Graphic Era Deemed to be University DEHRADUN

NAAC GRADE A+ ACCREDITED

CURRICULUM
for
UNDERGRADUATE DEGREE PROGRAM

BACHELOR OF TECHNOLOGY
IN
Computer Science and Engineering
(ARTIFICIAL INTELLIGENCE and MACHINE LEARNING)

Scheme of Teaching and Evaluation 2025

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2025-26)

In accordance with NEP 2020

Computer Science and Engineering

GRAPHIC ERA (DEEMED TO BE UNIVERSITY)

566/6, Bell Road, Clement Town,
Dehradun, Uttarakhand 248002 INDIA

https://www.geu.ac.in

CONTENTS

1. Preamble

The role of higher education is pivotal in securing gainful employment and/or providing access to further studies comparable to those offered by world-class institutions. Therefore, improving the quality of higher education must be accorded the highest priority to equip the younger generation with the skills, training, and knowledge necessary to enhance critical thinking, comprehension, and application abilities, thereby preparing them to compete, succeed, and excel globally. Sustained reforms are essential to strengthen the current higher education system by upgrading academic resources and learning environments, raising the quality of teaching, and improving standards of achievement in undergraduate learning outcomes. In alignment with this vision, the Graphic Era (Deemed to be University) has revised its undergraduate programmes in Computer Science and Engineering to meet the model curriculum proposed by the All India Council for Technical Education (AICTE) and the guidelines of the National Education Policy (NEP) 2020. The updated curriculum incorporates Outcome-Based Education (OBE) and the Choice-Based Credit System (CBCS), making it student-centric, interactive, and well-defined in its aims, objectives, and goals. In keeping with NEP 2020's emphasis on multidisciplinary learning, the curriculum is designed to be flexible, enabling students to pursue creative and diverse subject combinations.

2. About the Program

The Department of Computer Science & Engineering was established in the year 2001. Since then, the department has held a position of pride in the Graphic Era (Deemed to be University). It has consistently fulfilled its role of producing Computer Engineers ready to meet the demands of the IT world. The department has always attracted the best engineering aspirants from all over the country. It has a well-qualified and experienced team of faculty. The Department offers B.Tech., M.Tech., and Ph.D. courses in Computer Science and Engineering. The department has adequate facilities to support these teaching activities. Students of the department have access to sufficient high-end computing facilities. The Department is also actively involved in various research activities. The facilities are adequate to cater to the needs of Research activities. The department has signed an MoU with reputed Companies and Universities for academic collaborative projects.

This program equips students with the skills and knowledge required to analyse, design and control intelligent systems. The main objective of offering this program is developing

professionals who are skilled in the area of AI & ML. This program enables students to gain an in-depth understanding of fundamental subjects in Computer Science and deals with technologies like image processing, machine learning, natural language processing, neural networks, deep learning, reinforcement learning, and big data analytics. This course is designed for both academic and skill-based education to create a bright career for the students.

3. Vision & Mission

3.1 Vision and Mission of the University

Vision

We visualize Graphic Era (Deemed to be University) as an internationally recognized, enquiry-driven, ethically engaged diverse community, whose members work collaboratively for positive transformation in the world, through leadership in teaching, research, and social action

Mission

The mission of the university is to promote learning in true spirit and offering knowledge and skills in order to succeed as professionals. The university aims to distinguish itself as a diverse, socially responsible learning community with a high quality scholarship and academic rigor.

3.2 Vision and Mission of the Department

Vision

To impart quality education for producing highly talented globally recognizable technocrats and entrepreneurs with sound ethics, latest knowledge and innovative ideas in Computer Science and Engineering to meet industrial needs and societal expectations.

Mission

M1. To impart high standard value based technical education in all aspects of Computer Science and Engineering through state of the art infrastructure and innovative approach.

M2. To produce ethical, motivated and skilled engineers through theoretical knowledge and practical applications.

M3. To impart the ability for tackling simple to complex problems individually as well as in a team.

M4. To develop globally competent engineers with strong foundations, capable of "out of the box" thinking so as to adapt to the rapidly changing scenarios requiring social conscious green computing solutions.

4. Program Educational Objectives

PEO1: To produce students employable towards building a successful career based on a sound understanding of theoretical and applied machine learning, as well as methodology to solve multidisciplinary real-life problems.

PEO2: To produce professional graduates ready to work with a sense of responsibility, ethics, and enabling them to work efficiently individually and also as a team.

PEO3: To impart the competency in students so that they are able to pursue higher studies and research in areas of engineering and other professionally related fields.

PEO4: To inculcate the ability to adapt to changing technology through continuous learning.

5. Consistency of PEOs with Mission of the Department

PEO Statements	M1	M2	M3	M4
PEO1	3	1	2	2
PEO2	-	2	3	2
PEO3	2	3	2	3
PEO4	2	2	-	3

High correlation (3); Medium correlation (2); Low correlation (1), No correlation (-)

6. Program Outcomes (POs)

Engineering Graduates will be able to:

PO1. Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization to develop to the solution of complex engineering problems.

PO2. Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.

PO3. Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required.

PO4. Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions.

PO5. Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems.

PO6. The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.

PO7. Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws.

PO8. Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9. Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

PO10. Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11. Life-long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.

7. Program Specific Outcomes (PSOs)

In addition to these twelve POs, three Program Specific Outcomes (PSOs) are formulated

PSO1: Ability to analyze, design, implement, and test Artificial Intelligence-based software systems based on requirement specifications and development methodologies of software systems.

PSO2: Apply computer science theory blended with engineering mathematics to solve problems in the areas related to Deep Learning, Machine learning, Artificial

Intelligence, and model real-world problems using appropriate programming language, data structure, and algorithms.

