropriate metrics and validation techniques.	S4	Tutorials and discussions	Programming assignments and project
2.3	Integrate generative AI models into deployable applications.	S1	Tutorials and discussions	Programming assignments and project
2.4	Present recent research in the field of generative AI	S2, S3	Discussions	Presentations
3.0	Values, autonomy, and responsibility			
3.1	Identify ethical concerns related to generative AI, including bias, privacy, and misuse.	V1	Lectures and discussions	Project
3.2	Work effectively as a team member in building a system prototype with generative AI techniques.	V2	Project	Team project

C. Course Content:

No	List of Topics	Contact Hours
1.	Generative Models	3
2.	Deep Learning	3
3.	Variational Autoencoders	3
4.	Generative Adversarial Networks	3
5.	Autoregressive Models	3
6.	Diffusion Models	3
7.	Transformers	3
8.	World models and Multimodal models	3
9.	LLM Architectures	3
10.	LLMs in Practice	3
11.	LLM Prompt Engineering	2
12.	Retrieval augmented generation	3
13.	Finetuning	4
14.	Agents	3
15.	Deployment and Optimizations	3
Total		45



D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes		20
2.	Paper presentations		20
3.	Course Project		40
4.	Literature Review Report		20

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	"Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play" by David Foster 2 nd Edition, 2023 Building LLMs for Production: Enhancing LLM Abilities and Reliability with Prompting, Fine-Tuning, and RAG by Louis-François Bouchard and Louie Peters, 2024
Supportive References	Generative AI with Python and TensorFlow 2: Create images, text, and music with VAEs, GANs, LSTMs, Transformer models by Joseph Babcock and Raghav Bali, 2021 "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville, 2016
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
Facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms
Technology equipment (Projector, smart board, software)	Projector
Other equipment (Depending on the nature of the specialty)	





F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Program Leaders	Indirect
Effectiveness of students' assessment	Program Leaders	Direct
Quality of learning resources	Students, Faculty	Indirect
The extent to which CLOs have been achieved	Students, Faculty, Program Leaders	Direct and Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify))

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	Computer and Network Engineering Department Council
REFERENCE NO.	The 18 th Session Of The Academic Year 1446
DATE	15/4/2025

