Semester: VI						
GENERATIVE ARTIFICIAL INTELLIGENCE **Category: Professional Core Elective-III** **(Common to AI,CS,IS,CD)** **(Theory)**						
Course Code	**:**	**AI365TDD**		**CIE**	**:**	**100 Marks**
Credits: L: T: P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3.00 Hours**

Unit-I	**9Hrs**
Introduction to Generative Deep Learning, Generative Modeling What Is Generative Modeling? Historical perspective on Generative AI, Generative Versus Discriminative Modeling, Introduction to Large Language Models (LLMs), Applications of Large Language Models, Limitations and Risks of Large Language Models	
Unit – II	**9Hrs**
Variational Autoencoders Introduction, Autoencoders, The Autoencoder Architecture The Encoder, The Decoder, Joining the Encoder to the Decoder, Analysis of the Autoencoder **Building a Variational Autoencoder** The Encoder The Loss Function Analysis of the Variational Autoencoder Using VAEs to Generate Faces, Training the VAE, Analysis of the VAE, Generating New Faces, Latent Space Arithmetic, Morphing Between Faces	
Unit –III	**9Hrs**
Generative Adversarial Networks Introduction to GAN (GAN), The Discriminator, TheGenerator **Cycle GAN** Overview, The Generators (U-Net) The Discriminators Compiling the Cycle GAN Training the Cycle GAN Analysis of the Cycle GAN Creating a Cycle GAN to Paint Like Monet the Generators (ResNet) Analysis of the Cycle GAN. **Neural Style Transfer** Content Loss Style Loss Total Variance Loss Running the Neural Style Transfer Analysis of the Neural Style Transfer Model	
Unit -IV	**9Hrs**
Diffusion Models Introduction Denoising Diffusion Models (DDM), The Flowers Dataset, The Forward Diffusion Process, The Reparameterization Trick, Diffusion Schedules, the Reverse Diffusion Process. **Energy-Based Models** Introduction Energy-Based Models, The MNIST Dataset, The Energy Function Sampling, Using Langevin Dynamics	
Unit -V	**9Hrs**
Bias and Fairness in Generative AI: Understanding Bias in AI Types of biases (algorithmic, data, societal) Fairness Metrics Statistical parity, equal opportunity, disparate impact Mitigation Strategies Pre-processing, in-processing, and post-processing techniques **Ethical Design and Deployment of Generative** AI Ethical AI Design Principles Human-centered design, ethical by design Deployment Challenges Real-world implementation, monitoring, and feedback loops Responsible AI Frameworks Guidelines and best practices for ethical deployment	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the concepts and principles of Generative Artificial Intelligence to engineering requirements.
CO2	Design and demonstrate proficiency in implementing and training various generative AI models using modern tools.
CO3	Investigate the need for Generative AI techniques to solve real-world problems in diverse domains.
CO4	Explore advanced topics and research directions in Generative AI and critically evaluate their potential applications.
CO5	Equip students with the knowledge to identify and address ethical issues in Generative AI, focusing on fairness, accountability, transparency, and human rights.

Reference Books	
1	"Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play" by David Foster,2nd Edition, 2023. ISBN: 978-1492041948. Publisher: O'Reilly Media.
2	'Deep Learning" by Ian Good fellow, Yoshua Bengio, and Aaron Courville.2nd Edition 2016, ISBN: 978-0262035613. Publisher: MIT Press.
3	"Fairness and Machine Learning: Limitations and Opportunities"; Author(s) Solon Barocas, Moritz Hardt, Arvind Narayanan, 2023, ISBN-10/ASIN: 0262048612, Publisher: MIT Press
4	"Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way" by Virginia Dignum , 1st Edition, 2021,ISBN 9783030303716, Publisher: MIT Press

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing & Modeling (10) **Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	16
3 & 4	Unit 2 : Question 3 or 4	16
5 & 6	Unit 3 : Question 5 or 6	16
7 & 8	Unit 4 : Question 7 or 8	16
9 & 10	Unit 5: Question 9 or 10	16
	TOTAL	**100**