PSO3: Ability to explore technological advancements in the domains like Human cognition, Machine Learning, and Artificial Intelligence, evaluate their merits, and identify research gaps to provide solutions to new ideas and innovations.

8. Program Structure

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hours Practical (P) per week	1 Credit

B. Nomenclature as per AICTE

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
C	Credits
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional core courses
PEC	Professional Elective courses
OEC	Open Elective courses
LC	Laboratory courses
MC	Mandatory courses

C. Nomenclature as per NEP 2020

Code	Definitions
DSC	Discipline Specific Core
DSE	Discipline Specific Elective
UOE	University Open Elective/Generic Elective
AEC	Ability Enhancement Course
SEC	Skill Enhancement Course
PROJ	Project/Seminar/Internship/Summer training
VAC	Value Addition Course
MNG	Mandatory Non-Graded Course

Definitions

Courses of study – Courses of study indicates pursuance of study in a particular discipline. Every discipline shall offer various categories of courses of study, viz. Discipline Specific Core courses (DSC), Discipline Specific Electives (DSE), University Open Elective/Generic Elective (UOE), Ability Enhancement Course (AEC), Skill Enhancement Course (SEC), Value Addition Course (VAC), Internship/Apprenticeship/Project/Community Outreach (PROJ) and Mandatory Non-Graded Course (MNG)

a) Discipline Specific Core (DSC): Discipline Specific Core is a course of study, which should be pursued by a student as a major component, of the discipline as mandatory requirement of his/her programme of study. DSC shall be the core credit courses of that particular discipline which will be appropriately graded and arranged across the semesters of study.

b) Discipline Specific Elective (DSE): The Discipline Specific Electives (DSE) shall be a pool of credit courses of that particular discipline (single discipline programme of study) or those disciplines (multidisciplinary programme of study), as the case may be, which a student chooses to study from his/her particular discipline(s). There shall be a pool of DSE from which a student may choose a course of study.

c) University Open Elective/Generic Elective (UOE): An elective course chosen generally from other discipline(s) with an intention to seek exposure is called a University Open Elective/Generic Elective. UOE shall consist of a pool of courses offered by various disciplines of study in groups of odd and even semesters, from which a student can choose.

d) Ability Enhancement Course (AEC): Ability Enhancement courses aim at enabling the students to acquire and demonstrate the core linguistic skills, including critical reading and expository and academic writing skills, that help students articulate their arguments and present their thinking clearly and coherently and recognize the importance of language as a mediator of knowledge and identity.

e) Skill Enhancement Course (SEC): SE courses are skill-based courses in all disciplines and are aimed at providing hands-on-training, skills etc, to enhance student skills.

f) Value Addition Course (VAC): VA courses are value-based courses which are meant to inculcate ethics, culture, Indian Knowledge systems, constitutional values, soft skills, sports education and such similar values to students which will help in all round development of students.

g) Major Project/Seminar/Internship/Summer training (PROJ)

i. Internship /Apprenticeship: All students will also undergo internships / Apprenticeships in a firm, industry, or organization or Training in labs with faculty and researchers in their own or other HEIs/research institutions.

ii. Major Project: Students are required to take up major project under the guidance of a faculty member. The student shall be encouraged to get engaged in Research Based Project in final year (VII and VIII semesters). The research outcomes of their project work may be published in peer-reviewed journals or may be presented in conferences /seminars or may be patented.

h) Mandatory Non-Graded Course (MNG)

These courses are offered to nurture holistic qualities in a student, making him/her a responsible citizen conscious of societal & global challenges and responsibilities thereof. These include Indian Knowledge System (IKS), Healthy Living and Fitness, Environmental Sciences, Indian Constitution and so on. Generally, shall be offered through hybrid mode with mentors and shall be evaluated through End Semester examination.

9. Major Features of Curriculum

- Flexible Choice Based System for students to pursue courses of their interest.
- Includes a Range of Courses to cover the diversity of Computer Science and Engineering Specializations.
- The curriculum is designed with a proper blend of research and industry-relevant subjects taught through collaborative learning.
- Core courses provide a strong foundation in programming, algorithms, data structures, computer architecture, etc. These essential courses equip students with the skills needed for problem-solving and software development.
- Elective courses allow students to tailor their education to their interests and career goals. These courses cover advanced topics such as artificial intelligence, cybersecurity, Data Science, cloud computing, etc., providing in-depth knowledge and specialized skills in emerging areas of computer science.
- Practical experience in the curriculum is gained through laboratory courses that offer hands-on engagement with hardware and software, reinforcing theoretical knowledge.

Internship programs provide real-world industry exposure, while capstone projects integrate learning by solving real-world problems

- To impart high competency to the students, the curriculum offers distinct ability enhancement and value-added courses.
- Apart from the technical course, the program offers a range of courses that provide the students with a broad range of knowledge and skill sets, like life skills and mentoring, soft skills, Aptitude, and Communication skills.
- The curriculum offers multi-disciplinary courses running in the university for other fields/areas.

Course Components of Academic Program
B. Tech (Computer Science and Engineering)

Program Duration : 8 Semesters (4 Years)

Total Number of Credits : **170 Credits**

AICTE Course Components		Credits
1.	Basic Science Courses (BSC)	12
2.	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc. (ESC)	10
3.	Professional Core Courses (PCC)	63
4.	Laboratory Courses (LC)	27
5.	Open Elective Courses (OEC)	06
6.	Professional Elective Courses (PEC)	18
7.	Humanities and Social Sciences including Management courses (HSMC) / Skill Enhancement Course (SEC)/ Ability Enhancement Course (AEC)/ Value Added Course (VAC)	19
8.	Project work, seminar and internship in industry or elsewhere (PROJ)	15
	Total Credits	170

9.	Mandatory Courses (MC)	08

NEP Course Components		Credits
1.	Discipline Specific Core (DSC)	108
2.	Discipline Specific Elective (DSE)	18
3.	University Open Elective/Generic Elective (UOE)	06
4.	Ability Enhancement Course (AEC)	10
5.	Value Added Course (VAC)	05
6.	Skill Enhancement Course (SEC)	08
7.	Project/Seminar/Internship/Summer training (PROJ)	15
	Total Credits	170

8.	Mandatory Non-Graded Course (MNG)	08

10. Scheme

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B.Tech. in Computer Science and Engineering (AI and ML)

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Semester I

COURSE MODULE					TEACHING PERIODS				WEIGHTAGE : EVALUATION			
COURSE				Credits	L	T	P	Contact Hr.	CIE	MSE	ESE	Total
Code	Title	NEP Component	AICTE Component									
TPH101/ 201	Engineering Physics	DSC	BSC	3	3	-	-	3	25	25	50	100
TMA102	Mathematics for AI-I	DSC	BSC	3	2	1	-	3	25	25	50	100
TEE101/ 201	Basic Electrical Engineering	DSC	ESC	2	2	-	-	2	25	25	50	100
TCS102	Introduction to Python Programming	DSC	ESC	3	3	-	-	3	25	25	50	100
PPH151/ 251	Physics Lab	DSC	LC	1	-	-	2	2	25	25	50	100
PEE151/ 251	Electrical Engineering Lab	DSC	LC	1	-	-	2	2	25	25	50	100
PCS152	Python Programming Lab	DSC	LC	2	-	-	4	4	25	25	50	100
PME151/ 251	Workshop And Manufacturing Practices	SEC	LC	2	-	-	4	4	25	25	50	100
THU101	Professional Communication	AEC	HSMC	2	2	-	-	2	25	25	50	100
HSMC 101/201	Design Thinking	VAC	HSMC	1	-	-	2	2	25	25	50	100
			Total	**20**								**1000**

Mandatory Non-Graded Course												
THF101/ 201	Healthy Living & Fitness	MNG	MC	2	2	-	-	2	-	-	100	100
									Qualified/ Non-Qualified			

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B.Tech. in Computer Science and Engineering (AI and ML)

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Semester II

COURSE MODULE Physics/Chemistry Group					TEACHING PERIODS				WEIGHTAGE : EVALUATION			
COURSE				Credits	L	T	P	Contact Hr.	CIE	MSE	ESE	Total
Code	Title	NEP Component	AICTE Component									
TCH101/ 201	Engineering Chemistry	DSC	BSC	3	3	-	-	3	25	25	50	100
TMA203	Mathematics for AI-II	DSC	BSC	3	2	1	-	3	25	25	50	100
TCS202	Programming in C	DSC	ESC	3	3	-	-	3	25	25	50	100
TEC101/ 201	Basic Electronics Engineering	DSC	ESC	2	2	-	-	2	25	25	50	100
TCS203	Fundamentals of AI and ML	DSC	PCC	3	3	-	-	3	25	25	50	100
PCH151 /251	Chemistry Lab	DSC	LC	1	-	-	2	2	25	25	50	100
PCS252	C Programming Lab	DSC	LC	2	-	-	4	4	25	25	50	100
PEC151/ 251	Electronics Engineering Lab	DSC	LC	1	-	-	2	2	25	25	50	100
PME153 /253	Engineering Graphics and Design Lab	SEC	LC	2	-	-	4	4	25	25	50	100
PCE151/ 251	Basic Civil Engg Lab	DSC	LC	1	-	-	2	2	25	25	50	100
PCS253	AI and ML Lab using Python	DSC	LC	1	-	-	2	2	25	25	50	100
GP201	General Proficiency-I	SEC	SEC	1	-	-	-	-	100	-	-	100
			Total	**23**								**1200**

Mandatory Non-Graded Course												
TEV101/201	Environmental Science	MNG	MC	2	2	-	-	2	-	-	100	100
									Qualified/ Non-Qualified			

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Semester III

COURSE MODULE					TEACHING PERIODS				WEIGHTAGE : EVALUATION			
COURSE				Credits	L	T	P	Contact Hr.	CIE	MSE	ESE	Total
Code	Title	NEP Component	AICTE Component									
TCS308	Logic Design and Computer Organization	DSC	PCC	3	3	-	-	3	25	25	50	100
TCS302	Data Structures with C	DSC	PCC	3	3	-	-	3	25	25	50	100
TCS307	Object Oriented Programming with C++	DSC	PCC	3	3	-	-	3	25	25	50	100
TCS368	Advanced Probability for AI	DSC	PCC	3	3	-	-	3	25	25	50	100
	Discipline Specific Elective-I	DSE	PEC	3	3	1	-	4	25	25	50	100
PCS308	Logic Design and Computer Organization Lab	DSC	LC	1	-	-	2	2	25	25	50	100
PCS302	Data Structures Lab	DSC	LC	1	-	-	2	2	25	25	50	100
PCS307	OOPS with C++ Lab	DSC	LC	1	-	-	2	2	25	25	50	100
XCS301	Career Skills-I	AEC	AEC	2	2	-	-	2	25	25	50	100
UHV301	UHV-II	VAC	VAC	2	2	-	-	2	25	25	50	100
			Total	**22**								**1000**

Optional									
		TEACHING PERIODS				**WEIGHTAGE: EVALUATION**			
	Credits	**L**	**T**	**P**	**Contact Hr.**	**CIE**	**MSE**	**ESE**	**Total**
**Minor-I/Specialization-I	3	3	-	-	3	25	25	50	100
** *List of minor/ specialization courses is mentioned on page no. 34-38*									

DISCIPLINE SPECIFIC ELECTIVE-I

COURSE CODE	COURSE NAME
TCS349	Responsible and Explainable AI
TCS331	Fundamentals of IoT
TCS351	Fundamentals of Cloud Computing and Big Data
TCS362	Statistical Learning For Reliability Analysis (Through Swayam)

NOTE:

1. The department will identify courses for Project-Based Learning (PBL) at the beginning of the semester. The implementation and evaluation of PBL courses will be carried out as per the SOP document. Each PBL course carries a total of 150 marks.
2. General Proficiency shall be assessed based on the participation in NCC, NSS, Conferences (Research paper Publication (Journal/ Conference)), Organizing events, competitions (Inter-University, State, National, International level), including Music, Debate, Sports, Hackathon and so on.
3. *If the mentioned SWAYAM course is unavailable on the SWAYAM platform during the time of offering, the Departmental Committee will review and finalize a suitable alternative course available on the SWAYAM platform.

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Semester IV

COURSE MODULE					TEACHING PERIODS				WEIGHTAGE : EVALUATION			
COURSE				Credits	L	T	P	Contact Hr.	CIE	MSE	ESE	Total
Code	Title	NEP Component	AICTE Component									
TCS408	Programming in Java	DSC	PCC	3	3	-	-	3	25	25	50	100
TCS402	Finite Automata and Formal Languages	DSC	PCC	3	3	-	-	3	25	25	50	100
TCS403	Microprocessors	DSC	PCC	3	3	-	-	3	25	25	50	100
TCS409	Design and Analysis of Algorithms	DSC	PCC	3	3	-	-	3	25	25	50	100
TCS464	Deep Learning	DSC	PCC	3	3	-	-	3	25	25	50	100
	Discipline Specific Elective-II	DSE	PEC	3	3	1	-	4	25	25	50	100
PCS408	Java Programming Lab	DSC	LC	1	-	-	2	2	25	25	50	100
PCS403	Microprocessors Lab	DSC	LC	1	-	-	2	2	25	25	50	100
PCS409	DAA Lab	DSC	LC	1	-	-	2	2	25	25	50	100
PCS464	Deep Learning Lab	DSC	LC	1	-	-	2	2	25	25	50	100
XCS401	Career Skills-II	AEC	AEC	2	2	-	-	2	25	25	50	100
GP401	General Proficiency-II	SEC	SEC	1	-	-	-	-	100	-	-	100
			Total	**25**								**1200**

Mandatory Non-Graded Course												
HSS203	Constitution of India	MNG	MC	2	2	-	-	2	-	-	100	100
									Qualified/ Non-Qualified			

Optional									
		TEACHING PERIODS				**WEIGHTAGE: EVALUATION**			
	Credits	**L**	**T**	**P**	**Contact Hr.**	**CIE**	**MSE**	**ESE**	**Total**
**Minor-II/Specialization-II	3	3	-	-	3	25	25	50	100
** *List of minor/ specialization courses is mentioned on page no. 34-38*									

DISCIPLINE SPECIFIC ELECTIVE-II

COURSE CODE	COURSE NAME
TCS448	Reinforcement Learning
TCS484	Biometric Securities
TCS471	Statistical Data Analysis with R
TCS433	*Blockchain and its Applications (Through Swayam)
TCS465	*Linear Algebra (Through Swayam)
TCS463	*Discrete Mathematics (Through Swayam)

AUDIT COURSE: TOC 401: COMPETITIVE PROGRAMMING

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Semester V

COURSE MODULE					TEACHING PERIODS				WEIGHTAGE : EVALUATION			
COURSE				Credits	L	T	P	Contact Hr.	CIE	MSE	ESE	Total
Code	Title	NEP Component	AICTE Component									
TCS564	Natural Language Processing and Computer Vision	DSC	PCC	3	3	-	-	3	25	25	50	100
TCS502	Operating Systems	DSC	PCC	3	3	-	-	3	25	25	50	100
TCS503	Database Management Systems	DSC	PCC	3	3	-	-	3	25	25	50	100
TCS511	Computer Networks	DSC	PCC	3	3	-	-	3	25	25	50	100
	Discipline Specific Elective-III	DSE	PEC	3	3	1	-	4	25	25	50	100
PCS564	Natural Language Processing and Computer Vision Lab	DSC	LC	1	-	-	2	2	25	25	50	100
PCS503	DBMS Lab	DSC	LC	1	-	-	2	2	25	25	50	100
PCS511(S)	OS and CN Lab	DSC	LC	1	-	-	2	2	25	25	50	100
XCS501	Career Skills-III	AEC	AEC	2	2	-	-	2	25	25	50	100
			Total	**20**								**900**

Mandatory Non-Graded Course												
HSS304	Indian Knowledge System	MNG	MC	2	2	-	-	2	-	-	100	100
									Qualified/ Non-Qualified			

Optional									
		TEACHING PERIODS				**WEIGHTAGE: EVALUATION**			
	Credits	**L**	**T**	**P**	**Contact Hr.**	**CIE**	**MSE**	**ESE**	**Total**
**Minor-III/Specialization-III	3	3	-	-	3	25	25	50	100
** *List of minor/ specialization courses is mentioned on page no. 34-38*									

DISCIPLINE SPECIFIC ELECTIVE- III

COURSE CODE	COURSE NAME
TCS548	Optimization for Deep Learning
TCS543	Knowledge Representation
TCS584	Foundation of Quantum Computing
TCS595	Security and Auditing
TCS552	Cloud Based Application Development and Management
TCS571	Big Data Visualization
TCS531	Communication models and protocols
TCS597(E)	Computer system security
TCS521	User Interface Design
TMA502	Computer Based Numerical and Statistical Techniques
TCS586	*Parallel Computer Architecture (Through Swayam)

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Semester VI

COURSE MODULE					TEACHING PERIODS				WEIGHTAGE : EVALUATION			
COURSE				Credits	L	T	P	Contact Hr.	CIE	MSE	ESE	Total
Code	Title	NEP Component	AICTE Component									
TCS601	Compiler Design	DSC	PCC	3	3	-	-	3	25	25	50	100
TCS611	Software Engineering	DSC	PCC	3	3	-	-	3	25	25	50	100
TCS666	Transformer Models and Applications	DSC	PCC	3	3	-	-	3	25	25	50	100
TCS693	Full Stack Web Development	DSC	PCC	3	3	-	-	3	25	25	50	100
	Discipline Specific Elective-IV	DSE	PEC	3	3	1	-	4	25	25	50	100
PCS601	Compiler Design Lab	DSC	LC	1	-	-	2	2	25	25	50	100
PCS666	Transformer Models and Applications Lab	DSC	LC	1	-	-	2	2	25	25	50	100
PCS693	Web Development Lab	DSC	LC	1	-	-	2	2	25	25	50	100
XCS601	Career Skills-IV	AEC	AEC	2	2	-	-	2	25	25	50	100
GP601	General Proficiency-III	SEC	SEC	1	-	-	-	-	100	-	-	100
			Total	**21**								**1000**

Optional									
		TEACHING PERIODS				**WEIGHTAGE: EVALUATION**			
	Credits	**L**	**T**	**P**	**Contact Hr.**	**CIE**	**MSE**	**ESE**	**Total**
**Minor-IV/Specialization-IV	3	3	-	-	3	25	25	50	100
** *List of minor/ specialization courses is mentioned on page no. 34-38*									

DISCIPLINE SPECIFIC ELECTIVE-IV

COURSE CODE	COURSE NAME
TCS665	Generative Adversarial Networks (GANs)
TCS645	AI in Creative Fields
TCS688	Quantum Machine Learning
TCS684	Information Retrieval
TCS685	Quantum Cryptography
TCS695	Database Security, Identity and Access Management
TCS651	Devops on cloud
TCS679(E)	Network and system security
TCS631	*Network Programming and Wireless Technologies (Through Swayam)
TCS641	*Virtual Reality (Through Swayam)
TCS661	*Computer Graphics (Through Swayam)
TCS663	*Applied Accelerated Artificial Intelligence (Through Swayam)

AUDIT COURSE: TOC601: COMPETITIVE PROGRAMMING

NOTE:

1. The department will identify courses for Project-Based Learning (PBL) at the beginning of the semester. The implementation and evaluation of PBL courses will be carried out as per the SOP document. Each PBL course carries a total of 150 marks.
2. General Proficiency shall be assessed based on the participation in NCC, NSS, Conferences (Research paper Publication (Journal/ Conference)), Organizing events, competitions (Inter-University, State, National, International level), including Music, Debate, Sports, Hackathon and so on.

3. *If the mentioned SWAYAM course is unavailable on the SWAYAM platform during the time of offering, the Departmental Committee will review and finalize a suitable alternative course available on the SWAYAM platform.

Graphic Era (Deemed to be University)

B.Tech. in Computer Science and Engineering (AI and ML)

Scheme of Teaching and Evaluation 2025

Outcome Based Education (OBE) and Choice Based Credit System (CBCS) as per NEP 2020

(Effective from the academic year 2025-26)

Semester VII

COURSE MODULE					TEACHING PERIODS				WEIGHTAGE : EVALUATION			
COURSE				Credits	L	T	P	Contact Hr.	CIE	MSE	ESE	Total
Code	Title	NEP Component	AICTE Component									
TCS765	Large Language Models (LLMs)	DSC	PCC	3	3	-	-	3	25	25	50	100
TCS766	Multimodal AI	DSC	PCC	3	3	-	-	3	25	25	50	100
TRM701	Research Methodology and IPR	DSC	PCC	3	3	-	-	3	25	25	50	100
	Discipline Specific Elective-V	DSE	PEC	3	3	1	-	4	25	25	50	100
	Generic Elective-I	UOE	OEC	3	3	-	-	3	25	25	50	100
SCS701	Seminar on Industrial Interaction	PROJ	PROJ	4	-	-	-	-	-	-	100	100
CSP701	Major Project Phase I	PROJ	PROJ	3	-	-	6	6	50	-	50	100
			Total	**22**								**700**

Optional									
		TEACHING PERIODS				**WEIGHTAGE: EVALUATION**			
	Credits	**L**	**T**	**P**	**Contact Hr.**	**CIE**	**MSE**	**ESE**	**Total**
**Minor-V/Specialization-V	3	3	-	-	3	25	25	50	100
** *List of minor/ specialization courses is mentioned on page no. 34-38*									

DISCIPLINE SPECIFIC ELECTIVE-V

Course Code	**Course Name**
TCS745	Advanced GANs
TCS785	Generative AI and Prompt Engineering
TCS737	UI/UX Design
TCS738	Object-Oriented Analysis and Design
TCS743	Evolutionary Computation
TCS731	Computer Forensics
TCS761	Cloud Infrastructure Services
TCS726(E)	Business Intelligence
TCS756	Human-Computer Interaction
TCS723	Distributed Systems
TCS799	Software Verification, Validation and Testing
TCS734	Robotic Process Automation Design and Development
TCS795	Cryptography and Network Security
TCS722	*Data warehousing and data mining (Through Swayam)
TCS732	*Web Mining (Through Swayam)

NOTE:

1. The department will identify courses for Project-Based Learning (PBL) at the beginning of the semester. The implementation and evaluation of PBL courses will be carried out as per the SOP document. Each PBL course carries a total of 150 marks.

2. General Proficiency shall be assessed based on the participation in NCC, NSS, Conferences (Research paper Publication (Journal/ Conference)), Organizing events, competitions (Inter-University, State, National, International level), including Music, Debate, Sports, Hackathon and so on.
3. *If the mentioned SWAYAM course is unavailable on the SWAYAM platform during the time of offering, the Departmental Committee will review and finalize a suitable alternative course available on the SWAYAM platform.

Graphic Era (Deemed to be University)

B.Tech. in Computer Science and Engineering (AI and ML)

Scheme of Teaching and Evaluation 2025

Outcome Based Education (OBE) and Choice Based Credit System (CBCS) as per NEP 2020

(Effective from the academic year 2025-26)

Semester VIII

COURSE MODULE					TEACHING PERIODS				WEIGHTAGE : EVALUATION			
COURSE				Credits	L	T	P	Contact Hr.	CIE	MSE	ESE	Total
Code	Title	NEP Component	AICTE Component									
DM001	Disaster Management	VAC	VAC	2	2	-	-	2	25	25	50	100
	Discipline Specific Elective-VI	DSE	PEC	3	3	1	-	4	25	25	50	100
	Generic Elective-II	UOE	OEC	3	3	-	-	3	25	25	50	100
CSP801	Major Project Phase II	PROJ	PROJ	6	-	-	12	12	-	-	100	100
CSC801	Comprehensive Viva-Voce	PROJ	PROJ	2	-	-	-	-	-	-	100	100
GP801	General Proficiency-IV	SEC	SEC	1	-	-	-	-	100	-	-	100
			Total	**17**								**600**

Optional									
		TEACHING PERIODS				**WEIGHTAGE: EVALUATION**			
	Credits	**L**	**T**	**P**	**Contact Hr.**	**CIE**	**MSE**	**ESE**	**Total**
**Minor-IV/Specialization-IV	3	3	-	-	3	25	25	50	100
*** List of minor/ specialization courses is mentioned on page no. 34-38*									

DISCIPLINE SPECIFIC ELECTIVE - VI

Course Code	Course name
TCS842	Recent Trends in AI
TCS848	Generative AI Model Deployment & Cloud Integration
TCS881	Advanced Computer Vision
TCS801	Mobile Computing
TCS822	Mobile Applications Development
TCS823	Multimedia Systems and Data Compression
TCS826	Unix Systems Programming
TCS851	Storage Networks
TCS852	Pattern Recognition
TCS855	Agile Software Engineering
TCS857	Game Theory
TCS821	Soft Computing (Through Swayam)
TCS825	Computational Geometry (Through Swayam)

NOTE:

1. The department will identify courses for Project-Based Learning (PBL) at the beginning of the semester. The implementation and evaluation of PBL courses will be carried out as per the SOP document. Each PBL course carries a total of 150 marks.

2. General Proficiency shall be assessed based on the participation in NCC, NSS, Conferences (Research paper Publication (Journal/ Conference)), Organizing events, competitions (Inter-University, State, National, International level), including Music, Debate, Sports, Hackathon and so on.
3. *If the mentioned SWAYAM course is unavailable on the SWAYAM platform during the time of offering, the Departmental Committee will review and finalize a suitable alternative course available on the SWAYAM platform.

List of courses offered under the Discipline Specific Elective (DSE)

Sl.No.	Semester	Course Code	Course Name	Credits
1.	III	TCS349	Responsible and Explainable AI	3
2.	III	TCS368	Advanced Probability for AI	3
3.	III	TCS351	Fundamentals of Cloud Computing and Big Data	3
4.	IV	TCS448	Reinforcement Learning	3
5.	IV	TCS484	Biometric Securities	3
6.	IV	TCS471	Statistical Data Analysis with R	3
7.	V	TCS548	Optimization for Deep Learning	3
8.	V	TCS584	Foundation of Quantum Computing	3
9.	V	TCS543	Knowledge Representation	3
10.	V	TCS595	Security and Auditing	3
11.	V	TCS552	Cloud Based Application Development and Management	3
12.	V	TCS571	Big Data Visualization	3
13.	V	TCS531	Communication models and protocols	3
14.	V	TCS591	Computer system security	3
15.	V	TCS521	User Interface Design	3
16.	VI	TCS665	Generative Adversarial Networks (GANs)	3
17.	VI	TCS645	AI in Creative Fields	3
18.	VI	TCS688	Quantum Machine Learning	3
19.	VI	TCS684	Information Retrieval	3
20.	VI	TCS685	Quantum Cryptography	3
21.	VI	TCS695	Database Security, Identity and Access Management	3
22.	VI	TCS651	Devops on cloud	3
23.	VI	TCS679(E)	Network and system security	3
24.	VII	TCS745	Advanced GANs	3
25.	VII	TCS743	Evolutionary Computation	3
26.	VII	TCS731	Computer Forensics	3
27.	VII	TCS761	Cloud Infrastructure Services	3
28.	VII	TCS726(E)	Business Intelligence	3
29.	VII	TCS756	Human computer interaction	3
30.	VII	TCS723	Distributed Systems	3
31.	VII	TCS799	Software Verification, Validation and Testing	3
32.	VII	TCS734	Robotic Process Automation Design and Development	3

33.	VII	TCS795	Cryptography and Network Security	3
34.	VIII	TCS842	Recent Trends in AI	3
35.	VIII	TCS848	Generative AI Model Deployment & Cloud Integration	3
36.	VIII	TCS881	Advanced Computer Vision	3
37.	VIII	TCS801	Mobile Computing	3
38.	VIII	TCS822	Mobile Applications Development	3
39.	VIII	TCS823	Multimedia Systems and Data Compression	3
40.	VIII	TCS826	Unix Systems Programming	3
41.	VIII	TCS851	Storage Networks	3
42.	VIII	TCS852	Pattern Recognition	3
43.	VIII	TCS855	Agile Software Engineering	3
44.	VIII	TCS857	Game Theory	3

List of Discipline Specific Elective (DSE) courses offered through Swayam

Sl. No.	Semester	Course Code	Course Name	Credits
1.	III	TCS362	Statistical Learning For Reliability Analysis	3
2.	IV	TCS433	Blockchain and its Applications	3
3.	IV	TCS465	Linear Algebra	3
4.	IV	TCS463	Discrete Mathematics	3
5.	V	TCS586	Parallel Computer Architecture	3
6.	VI	TCS641	Virtual Reality	3
7.	VI	TCS631	Network programming and wireless technologies	3
8.	VI	TCS661	Computer Graphics	3
9.	VI	TCS663	Applied Accelerated Artificial Intelligence	3
10.	VII	TCS732	Web Mining	3
11.	VII	TCS722	Data warehousing and data mining	3
12.	VIII	TCS821	Soft Computing	3
13.	VIII	TCS825	Computational Geometry	3

List of courses offered under Ability Enhancement (AEC)

Sl. No.	Semester	Course Code	Course Name	Credits
1.	I	THU101	Professional Communication	2
2.	II	THU201	Advanced Professional Communication	2
3.	III	XCS301	Career Skills-I	2
4.	IV	XCS401	Career Skills-II	2
5.	V	XCS501	Career Skills-III	2
6.	VI	XCS601	Career Skills-IV	2

List of courses offered under Skill Enhancement (SEC)

Sl. No.	Semester	Course Code	Course Name	Credits
1.	I/II	PME151/251	Workshop And Manufacturing Practices	2
2.	I/II	PME153/253	Engineering Graphics and Design Lab	2
3.	II	GP201	General Proficiency-I	1
4.	IV	GP401	General Proficiency-II	1

5.	VI	GP601	General Proficiency-III	1
6.	VIII	GP801	General Proficiency-IV	1

List of courses offered under Value Added (VAC)

Sl. No.	Semester	Course Code	Course Name	Credits
1.	I/II	HSMC101/201	Design Thinking	1
2.	III	UHV301	UHV-II	2
3.	VIII	DM001	Disaster Management	2

List of courses offered under Mandatory Non-Graded Course (MNG)

Sl. No.	Semester	Course Code	Course Name	Credits
1.	I/II	THF101/201	Healthy Living & Fitness	2
2.	I/II	TEV101/201	Environmental Science	2
3.	IV	HSS203	Constitution of India	2
4.	V	HSS304	Indian Knowledge System	2

Details of Minors Offered by Other Departments for CSE (AI and ML) Students

Department of Electronics and Communication Engineering

Minor Scheme

Minor in Internet of Things (IoT)					
Semester	Course Code	Course Name	SWAYAM Course Name	Credits	Total No. Students may opt for this course
3rd	TEC 359	Fundamentals of Computer Organization		3	60
4th	TEC 491	Sensors and Signal Conditioning		3	
5th	TEC 591	Transducers, Actuators and Display Devices		3	
6th	TEC 659	Advanced Embedded Systems		3	
7th	TEC 759	Internet of Things and Its Applications		3	
8th	TEC 859	GPU Architectures and Programming	GPU Architectures and Programming	3	
			Total Credits	18	

Department of Electrical Engineering

Minor Scheme

Minor in Sustainable Energy Engineering					
Semester	Course Code	Course Name	SWAYAM Course Name	Credits	Total No. Students may opt for this course
3	SEE301	Energy and its resources	-	3	30
4	SEE 401	Climate Change Understanding& Observations	-	3	30
5	SEE 501	Energy storage systems for renewables	-	3	30
6	SEE 601	Electronics for Renewables	-	3	30
7	SEE 701	Solar Energy Technologies and System Design	-	3	30
8	SEE 801	Solar Energy System Installations and Maintenance	-	3	30
			Total Credits	18	

Department of Civil Engineering

Minor Scheme

Minor in Remote Sensing and GIS					
Semester	**Course Code**	**Course Name**	**SWAYAM Course Name**	**Credits**	**Total No. Students may opt for this course**
3	TCE 399	Remote Sensing and Its Techniques	As per availability	3	30
4	TCE 499	Basic Geographical Information Systems	As per availability	3	30
5	TCE 599	Advance Geographical Information systems	As per availability	3	30
6	TCE 699	RS & GIS for Hydrology and Water Resources	As per availability	3	30
7	TCE 799	Remote Sensing and GIS in Environmental Science	As per availability	3	30
3	PCE 399	Geographic Information Systems Laboratory	As per availability	1	30
5	PCE 599	ArcGIS Pro Laboratory	As per availability	1	30
6	PCE 699	Geospatial Analysis with Python Laboratory	As per availability	1	30
Total Credits				**18**	

Department of Mechanical Engineering

Minor Scheme

Minor in Manufacturing and Operations					
Semester	**Course Code**	**Course Name**	**SWAYAM Course Name**	**Credits**	**Total No. Students may opt for this course**
3	TME 310	Basic Mechanical Engineering		3	60
4	TME 410	Product Design & Manufacturing	Product Design and Manufacturing By Prof. J. Ramkumar, Prof. Amandeep Singh | IIT Kanpur	3	60
5	TME 508	Computer integrated Manufacturing	Computer Integrated Manufacturing By Prof. J. Ramkumar, Prof. Amandeep Singh | IIT Kanpur	3	60
6	TME 611	Operation management	Operations Management By Prof. Inderdeep Singh | IIT Roorkee	3	60
7	TME 710	Robotics and Automation		3	60
8	TME 819	Emerging areas in mechanical engineering		3	60
			Total Credits	18	

Department of BIOTECHNOLOGY

Minor Scheme

Minor in Biotechnology for Sustainability					
Semester	Course Code	Course Name	SWAYAM Course Name	Credits	Total No. Students may opt for this course
I	-	-	-	-	
II	-	-	-	-	
III	TBT 301M	Sustainable Agriculture and Organic Farming for Food Security	Organic farming for sustainable Agricultural Production	3	20
IV	TBT 401M	Bio resource Technology for Sustainable Development	-	3	20
V	TBT 501M	Circular Economy and Sustainability	-	3	20
VI	TBT 601M	Biotechnology for One Health	One Health	3	20
VII	TBT 701M	Biotechnology and Natural Resource Management	Natural Resource Management	3	20
VIII	TBT 801M	Sustainable Biomass Conversion and Bio refinery	Biomass Conversion and Bio refinery	3	20
			Total Credits	18	

Department of Aerospace Engineering

Minor Scheme

Minor in Aerospace Engineering					
Semester	**Course Code**	**Course Name**	**SWAYAM Course Name**	**Credits**	**Total No. Students may opt for this course**
III	**TAS 310**	Fundamentals of Aerospace Engineering	Introduction to Aerospace Engineering	**3**	**60**
IV	**TAS 415**	Theoretical and Experimental Aerodynamics	Fundamentals of Theoretical and Experimental Aerodynamics	**3**	**60**
V	**TAS 515**	Aerospace Propulsion	Aircraft Propulsion	**3**	**60**
VI	**TAS 615**	Flight Mechanics	Introduction to Airplane Performance	**3**	**60**
VII	**TAS 715**	Aerospace Structures	Aircraft Structures - I	**3**	**60**
VIII	**ASP 802**	Project		**5**	**60**
			Total Credits	**20**	

Department of Computer Science and Engineering (AI and ML)

Honours with Specialization

Honours with Specialization in Generative AI					
Semester	**Course Code**	**Course Name**	**SWAYAM Course Name**	**Credits**	**Total No. Students may opt for this course**
3	HCS341	Applied Linear Algebra in AI and ML	Applied Linear Algebra in AI and ML	3	**30**
4	HCS442	Generative AI for Everyday Life	Generative AI for Everyday Life	3	
5	HCS542	Programming with Generative AI	Programming with Generative AI	3	
6	HCS642	Generative AI and Large Language Models	Generative AI and Large Language Models	3	
7	HCS741	Affective Computing	Affective Computing	3	
8	HCS841	GPU Architectures And Programming	GPU Architectures And Programming	3	
			Total Credits	**18**	

Honours with Specialization in Cyber Security					
Semester	**Course Code**	**Course Name**	**SWAYAM Course Name**	**Credits**	**Total No. Students may opt for this course**
3	HCS361	Basic Linear Algebra	Basic Linear Algebra	3	**30**
4	HCS461	Cyber Security, Tools, Techniques and Counter Measures	Cyber Security, Tools, Techniques and Counter Measures	3	
5	HCS561	Foundations of Cyber Physical Systems	Foundations of Cyber Physical Systems	3	
6	HCS661	Information Security and Cyber Forensics	Information Security and Cyber Forensics	3	
7	HCS761	Privacy and Security in Online Social Media	Privacy and Security in Online Social Media	3	
8	HCS861	Secure Computation: Part I	Secure Computation: Part I	3	
			Total Credits	**18**	

14. EXIT OPTIONS

SEM	Exit Option	Credits	Additional Credit	List of Exit Courses
I & II	U.G Certificate in Computer Science	43	6	1. Programming in Python (Swayam) 2. HTML (Swayam)
III & IV	U.G. Diploma in Computer Science	47	6	1. PHP and MySQL (Swayam) 2. Java Business Application (Swayam)
V & VI	BSc in Computer Science	41	6	1. Web Technology (Swayam) 2. Machine Learning and Deep Learning - Fundamentals and Applications (Swayam)
VII &VIII	B.Tech. in Computer Science and Engineering (AI and ML)	39	--	--
VII &VIII	B.Tech. in Computer Science and Engineering (AI and ML) with (Name of the Minor **or** Name of the Honours with Specialization)	**39	--	--

****An additional 18 credits are required to award (Minor or Honours with Specialization)**

15. List of Potential Recruiters for Employing Graduates in Computer Science and Engineering

- Microsoft Corporation
- Google
- Adobe
- Amazon
- Walmart Global Technology
- Coforge
- TCS
- Infosys
- Capgemini
- HCL
- Informatica
- Teradata
- EY India
- 75Way Technologies
- Global Logic
- PWC
- Enquero Global
- HSBC
- Accenture
- Accolite
- Cognizant
- Vinculum
- Atlassian
- Airbus India
- Tally India
- Morgan Stanley
- Flipkart
- L&T Infotech
- Apps Associates
- Acuity Knowledge
- LTTS
- LTIMindtree
- IBM
- Zscaler
- Goldman Sachs
- Latent View
- Bonami Software
- Incture
- ANM
- Wissen Technologies
- DXC
- Contata
- Sopra Steria
- MAQ Software
- Intel
- Hexaware Technology
- Yamaha
- JSW
- Autopay
- Nineleaps
- American Express
- Salesforce
- Lowes India
- AbinBevGCC
- Siemens
- Deloitte And many more